

The Link Between Poverty and Teacher Quality in Virginia Public Schools

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December 8, 2014

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I. Executive Summary

The purpose of this study was to analyze the effect of teacher quality and poverty on student achievement scores in Virginia public schools, using both quantitative and qualitative research methods. We measured teacher quality using indicators for experience, education, and certification. Ultimately, teacher quality is a complex attribute to measure and our interviews conducted with experts in the education field highlight the various issues that must be taken into consideration when analyzing the effect of teacher quality in general, as well as teacher quality in relation to poverty. We found that schools in high poverty areas have on average slightly lower teacher quality and tend to have greater variance in teacher quality. We also found that while there is a small positive effect of teacher quality on student scores, poverty has a significantly larger impact. We provide policy recommendations on improving teacher quality and improving Virginia's data collection standards.

II: Measuring Teacher Quality

Teacher quality is a complex attribute to measure, and there are varying perspectives on the appropriate methodology to use when evaluating it. It is first important to differentiate between teacher quality and teacher effectiveness. While teacher quality is an indicator that is often sought to be measured, teacher effectiveness is not tangible; teachers often impact students in ways that are immeasurable. Christopher Gareis, Associate Professor of Educational Leadership in the School of Education at The College of William & Mary, suggests utilizing a more comprehensive framework, as opposed to SOL scores, to evaluate teacher quality. Gareis' approach entails assessing teachers across five broad domains that capture the intricacies of everyday teaching: 1) planning instruction, 2) delivering instruction, 3) assessing student learning, 4) working with and developing rapport with students/managing the classroom, and 5) conducting oneself as a professional. These domains contain the professional knowledge, skills, and dispositions that high quality teachers generally possess, but, unlike the sole use of SOL scores, they also leave room for a more balanced review of the teaching process. Additionally, implementing a 360° evaluation, which includes both peer evaluation and self-evaluation, can provide a more holistic assessment of teacher performance. While this may be time consuming, such evaluations should incorporate a teacher's portfolio as much of the work that encompasses teaching occurs behind the scenes and can be characterized by preparation outputs such as lesson plans. The five dimensions framework in the context of a 360° evaluation technique lends to more credible, transparent, and ultimately, fair assessments of teacher quality where teachers are granted due process as well as opportunities to identify and correct weaknesses (Gareis). James H. Stronge, author of *Evaluating What Good Teachers Do: Eight Research-based Standards for Assessing Teacher Excellence* and Professor in the Educational Policy, Planning, and Leadership

Area at the College of William and Mary, promotes a two-part view for measuring teacher quality. The first part includes observing the behaviors that have been proven indicative of high quality teachers and assessing the extent to which teachers engage in these behavior. Measuring teacher behaviors can be achieved through observation, artifact review, and various, more traditional ways of teacher assessment. It is important to recognize that there may be measurement errors. For example, there will be variations in performance assessments due to differences and natural inconsistencies in perception. The second part includes evaluating student results in a gain-score model (Stronge).

While Stronge supports the use of gain-score models, he strongly cautions against using just one measure, which provide just a single-point-in-time observation. Furthermore, one measure is incapable of measuring various dimensions of student learning, for example, how well students have learned to read as well as whether students enjoy reading. Instead, Stronge recommends the use of multiple measures to assess teacher quality. In the case of reading assessments, this might include the gain in test scores from the beginning of the year to the end of the year as well as pre-assessments for other benchmarks, such as reading inventory which would be measured throughout the year, along with other demonstrations of literacy development. This allows for a more nuanced diagnostic profile, which leads to better assessments of something as complex as teacher quality (Stronge).

When it comes to measuring teacher quality in high poverty areas, Patricia Popp, State Coordinator for the Education of Homeless Children and Youth, also cautions against using one measure for teacher quality based on test score. While Virginia does not exclusively use standardized test scores to evaluate teacher quality (they only account for 40 percent of the evaluations), Popp notes that using one single-point in time test measure is a significant

disincentive to teachers who are trying to work with the most vulnerable students. This is particularly true with respect to homeless and highly mobile students, who may have numerous teachers during the school year and whose test scores cannot be attached to any one teacher. Popp strongly recommends gathering data and analyzing other important factors such as the length of time a teacher has taught a particular student, numerous benchmark tests and curriculum based measures, which progress evaluations that taken in short probes, multiple times over a given period (this can be as many as several times per week) (Popp).

There are several other weaknesses to measuring teacher quality based on a standardized test score. Firstly, the tests were not originally designed to evaluate teacher performance, but instead were intended to measure what Gareis refers to as “trade winds,” or in other words, to answer questions such as, “What is the prevailing achievement of a school division, or a school?” A second area of concern is that such standardized tests were not developed to be growth-based (Gareis).

For example, to measure growth, there is an underlying assumption that the curriculum follows a building block approach, such as in mathematics, where the material learned in one year is crucial to understanding the following year’s curriculum. This is not the case in most other subjects. For instance, history class may focus on U.S. history in one year, and civic and economics in the following year. While these are two subsets of social studies, they undoubtedly cover different domains. Furthermore, language arts classes tend to follow a more spiraling curriculum as opposed to a linear approach. It is also important to consider the dynamics of student cognitive growth, which does not occur in constant set increments each year (Gareis).

A third area of concern is that state standardized accountability assessments are not instructionally sensitive, which is a term used by noted assessment experts such as Jim Popham

and Tom Guskey to describe the fact that the results of such assessments cannot be usefully analyzed by teachers and other school-level administrators to make discrete decisions about instruction at the lesson or even the unit planning level (Gareis).

Factors Affecting Teacher Quality

Historically, evaluations have been conducted on the basis of procedural reviews and infrequent classroom observation by untrained and overtaxed school administrators. One study analyzed whether or not improving teacher evaluations can positively impact teacher quality. In this day and age, it is easier to develop accountability and data systems capable of tracking learning gains by individual students, consequently, there are new ways to evaluate teachers. The study suggests that to improve teacher evaluation, policymakers should employ the following strategies: define teacher quality (by defining exactly what a teacher needs to know and be able to do), focus evaluation policy on improving teacher practice (so as to identify which teachers need assistance in which areas), incorporate student learning into teacher evaluation (transform the input-based evaluation into an outcome driven evaluation), create professional accountability (such as career ladders with professional classifications such as “beginning”, “mentor”, and “master” teacher levels), train evaluators to analyze effective teacher practices, and broaden participation design by reaching out to all education stakeholders (Goldrick 2).

Moyer-Packenham et al. analyze the characteristics of teachers that received nationally funded mathematics and science education awards in an attempt to determine what characteristics contributed to a “good” math and science teacher through use of exams, surveys, observations, and interviews of the teachers. There were six characteristics that were identified and studied by the researchers: teacher behaviors/practices/beliefs, subject knowledge, pedagogical knowledge, experience, certification status, and general ability. Proxies are used as

substitutes to approximate these characteristics, which caused controversy surrounding the interpretation of the results (Moyer-Packenham et al. 565-567). The characteristics most important to the awardees in their assessment of the teachers were the teachers' behaviors/practices/beliefs, subject knowledge, and pedagogical knowledge, rather than the conventional characteristics of experience, general ability, and certification status typically used in pure research (Moyer-Packenham et al. 584).

Data Overview and Summary Statistics

The data used in this project was collected from four main sources. We were initially provided three years of SOL scores by JLARC, which had been used in another 2014 study. Data concerning poverty rates by school district was originally collected by the US Census Bureau's Small Area Income and Poverty Estimates program. Information on teacher certification and education was collected from the Virginia Department of Education. All other data, including data regarding student demographics, discipline, teacher education and school staffing, was collected by the Office of Civil Rights in the US Department of Education. These data sets were compiled into a single data file organized by school district, school, and year. There are just under 2,000 public schools, and data was collected on an annual basis from 2010 through 2013, though not all data was available for every year or every school. Despite this, enough data was collected to ensure sufficiently large sample sizes for the purposes of regression. Due to privacy concerns, the most detailed data available is at the school-level, but this is fine for the purposes of our study.

Given the available data, three different components of teacher quality emerged: teacher experience, teacher education, and teacher certification. It was decided early on that creating an index to represent these factors would not yield a useful result, as the success of an index often

hinges on the subjective weights given to each component. Therefore, we chose key indicators that would serve as representatives in lieu of more comprehensive measures. Ideally, teacher experience would be represented by the number of years each teacher has worked, but data with that level of detail is not available in Virginia. Instead, the percent of teachers in at least their third year of teaching is used to estimate the number of “experienced” teachers in each school. Teacher education is measured by the highest degree attained, whether that is a bachelor’s or a master’s degree. Finally, teacher certification is represented by whether or not a teacher meets all of the state licensing requirements.

Table 1: Summary Statistics of Key Variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
Average 3rd Grade Reading SOL Score	4,468	459	31	347	557
Average 4th Grade Reading SOL Score	4,454	465	35	335	566
Average 5th Grade Reading SOL Score	4,384	462	30	365	539
Average 6th Grade Reading SOL Score	2,077	470	34	346	561
Average 7th Grade Reading SOL Score	1,591	462	30	360	569
Average 8th Grade Reading SOL Score	1,845	453	43	275	568
Average 11th Grade Reading SOL Score	1,272	470	32	397	581
Average 5th Grade Writing SOL Score	4,383	451	27	353	543
Average 8th Grade Writing SOL Score	1,517	432	18	333	542
Average 11th Grade Writing SOL Score	1,271	464	26	381	562
Average 3rd Grade Math SOL Score	4,468	447	47	327	573
Average 4th Grade Math SOL Score	4,454	457	40	346	592
Average 5th Grade Math SOL Score	4,384	455	45	344	588
Average 6th Grade Math SOL Score	2,396	448	36	333	600
Average 7th Grade Math SOL Score	1,937	440	55	270	600
Average 8th Grade Math SOL Score	1,748	418	62	46	600
Average Algebra 1 SOL Score	2,652	445	40	365	600
Average Algebra 2 SOL Score	1,357	434	41	337	600
Average Geometry SOL Score	2,231	457	44	357	600
School-Wide Average English SOL Score	6,796	460	28	362	571
School-Wide Average Math SOL Score	6,694	444	40	344	569

Variable	Obs.	Mean	Std. Dev.	Min	Max
Percent of Teachers in Their 1st Year of Teaching	9,553	5.27	6.26	0	100
Percent of Teachers in Their 2nd Year of Teaching	9,553	4.29	5.07	0	100
Percent of Teachers in Their 3rd Year of Teaching	9,553	90	9	0	100
Ratio of Teachers With At Most A Master's Degree to Those With Bachelor's Degree	6,641	2	1	0	20.75
Percent of Teachers Meeting All State Certification Requirements	9,553	97	6	0	100
Student-Teacher Ratio	9,553	15	26	.04	1460
Percent of Students who are Eligible for Free and Reduced Lunch, TANF, or Medicaid, or Ever Homeless During School Year	7,213	42	23	0	100
Percent of Children 5 yrs. - 17 yrs. in Poverty by School District	6,964	15	8	2.17	39.4

The table above includes summary statistics on some of our key variables. Generally, all of the average scores are above passing, but there is significant variation in both English and Math SOL scores between schools. In fact, the standard deviation of average Math SOL scores is over ten points higher than the standard deviation in average English SOL scores. One important point to underscore is the fact that there is generally low variation in the teacher quality indicators. On average, just 5 percent and 4 percent of teachers are in their first and second years of teaching, respectively. Additionally, on average schools have slightly more than 50% teachers with master's degrees and slightly less than 50% that have bachelor's degree. Furthermore, most schools had certification rates near 100%, as the average number of certified teachers is only one fewer than the average number of total FTE teachers. In our analysis, we used one of two variables to identify the poverty characteristics of a given school. The analysis below utilizes the economically disadvantage variable, which measures the percentage of students who are eligible for free or reduced lunch, TANF, Medicaid, or were ever homeless during the school year. The second variable comes from data from the US Census Bureau, and

measures the percent of children 5-17 years old who live under the poverty line according to their household income, by school district. The mean for economically disadvantaged is much higher than the percent of school age children under poverty, and there is also significantly more variation in the economically disadvantaged variable due to the fact that the census data is the same for each school district. Additional regressions using the U.S. Census Bureau data can be found in the Appendix.

To analyze the effects of these factors on student achievement, a series of pooled regression models were calculated. Due to the short time frame of the available data, a full time series model was not feasible, so multiple years worth of data are included in the same linear regression. Rather than create one large model containing every variable, separate regressions were run for each of the three quality variables, each test subject and grade level. For the ease of analysis, several key independent variables were de-measured and centered around 0.

Also included in the models are variables denoting the interaction effect between the independent variable in question (i.e. experience, education, or certification) and poverty. In addition, every model contains variables to control for the effects of poverty, the total number teachers, and the total number of students at a given school.

It is important to note that under ideal circumstances, our data set would include variables that link specific teachers to specific students' achievement scores, taken at both the beginning of the year and the end of the year. This would allow us to conduct value-added analysis in order to measure teacher quality based on student growth scores, taking into account numerous other factors, including poverty, which might affect student achievement gains. Given our limited dataset, which is at the school-level and not at the individual classroom level, as well as the makeshift measures we used to approximate teacher quality, our study may be underestimating

the effect of teacher quality due to measurement error. Given that Virginia does measure student growth scores as part of a \$17.5 million federal stimulus grant awarded in 2009, in order to receive a waiver from the No Child Left Behind law, this data would be conducive to further studies linking teacher quality and poverty (Chandler).

Section III: Teacher Quality and Student Outcomes

How does teacher quality affect student outcomes?

The literature related to factors that improve teacher quality covers a wide range of variables and has found varied results. In order to determine which aspects of teacher quality have the most impact on student learning, Goe and Stickler analyzed dozens of prior studies that link teacher quality variables to student scores on standardized tests. The authors identify four lenses for examining teacher quality: teacher qualifications (credentials, knowledge, and experience), teacher characteristics (attitudes and attributes), teacher practices (classroom practices employed by the teacher), and teacher effectiveness (a value-added assessment, indicated by higher-than-predicted increases in student achievement scores) (Goe & Stickler 21).

The results of the study is summarized in the table below.

Table 2: Summary of Teacher Quality Indicators

Teacher quality framework	Variables Impacting Student Achievement	General Findings
Teacher qualifications	Teaching Experience	Results were inconsistent. Studies' results ranged from experience having a marginal impact, experience having an impact only in the first few years, experience having an impact regardless beyond the first few years, and experience having no impact.
	Certification (general)	Results of various studies tend to agree that teacher certification contributes to student achievement.
	Subject-area certification	Various studies tend to agree that mathematics teachers with mathematics certification positively impacts students' math scores.
	Academic major/minor	Various studies agree that a teacher with a math or science major/minor positively impacts students in math/science courses (although one study suggests the impact is marginal)
	Advanced degrees	The results of various studies analyzing the impact of advanced degrees on student's math range from marginal to negative.
	Undergraduate institution	No impact
	Pedagogical content knowledge	Various studies agree that a teacher's pedagogical content knowledge positively impacts a student's scores.

Source: Goe, Laura, and Leslie M. Stickler. "Teacher Quality and Student Achievement: Making the Most of Recent Research. TQ Research & Policy Brief." National Comprehensive Center for Teacher Quality (2008), 19-21.

(Cont.)

Teacher quality framework	Variables Impacting Student Achievement	General Findings
Teacher characteristics	Teacher collaborations	Teachers that shared information, vision, and trust among other teachers, including shared decision making, reflected in a positive impact in the school's overall student achievements.
	Teacher efficacy	Teacher collective efficacy to improve student achievement was positively associated with school achievement.
	Teacher expectations	Results of various studies differed; some said that teacher's with high expectations had a positive impact on mathematic achievement while others found it marginal impact.
	Teacher race	Results of studies varied; a newer study suggested that same-race teachers improved minority students' achievements while an older study found no link between teacher's race and gender and student achievement.

Teacher practices	Whole-class instruction	Marginally improved elementary and middle school students' mathematics and reading growth.
	Interactive practices	Various studies agree that interactive practices have a positive impact on student achievement.
	Quality of assignments	Results vary; one study suggests that the quality of assignments has a marginal impact on middle and high school students while another study suggests that intellectually demanding assignments have a positive impact on elementary and middle school students.
	Principal assessments of teacher practice	Principal assessments are strongly related to better-than-predicted elementary student achievement in mathematics and reading.

Source: Goe, Laura, and Leslie M. Stickler. "Teacher Quality and Student Achievement: Making the Most of Recent Research. TQ Research & Policy Brief." National Comprehensive Center for Teacher Quality (2008), 19-21.

In the paper, "The Market for Teacher Quality," Hanushek et al. utilized matched panel data on students and teachers for a large district in Texas gathered by the Texas Schools Project of the University of Texas at Dallas to estimate student achievement gains (Hanushek et al. 3). They find that advanced degrees or certification has little bearing on teacher quality (Hanushek et al. 16). Furthermore, they found that teachers tend to see substantial improvement after their first year of teaching, but experience smaller marginal gains afterwards (Hanushek et al. 17-18). Hanushek et al. concluded that good teachers are effective with student of all ability levels, , but they tend to have the most success when matched with students of the same race (Hanushek et al. 20). The analysis conducted shows that teacher quality varies wildly not between schools but rather within schools (Hanushek et al. 14), and that teachers that stay with the same urban school

are of equal/better quality than teachers that leave, thus, the major expense of teacher turnovers is the introduction of first year teachers (Hanushek et al. 25-26).

Wenglinsky used data on 7,146 8th graders who took the National Assessment of Educational Progress (NAEP) mathematics assessment in 1996 and 7,776 8th graders who took the NAEP science assessment in 1996 in order to examine how improving teachers' classroom practices could improve teachers' quality (Wenglinsky 6). Three types of teacher quality were measured: teacher inputs (such as education level of teacher), classroom practices (such as use of hands-on learning), and professional development (Wenglinsky 8). The results found that conveying higher-order thinking skills (such as developing concepts through one set of problems and having students apply these concepts to a very different set of problems) leads to improved student performance in both math and science (Wenglinsky 6). Furthermore, results suggested that hands-on learning encouraged aspect of higher-order thinking skills (namely, concretizing concepts through simulations), which means that hands-on learning helps improve student performance (Wenglinsky 9). The result also found that individualizing instruction to take into account varying levels of student ability is an effective way to improve student performance. Professional development in cultural diversity, teaching students with limited English, and teaching students with special needs were linked to higher math scores, although these improvements do not necessarily translate to science success. Results suggest that collaborative learning (working in small groups) does not improve student performance and that assessment practices (such as projects or portfolios) tend to have a negative effect on student performance. The author is quick to point out, however, that these projects and portfolios should not be taken out of the curriculum entirely, as the problem with these projects is the difficulty in distinguishing individual students' strengths and weaknesses (Wenglinsky 33).

Our Research

With data gathered from the JLARC study, the Virginia DOE, and the OCR, a regression was performed examining the effect of teacher quality measures on SOL scores. A non-linear effect for the student to teacher ratio was included to help control for variation in classroom sizes.

Table 3: The Effect of Teacher Quality on Student Achievement

<i>DV: SOL Score</i>	Experience		Education		Certification	
	English	Math	English	Math	English	Math
Teacher Quality	0.33***	0.35***	6.78***	6.25***	0.43**	0.33
Student-Teacher Ratio	4.53***	4.29***	11.42***	6.50**	4.78***	4.67***
Ratio Squared	-0.12***	-0.11	-0.34***	-0.16	-0.13***	-0.12
Constant	390.94***	373.82***	372.90***	385.14***	376.85***	369.62***
Observations	6796	6694	4454	4377	6796	6694
R ²	0.03	0.01	0.14	0.03	0.03	0.01
Note: Method is OLS with robust standard errors clustered by school district. Significance is denoted by *=0.10; **=0.05; ***=0.01						

Even though the coefficient on the student to teacher ratio is positive, a negative squared term indicates that larger class are correlated with higher test scores until about 15 to 20 students, at which point the effect begins to decrease. This may be due to a network effect—as the number of students approaches 15, the classroom benefits from shared learning and teamwork—or it could simply be because we did not observe many classrooms with fewer than 15 students. As the qualitative research states, teacher quality has a statistically significant, positive effect on student outcomes. However, this effect is much smaller than the previous research indicates. For a ten percentage point increase in highly experienced teachers, we can only expect a 3.3 point increase in English SOL scores on a scale from 0 to 600. Similarly, the small R² values indicate that the selected teacher quality metrics and classroom size only account for 1% to 14% of the

total variation in SOL scores. In other words, there must be more influential factors on a student's performance than the classroom specific variables selected for this model.

Section IV: Poverty and Teacher Quality

Do higher poverty schools in Virginia tend to have lower quality teachers?

Studies find that there is a negative relationship between teacher quality and poverty. One relevant analysis, which utilizes student-level data from the 2000-2005 in Florida and North Carolina, finds that the average effectiveness of teachers is lower in high poverty schools (where greater than 70 percent of students are on free-and-reduced-price-lunch). These high poverty schools also have greater variation in teacher quality, which is driven by “less productive teachers at the bottom of the teacher effectiveness distribution in high poverty schools” (Sass et al. 1). The majority of the quality differential can be attributed to differences in unmeasured characteristics of teachers. Most importantly, the study finds that the gain in productivity to more experienced teachers from additional experience is much stronger in lower-poverty schools (Sass et al. 1). In terms of policy implications, the results from this study indicate that the more successful measures to improve teacher quality in high poverty schools will include measures that promote the retention of highly effective teachers in high poverty schools and that induce highly effective and experienced teachers in low poverty schools to move to high poverty schools (Sass et al. 32).

Furthermore, less experienced, less educated, and less skilled teachers tend to be assigned to the highest-poverty and highest-minority schools. Peske and Haycock collected data from schools in Cleveland, Chicago, and Milwaukee and show that regardless of how teacher quality is measured, poor and minority children get short-changed when it comes to their share of high-quality teachers. Children in high-poverty areas are assigned to first year teachers nearly twice as often as those in low-poverty schools. Classes in high-poverty and high-minority schools are also more likely to be taught by teachers inexperienced in the subject (that is, teachers without a

major or minor in the subject they teach) (Peske & Haycock 2). The Illinois Education Research Council measured teacher quality by creating an index called the Teacher Quality Index, which was determined by five teacher attributes (the percentage of teachers with BA degrees from more competitive schools; the percentage of teachers of with less than 4 years of experience; the percentage of teachers with emergency or provisional credentials; the percentage of teachers who failed the Basic Skills test on the first attempt; and the average ACT composite score of teachers), all of which have been shown to be related to student achievement (Peske & Haycock 7). Teachers' academic skills and knowledge, mastery of content, experience, and pedagogical skill were all shown to be related to student achievement (Peske & Haycock 8).

The study, "What Does 'Highly Qualified' Mean for Student Achievement? Evaluation the Relationships between Teacher Quality Indicators and At-Risk Students' Mathematics and Reading Achievement Gains in First Grade," focuses on the relationship between first grade student achievement gains and teacher quality indicators. The author uses data from the Early Childhood Longitudinal Study (ECLS-K), which documented the educational status and progress of a nationally representative cohort of U.S. children from kindergarten through fifth grade. The study reveals that the No Child Left Behind (NCLB) program is successful in placing emphasis on at-risk students, but there is no evidence suggesting that teacher quality is related to student achievement gains for either at-risk students or non-risk students. NCLB aims to ensure that disadvantaged students are not paired with under-qualified teachers (Phillips 465). Although the author acknowledges that much of the pre-existing research on teacher quality does not provide any evidence suggesting a relationship between student achievement and the three aforementioned characteristics of quality teachers, she does point out that many studies have concluded that teachers are one of the most important factors in explaining the variation in

student test scores (Phillips 466). The relevant characteristics of these teachers, however, are inconsistent across studies, which makes it difficult to pinpoint what makes a teacher a “good” teacher (Phillips 484). The paper concludes that the three characteristics as outlined by the NCLB for teacher quality are not necessarily associated with increased student achievement gains (Phillips 486).

In a paper that examines teacher quality and educational equality, Borman and Kimball ask whether teachers with higher standards-based evaluation ratings close student achievement gaps. The authors utilized achievement results for 7,000 students from grades 4-6 in the Washoe County, a mid-sized school district serving Reno and Sparks, Nevada. Teachers were rated by standards-based teacher evaluation, where the principal or assistant principal would evaluate teachers on planning and preparation, classroom environment, instruction, and professional responsibilities; these teachers were given scores ranging from 0 (unsatisfactory) to 3 (area of strength). The researchers took the average of the scores to obtain an overall measure of teacher quality (Borman & Kimball 6). The study found that classrooms with higher concentrations of minority, poor, and low-achieving students were often paired with teachers with low evaluation scores and that better teachers were either assigned or sought out classrooms with advantaged, low-minority, or higher-achieving students (Borman & Kimball 9-10). However, further analysis suggests that teacher quality is not necessarily a reliable factor in closing the student achievement gaps between high-achieving and low-achieving students (Borman & Kimball 18).

Our Research

Our research does not produce results as strong as the previous literature. While the indicators of teacher quality are lower in high-poverty areas than in low-poverty areas, the difference is relatively small. For example, 97.3% teacher certification at the lowest level of poverty is only slightly higher than at the highest level of poverty, which is 95.9%. The exception to this is teacher education, which shows almost a full point decrease in the ratio between teachers with Master's degrees and those with Bachelor's degrees. It is also important to note that the negative relationship is not strictly a linear one. For example, teacher education is higher at the 90th percentile of poverty than at the 50th percentile.

One significant difference that is present in the data is in the amount of variation in teacher quality at different levels of poverty. Schools at the highest percentiles of poverty have much higher standard deviations than those at the lowest percentiles of poverty. Once again, the exception to this is teacher education, which has far less variation in high poverty schools than at low poverty schools.

Table 4: Average Teacher Quality by Poverty Percentile

Poverty Percentile	Experience		Education		Certification	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
0-10	91.31	6.06	2.14	1.06	97.31	4.47
10-25	92.17	5.67	1.83	1.15	97.78	4.22
25-50	90.98	7.21	1.41	0.89	97.93	5.24
50-75	90.49	7.57	1.24	0.84	98.01	4.56
75-90	89.5	9.84	1.26	0.8	95.83	7.77
90-100	87.64	8.59	1.32	0.72	95.9	7.43

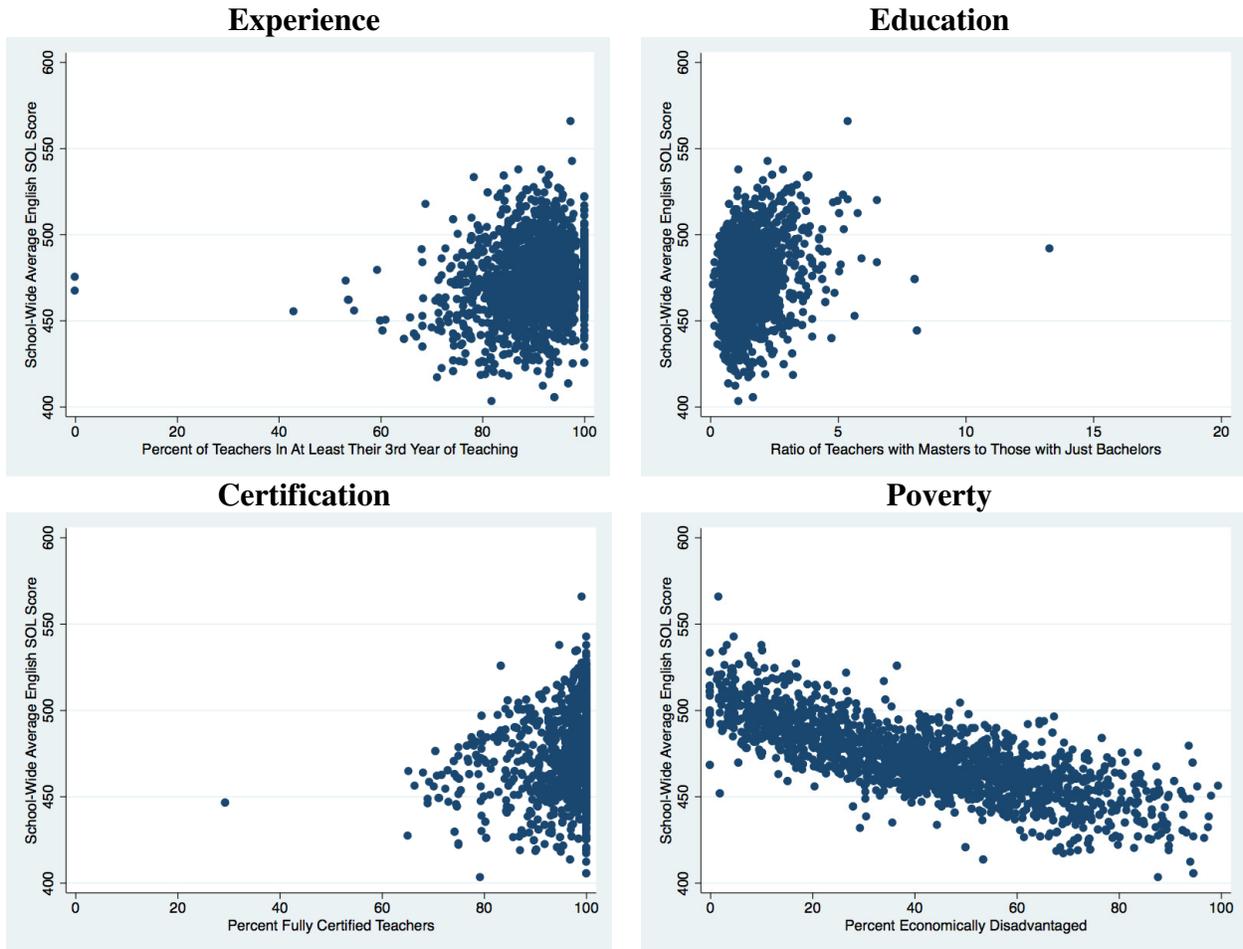
The table below shows a similar picture. Teacher experience and education have a statistically significant, negative relationship with poverty, albeit a small one. It is important to remember that the R-squared values for these regressions are extremely low, topping out at 0.07. This means that student economic status can only explain at most 7% of the variation in teacher quality across schools.

Table 5: The Effect of Poverty on Teacher Quality

<i>DV: Teacher Quality</i>	Experience	Education	Certification
Percent Economically Disadvantaged	-0.05***	-0.01***	-0.02
Constant	92.7***	1.95***	98.5***
Observations	7141	4663	7141
R-Squared	0.02	0.07	0.01
Note: Method is OLS with robust standard errors clustered by school district. Significance is denoted by *=0.10; **=0.05; ***=0.01			

After graphing the relationship between our three teacher quality indicators and student scores, we find that poverty has the strongest correlation (-0.6) with school-wide average English SOL scores in 2012 across all grades, explaining 35 percent of the variation in these scores. As you can see in the figure below, the teacher quality indicators experience, education, and certification do not exhibit any notable patterns against student scores. The results are similar for average Math SOL scores as well (see Appendix).

Figure 1: Effect of Teacher Quality and Poverty on 2012 English SOL scores
Which impacts SOL scores the most, teacher quality or poverty?



We found a small effect of teacher quality on student scores when compared to the effect of poverty on student scores. The table below summarizes the effects we observed in the simple teacher quality and student outcome model and highlights the increasing interaction effect. As you can see, for students in low-poverty schools, a change from 25th percentile teacher quality to 75th percentile teacher quality accounts for just one fifth of a point increase overall. For students in poverty, the effect was greater (1.4 points). Moving horizontally across the table, it is apparent that a change from the 75th percentile poverty value (which corresponds to low income), to the 25th percentile poverty value (which represents high income), accounts for a 25-26 point

difference. Additional tables highlighting similar trends using various combinations of teacher quality indicators and SOL scores can be found in the Appendix.

Figure 2: Predicted Average SOL Scores Given Percentile Values for Poverty and Teacher Experience

	25th Percentile Poverty (High Income)	75th Percentile Poverty (Low Income)
25th Percentile Teacher Experience (Low Experience)	497.7	471.1
75th Percentile Teacher Experience (High Experience)	497.9	472.5

Section V: Relevant Policy Recommendations

Policy Recommendations: Improving Teacher Quality

1-Encourage Developmentally and Culturally Responsive Professional Practices

This pertains to aspects of classroom management which entail building a strong rapport with students. This includes understanding developmental appropriateness, or that not all students grow in a predictable, segmented way, as well as understanding vulnerabilities to certain influences that may come from demographic differences (Gareis).

Popp stresses the importance of providing support to teachers in preparation programs in understanding the needs of children living in poverty. She also notes that upon talking to teachers who work with homeless and highly mobile children, many of them expressed that important professional development for them included learning how these children think and what kinds of things need to be done. This was a skill that was not honed in preparation programs, but was instead learned after gaining experience in these settings (Popp).

2-Implement Uniform Performance Standards across Schools

Stronge was instrumental in creating uniform performance standards, a framework from which all the school divisions create their own teacher evaluation systems. While local control is extremely important and a positive development, it makes it impossible to compare teachers across the five domains. Operationally defining the five domains such that there is a common set of measures for other characteristics of effective teachers would be beneficial (Gareis).

3-Improve Teacher Selection

The teaching profession is not selective in the United States when compared to other leading industrialized nations. For example, in Finland, only 10 percent of undergraduates are accepted into teacher preparation programs, and all teachers are required to have a master's

degree. This is in contrast to the United States, where teacher preparation programs tend to accept students from the bottom third of their high school class (Virginia Commission on Youth 52).

Table 6: Teacher Selection in Select Countries

Country	Teacher Selection Mechanism
Canada	<ul style="list-style-type: none"> ▪ Most schools require an undergraduate degree and an additional degree in education (1 to 2 years) ▪ Secondary certification often requires a specific number of credits in the subject area
Finland	<ul style="list-style-type: none"> ▪ Only 10 percent of undergraduates are accepted into teacher-training programs ▪ All teachers must have a master’s degree
Singapore	<ul style="list-style-type: none"> ▪ Only the top third of each graduating high school class is recruited for initial screening ▪ Final candidates enter a fully paid, four-year teacher education program and are paid by the government during their education. ▪ While anyone can apply and attend a teacher preparation program, only the top 30 percent will obtain teaching jobs after completing the program and passing examinations
United States	<ul style="list-style-type: none"> ▪ Two-thirds of teacher preparation programs accept more than half of their applicants ▪ One fourth of teacher preparation programs accepted nearly all of their applicants ▪ Only 40 percent of teacher preparatory programs were found to implement some type of minimum grade point average ▪ One study asserts that preparatory programs pull college bound students from the bottom third of their high school class

Source: Commonwealth of Virginia Commission on Youth. Rep. no. 218. Virginia Commission on Youth, 28 Sept. 2012. <[http://leg2.state.va.us/dls/h&sdocs.nsf/By+Year/RD2182012/\\$file/RD218.pdf](http://leg2.state.va.us/dls/h&sdocs.nsf/By+Year/RD2182012/$file/RD218.pdf)>.

Popp believes that part of the solution is garnering interest in the teaching profession, which includes emphasizing how rewarding the field is to students from a young age, as well as increasing teacher salaries.

4- Increase Teacher Salaries

Stronge believes that the teaching profession is not attracting the best and brightest individuals due to countless other opportunities in other professions, which has led to a deselection of teaching, an outcome that is not occurring in other countries. South Korea, for example, pays teachers in relative terms to what other professions earn within their country, twice the amount that American teachers earn. Higher pay and higher respect for teachers is generally found in most of the high-achieving countries. Stronge emphasizes that salaries are not the only issue affecting teacher quality, but ultimately, having a deeper, richer applicant pool of really high quality candidates is an integral part of the solution for improving teacher quality (Stronge).

It should be noted that high poverty schools are not necessarily underfunded relative to other schools. High poverty schools in urban areas have considerable tax income from business and industry that is located in the area. For example, Alexandria City is a high poverty school district, but the property value in Alexandria City is exceptionally high, with the cost of living in Alexandria about 50% higher than the national average. Moreover, relative to other countries, the United States spends more on per pupil basis. Newark, New Jersey, for example, spends more than \$20,000 per pupil and still does not achieve high results. Thus, reorganizing how funds are spent is an important component of the issue (Stronge).

While Stronge is generally not a proponent of differential pay at the K-12 level, he believes that one exception would be to provide a substantial bonus for teachers who not only agree to work in challenging schools, but also achieve positive results in these schools. This may help in attracting and retaining high performing teachers in high poverty areas (Stronge).

5-Attract Teachers with More Experience in Schools with High Poverty Rates

There is evidence high poverty schools have a higher percentage of low quality teachers. This may be partly attributable to the fact that high poverty schools tend to have a high teacher turnover rate, continually hiring novice teachers. Literature shows that novice teachers are not as effective as teachers with more experience, as it takes several years of experience for teachers to learn how to become effective. Novice teachers who are placed in challenging situations associated with schools with higher rates of students living in poverty, are likely to move to less challenging schools after a short period of time, and new pools of inexperienced teachers are hired (Stronge).

6-Retain Quality Teachers through Improved Teacher Evaluations

Stronge believes that improving teacher evaluations are one of many ways to improve teacher quality. Evaluations play an important role in improving teacher quality because, when conducted accurately, they allow for the distinction between effective and ineffective teachers. Making these distinctions is pivotal because without proper identification mechanisms, schools may be retaining poor performing teachers year after year. This undermines any efforts to reform or improve schooling (Stronge).

7-Modify the Teacher Preparation Model

Ideally, barring financial constraints, a teacher preparation model more akin to a medical model would likely provide better outcomes for education. This would entail significant increases in practice based teaching training and higher levels of experience in the classroom. While it may make sense for certain, more technical professions to allow individuals to dive straight into practice, this is not preferable for a profession as complex and multifaceted as

teaching, which deals with the intricacies of human nature and psychology. At a minimum, the required number of semester hours of classroom based teaching should be increased (Stronge).

8- Support Teacher Professional Development

Several dimensions of teaching require more technical development. These include teacher assessment skills, which can be developed through professional development. A continual professional development regiment is necessary to grow effective teachers (Stronge).

9-Improve Teacher Proficiency in Classroom-based Assessments

There is evidence out that teachers by and large—not just in Virginia, but around the world—tend to be pretty poorly prepared in the area of classroom based assessment. However, becoming proficient in assessment entails having a strong understanding of the curriculum and thereby improves instructional practices (Gareis).

10-Revise the Common Curriculum and the Standards of Learning

One measure that can be taken to improve teacher quality from a policy perspective is to reduce the scope of the curriculum and Standards of Learning. Compared to other countries, the curriculum is much wider in many states, and it can be argued that the scope is too wide. Thus, reducing the scope of content of the curriculum in order to allow for greater cognitive depth of teaching and student learning would be beneficial to both teachers and students (Gareis).

11-Continue to Encourage Greater Flexibility when Implementing the State Curriculum

School divisions should utilize curriculums that are tailored to their needs, as opposed to trying to implement the state curriculum framework, which was not intended to be translated to the classroom without adjustments. Theoretically, the school division curriculum should encompass the state curriculum and provide clear intended learning outcomes for students that are appropriate for its local environment (Gareis).

12- Remove the 24 Credit Cap on Elementary Education/Special Education Coursework

According to the Virginia Department of Education, “Professional studies coursework and methodology, excluding field experiences, are limited to 24 semester hours for any baccalaureate degree program (or equivalent thereof) in early/primary education (preK-3), elementary education (preK-6), and special education. All other baccalaureate degree programs (or equivalent thereof) shall not exceed 18 semester hours of professional coursework and methodology, excluding field experiences (Department of Education, 9).” The cap was instituted following a series of studies in the 1980s that stressed the importance of content and instigated the idea that having a subject area major would be more beneficial to teaching. However, elementary school teachers often are responsible for more than one subject, and under this system, their undergraduate major may be unrelated to the core subject matter that they may teach (Gareis).

Policy Recommendations: Improving Data on Teacher Quality

1-Track Teacher Performance

There would be value added from tracking graduates of teacher preparation programs along with their students’ growth scores as well as other outcome measures. North Carolina currently tracks teacher graduates and traces them back to their universities. This allows for the analysis of the value-added impact of a collective body of graduates from a particular university (Stronge).

2-Track Student Mobility and Attendance Data

Data tracking student mobility and attendance that matches students with teachers over all timeframes, no matter how short, would aid in further understanding and interpreting student achievement (Popp).

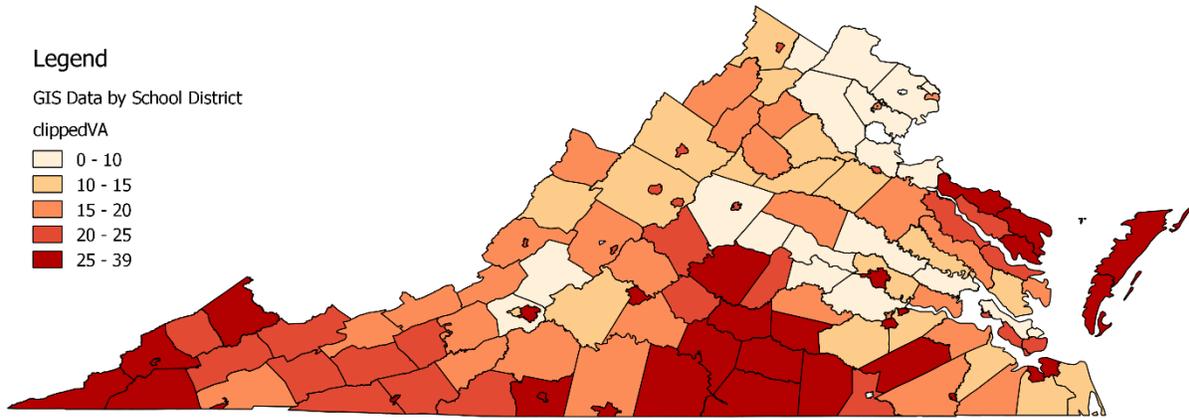
Appendix

Figure 1: Case Study on the Equity Project Charter School

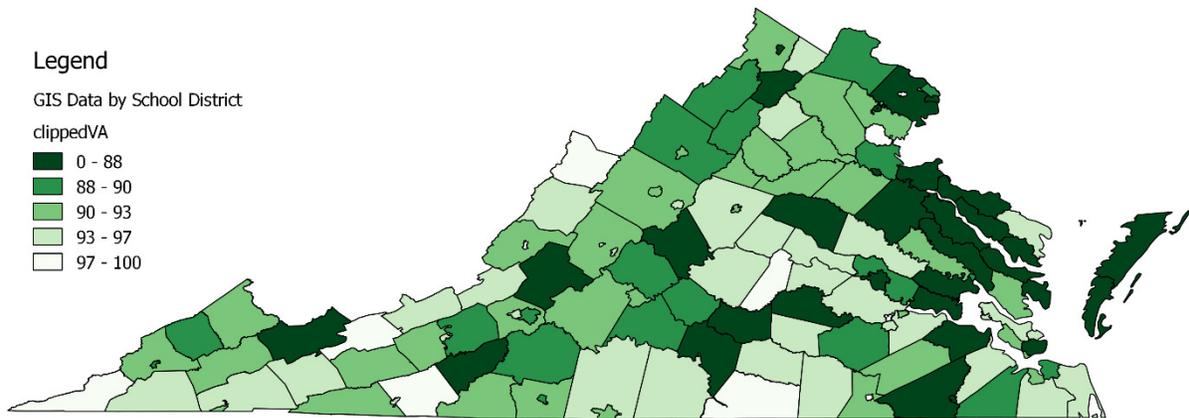
Case Study: The Equity Project Charter School
<p style="text-align: center;"><i>Background</i></p> <p>The Equity Project Charter School (TEP) attempts to “put into practice the central conclusion of a large body of research related to student achievement: teacher quality is the most important school-based factor in the academic success of students” (“Philosophy”). The middle school opened in New York City in 2009, and currently serves 480 students (“Philosophy”). The students at TEP are similar to other students in the Washington Heights neighborhood where the school is located, with over 90 percent of the students coming from low-income households. Moreover, compared to other similar New York City schools, TEP has comparable attrition rates and rates of students who receive special education services (“Long Term Study Results”).</p>
<p style="text-align: center;"><i>Attracting and Retaining High Quality Teachers</i></p> <p>The school focuses on attracting and retaining high quality, “master” teachers through employing a strategy that includes rigorous qualifications, redefined expectations, and revolutionary compensation. The compensation structure is comprised of a \$125,000 annual salary and the opportunity to earn a significant annual bonus based on school-wide performance (“Philosophy”).</p>
<p style="text-align: center;"><i>Funding</i></p> <p>TEP created a financial model that allows the provision of high compensation without relying on additional outside funding. TEP believes that high quality, highly productive teachers contribute to immense cost savings (“Philosophy”). Specifically, these savings are achieved given the following:</p> <ul style="list-style-type: none">▪ TEP Does Not Employ a Variety of Administrative and Support Staff – This includes positions such as attendance coordinator, parent coordinator, or discipline dean. TEP teachers are responsible for one whole-school process, program or project. School wide leadership is incorporated into teachers’ everyday roles (“Key Savings”).▪ Teachers are also Instructional Supervisors - TEP's Assistant Principal is also the 8th grade math teacher, and its Principal teaches a 7th grade class. TEP's teacher mentors hold full teaching schedules (“Key Savings”).▪ Low Professional Development Fees- Professional development is integrated into the structure of the teaching position (“Key Savings”).
<p style="text-align: center;"><i>Results</i></p> <p>TEP is closing the Latino-White achievement gap in Math, English, and Science</p> <ul style="list-style-type: none">▪ Students who attended TEP for four years had test score gains equal to an additional 1.6 years of school in math, slightly less than half a year in English, and slightly more than half a year in science (“Long Term Study Results”).▪ TEP’s cumulative effect on student achievement over four years closes nearly 80% of the Latino-White achievement gap in math (“Long Term Study Results”).

Figure 2: Mapping the Key Variables

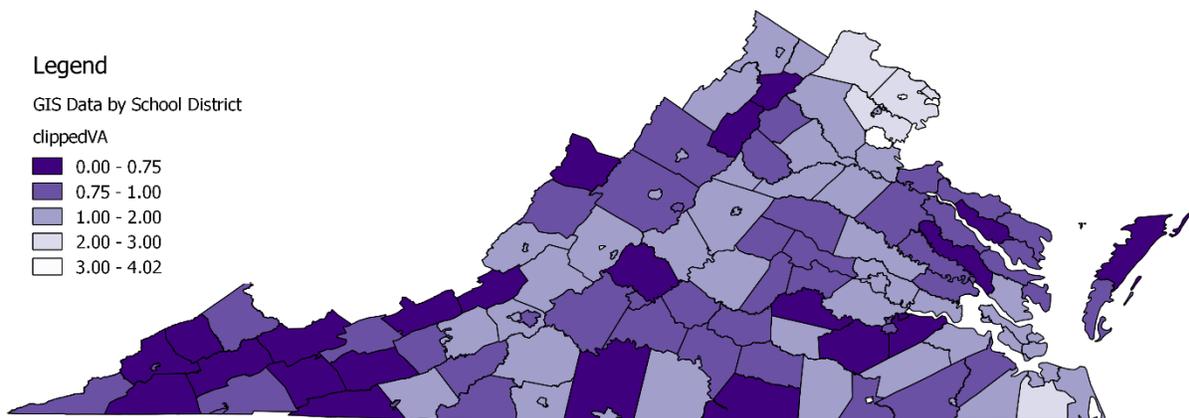
Percent of School-Age Children in Poverty by School District



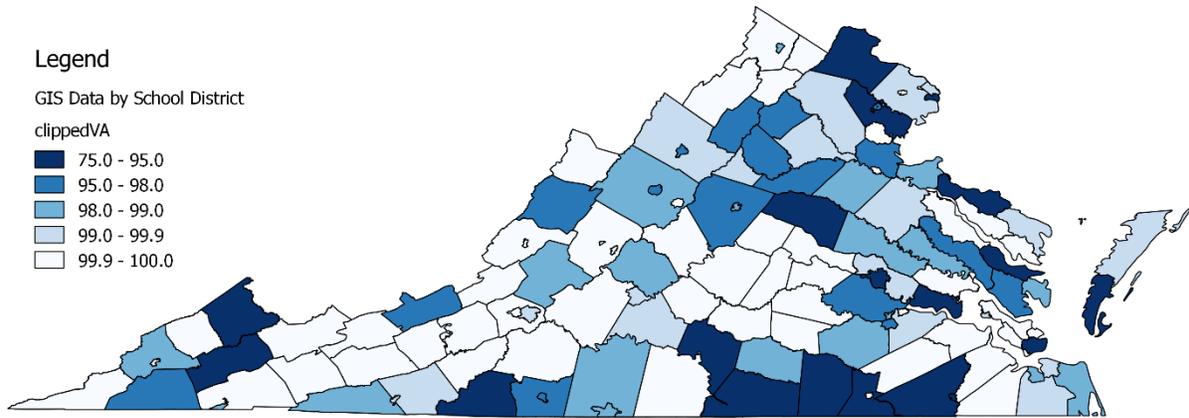
Percent of Teachers with at Least 3 Years of Experience



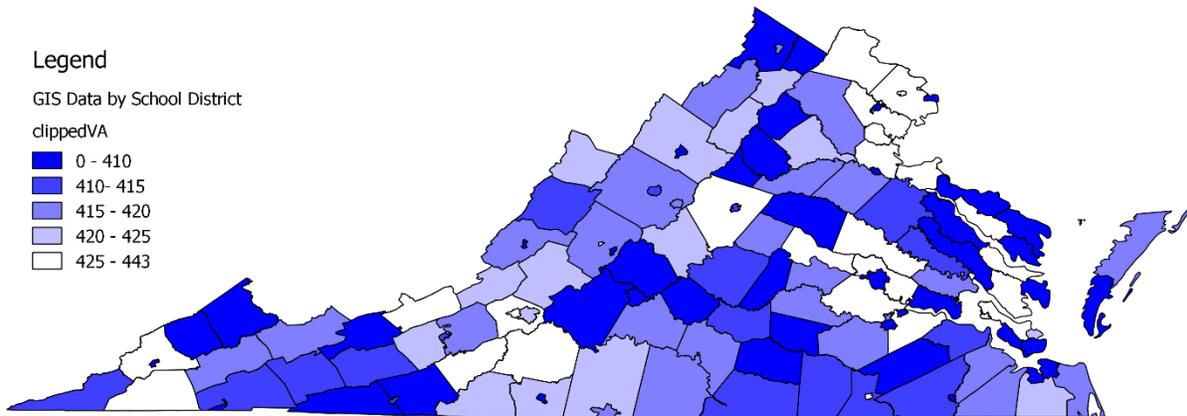
Teacher Master/Bachelor Ratio by School District



Percent of Certified Teachers by School District



Average Math SOL Scores by School District



Average English SOL Scores by School District

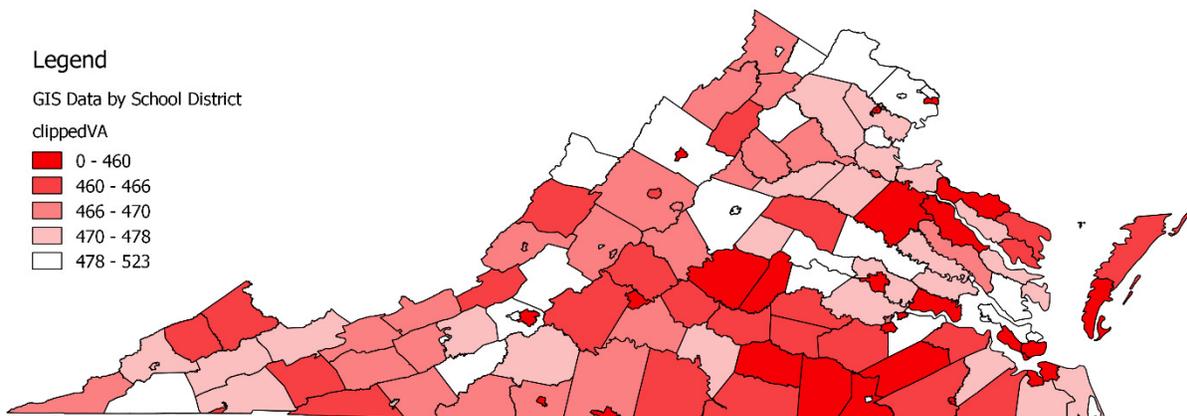


Table 1: Teacher Quality and School-Average Scores

	Experience		Education		Certification	
	English	Math	English	Math	English	Math
Student Poverty (%)	-1.108***	-1.028***	-0.960***	-0.999***	-1.162***	-1.022***
Student-Teacher Ratio	3.308***	3.078***	8.046**	3.929	3.600***	3.187***
Student-Teacher Squared	-0.0847***	-0.0637**	-0.237**	-0.0788	-0.0909***	-0.0675**
Teacher Experience	0.286***	0.303**				
Experience * Poverty	0.0158*	0.0270*				
Teacher Education			3.061**	1.864		
Education * Poverty			-0.182	-0.301*		
Teacher Certification					0.388***	0.389*
Certification * Poverty					-0.0356**	0.0148
Constant	443.2***	422.6***	407.4***	412.6***	440.3***	421.9***
N	3410	3358	3365	3309	3410	3358
R2	0.239	0.0553	0.254	0.0583	0.244	0.0529

* $p < .10$, ** $p < .05$, *** $p < .01$

Figure 3: Effect of Poverty on Teacher Quality and 2012 English SOL Scores

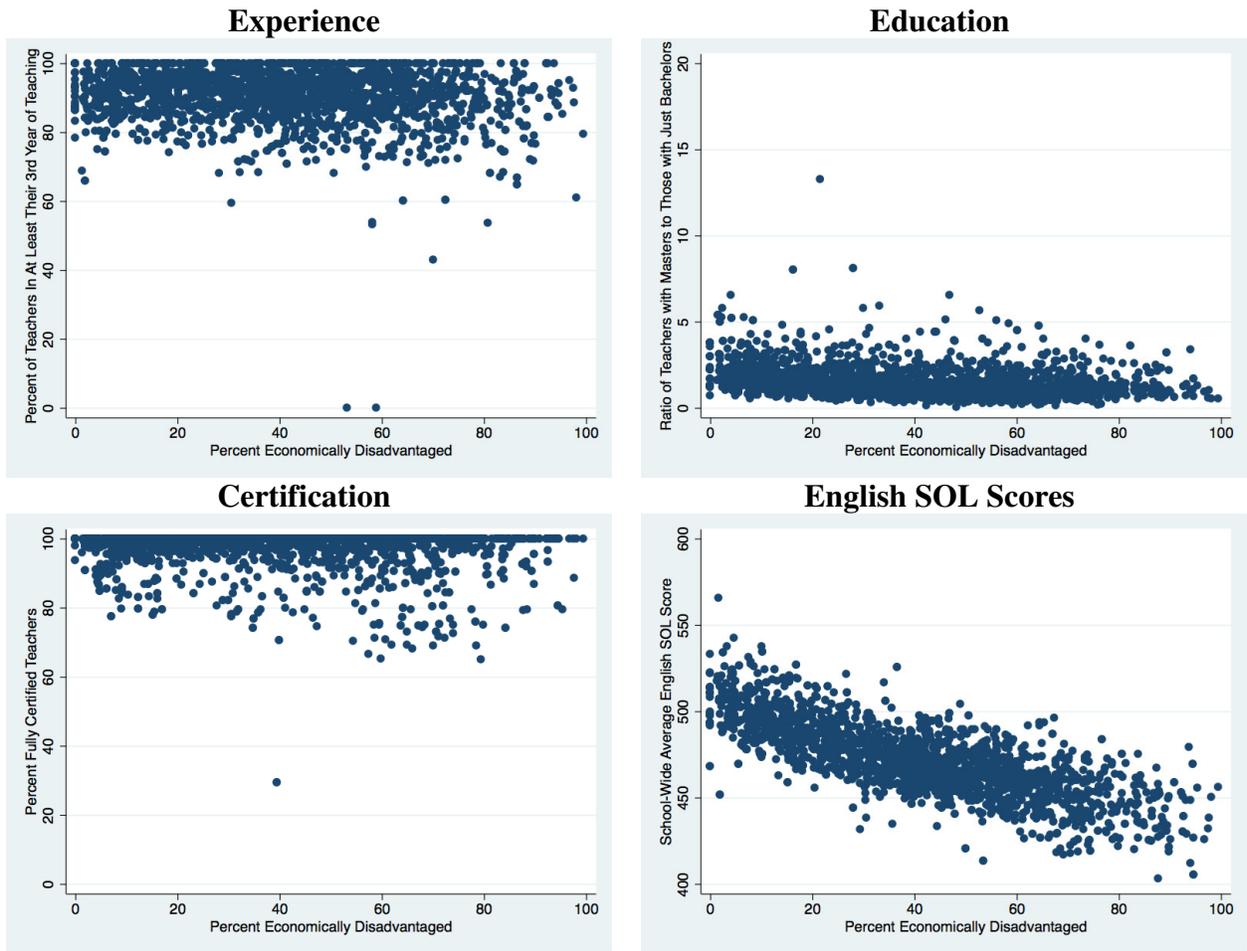


Figure 4: Effect of Teacher Quality and Poverty on 2012 Math SOL Scores

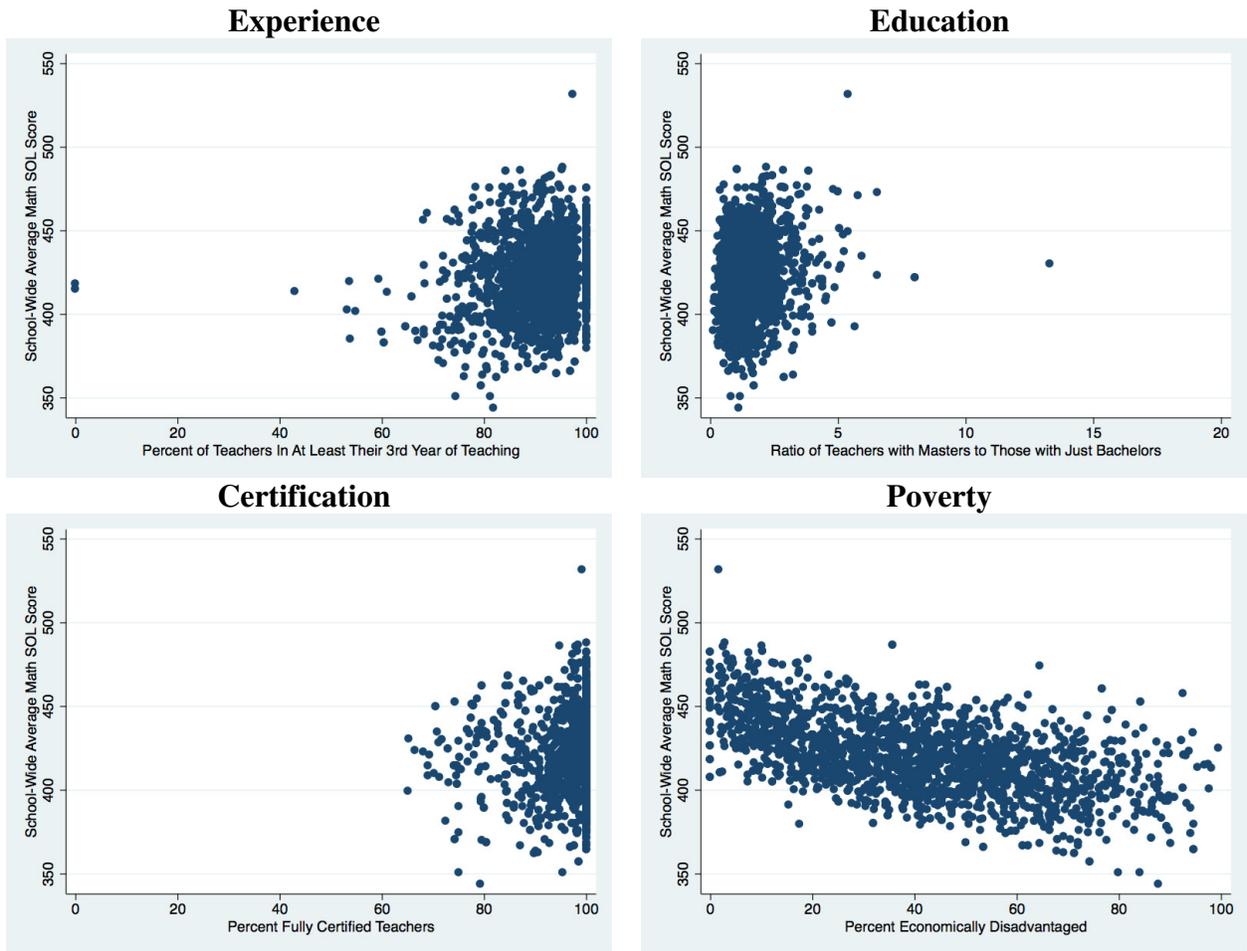


Figure 5: Predicted English SOL Scores Given Percentile Values for Poverty and Teacher Experience

	25th Percentile Poverty (High income)	75th Percentile Poverty (Low income)
25th Percentile Teacher Experience (Low Experience)	471.9	446.3
75th Percentile Teacher Experience (High Experience)	472.2	447.1

Figure 6: Predicted Math SOL Scores Given Percentile Values for Poverty and Teacher Experience

	25th Percentile Poverty (High income)	75th Percentile Poverty (Low income)
25th Percentile Teacher Experience (Low Experience)	458.9	436.4
75th Percentile Teacher Experience (High Experience)	460.7	438.0

Figure 7: Predicted English SOL Scores Given Percentile Values for Poverty and Teacher Education

	25th Percentile Poverty (High income)	75th Percentile Poverty (Low income)
25th Percentile Teacher Education (Low Education)	479.8	457.8
75th Percentile Teacher Education (High Education)	482.5	456.5

Figure 8: Predicted Math SOL Scores Given Percentile Values for Poverty and Teacher Education

	25th Percentile Poverty (High income)	75th Percentile Poverty (Low income)
25th Percentile Teacher Education (Low Education)	491.6	471.3
25th Percentile Teacher Education (Low Education)	493.2	469.5

Figure 9: Predicted English SOL Scores Given Percentile Values for Poverty and Teacher Certification

	25th Percentile Poverty (High income)	75th Percentile Poverty (Low income)
25th Percentile Teacher Certification (Low Certification)	468.0	442.5
75th Percentile Teacher Certification (High Certification)	468.5	442.9

Figure 10: Predicted Math SOL Scores Given Percentile Values for Poverty and Teacher Certification

	25th Percentile Poverty (High income)	75th Percentile Poverty (Low income)
25th Percentile Teacher Certification (Low Certification)	456.8	434.0
75th Percentile Teacher Certification (High Certification)	457.0	434.0

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