Factors Influencing Improved Student Achievement In Virginia

by

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DEDICATION

This is dedicated to my loving wife Ronnie and our five wonderful children Patrick, Joey, Tim, Duke and Kellie and my daughter-in-law Liz. I also dedicate this to our five grandchildren Emily, Jacob, Audrey, Grace and Ella – motivators and distracters at the same time.

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Dr. Aud performed a meticulous review of a draft of this dissertation and made it a much better product.

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LIST OF ABBREVIATIONS

No Child Left Behind ..... NCLB
Standards of Learning ..... SOL
Pupil-Teacher Ratio ..... PTR
Limited English Proficiency ..... LEP

LIST OF EQUATIONS

ABSTRACT

FACTORS INFLUENCING IMPROVED STUDENT ACHIEVEMENT IN VIRGINIA

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At the beginning of the last decade, Congress passed and President George W. Bush signed the No Child Left Behind (NCLB) Act of 2002. Key provisions of this act focused on holding schools accountable to ensure that all students met state established standards. In Virginia, the state Standards of Learning (SOL) assessments form the basis of measuring student achievement. Previous studies have identified the importance of family and socio-economic status factors on student performance. Other studies have examined the effects of resources, teachers and school characteristics on student achievement with varying results and interpretations. The purpose of this study is determine the factors that affect achievement in Virginia and to determine whether the Virginia results are similar to or different from national studies. The study examines student achievement from 2001 through 2011 with particular attention on school years 2007 to 2009. This study does not examine specific provisions established and implemented by the states in accord with NCLB requirements. Rather, it examines

factors traditionally seen to influence achievement and to determine the effects of those factors in the NCLB era.

CHAPTER ONE - INTRODUCTION

Policymakers, educators and the public, in general, have debated the state of the United States elementary and secondary education system and how to improve its performance for many decades. The 1983 report, *A Nation At Risk*, provided renewed emphasis on this debate and provided increased focus the on the federal role in what had traditionally been a state and local concern. Many studies have examined various factors thought to influence academic achievement including race/ethnicity, socio-economic status of students' families, funding allocated for education and teacher qualifications.

A key aspect of this debate, the role of accountability in K-12 education, was highlighted with the passage of the No Child Left Behind Act of 2001 (NCLB), which was signed into law in January 2002. Key provisions of this reenactment of the Elementary and Secondary Education Act (ESEA) of 1965 impose strict accountability provisions on states, districts and schools. These provisions require the states to establish state-wide proficiency standards for all students, assess attainment of these standards and report on the assessment results at the school, district and state levels. In addition, results are disaggregated by race, ethnicity, English proficiency, poverty and special education status.

Although many states are seeking and receiving waivers to the NCLB requirement for 100 percent proficiency by 2014, this law remains important and relevant

because this is the first time that the federal government required states to establish standards, measure against those standards and publish the results.

President Bush signed the NCLB legislation into law in early 2002 subjecting all 50 states to the accountability provisions of NCLB. States have largely implemented the provisions by setting academic standards, adopting standardized curriculum at the state level, and conducting annual assessments.

Virginia had implemented its own accountability system in the early 1990s based on its Standards of Learning (SOL) assessments that it implemented at that time. The first assessment reports were issued in 1999. [1] The Virginia assessments were developed as part of the Virginia Standards of Quality (SOQs). SOQs are required by the Constitution of Virginia and describe requirements for establishing and maintaining a high quality educational program. [2] As part of its program, the state promulgated its SOLs and schools began aligning their instruction with the standards. As curriculum alignment between the state standards and the teachers' instruction progressed, student achievement, as measured by the SOL assessments, improved.

This improvement in student achievement continued following the passage of the federally mandated accountability measures included in NCLB in 2001. Table 1 illustrates the progress of Virginia's 5th grade student achievement in reading and mathematics from 1998 to 2009. The blue highlighted column in the table is the year the NCLB was passed into law.

[1] Cross, "Are Virginia's Public Schools Failing? Assessing the Assessments."
[2] Jamerson, "Constitution of Virginia."

Table 1 Grade 5 SOL Assessment Results

1998 – 2009 Statewide 5th Grade Standards of Learning Spring Assessment Results (percent passing)													
SOL Assessment	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Change (1998 to 2009)
Reading	68	69	68	73	78	82	85	85	87	87	89	92	24
Math	47	51	63	67	71	74	78	80	83	87	88	90	43

The improvement over those eleven years is shown in the last column. A cursory review indicates that Virginia 5th grade students made progress in reading both prior to and subsequent to the passage of NCLB. In mathematics, 5th grade students started at a much lower level of proficiency than in reading in 1998. They improved in mathematics as well as reading, both prior to and subsequent to the passage of NCLB. By the end of this period, the math scores reached a point of equal proficiency to the reading scores. The table does not, however, identify the factors affecting that improvement, especially following the passage of NCLB. This makes the study of the factors for this demonstrated improvement timely and relevant. This study is set in the period since the passage of NCLB; however it is important to recognize that this study does not examine specific provisions of NCLB. Rather it examines factors traditionally seen to influence achievement and to determine the effects of those factors in the NCLB era.

These data also do not address to what degree minorities and other subgroups are sharing in the general improvement in Virginia student achievement. Groups for which achievement data are disaggregated include students of various races and ethnicities, LEP students and economically disadvantaged students. Virginia defines an 'economically disadvantaged' student as one who:

- is eligible for Free/Reduced Meals,

- receives TANF, or
- is eligible for Medicaid. [3]

The study addresses three groups of factors that have traditionally influenced student achievement to varying degrees. These factors are student background, school and teacher characteristics, and resources, also referred to as expenditures.

The student background variables used are race / ethnicity and poverty. In addition, LEP students with are examined and discussed separately in an appendix. The race/ethnicity data are grade-level for the 3rd and 5th grade at each school. . The poverty data are also grade-level; however, there are some instances in which the school level data rather than grade level data are used. This is explained in detail in the Methodology chapter.

School and teacher characteristics available are the pupil-teacher ratio (PTR), the percentage of teachers in a school that have advanced degrees, the percentage of teachers in a school that meet the definition of a Highly Qualified Teacher (HQT), and the average years of overall teaching experience for the teachers in a school. All of these data elements are gathered at the school level.

The requirement for Highly Qualified Teachers (HQT) comes from NCLB. A 'Highly Qualified Teacher' in Virginia is one who is fully licensed by the state, has at least a bachelor's degree and has demonstrated competency in each subject taught. In Virginia, the teacher licensure process ensures that new teachers meet these requirements. For experienced teachers, the Commonwealth provides several paths to demonstrate the required competency. An extract of these requirements is at Appendix J.

[3] "VDOE :: Data Collections :: Student & School Records :: Student Records Data Definitions."

The last area of potential influence on student achievement examined in this study is expenditures. With the passage of NCLB, many educators expected additional resources to implement provisions of the law. Advocates for improving the United States education system feel that in order to hold schools accountable, the federal government must provide sufficient resources to allow the schools to be successful. A key point from some educators and policymakers is that there has not been adequate funding from the federal government to meet all the mandates contained in the NCLB. Some supporters of NCLB understood that passage of NCLB with its accountability provisions would also result in additional federal funding to allow the states, districts and schools to meet the ambitious goals set forth in the legislation. Many have been disappointed that substantial additional federal funding has not been forthcoming.[4] The provision of resources by the federal government is an important factor to examine; however, this study does not address whether the federal government has provided sufficient funding to support implementation of NCLB. Rather, it examines the effect that the given level of expenditures has on student achievement.

[4] Kennedy, *True Compass*, 489–494.

CHAPTER TWO – LITERATURE REVIEW

While concern for student achievement and the performance of teachers and schools has been around since the early years of the United States, in recent decades educators and policymakers have more closely examined and identified factors influencing student achievement in the United States educational system. Areas that have been subjected to rigorous analysis and have engendered significant debate include student background factors, resources, teacher qualifications and school factors.

Accountability

In the second half of the 20th century in the United States, accountability in education became prominent. Leon Lessinger argued for accountability in 1970 stating that since the passage of the 1965 ESEA the federal government had spent $4.3 billion on education for students in poverty who need additional help. "We literally do not know what educational results have been produced by that $4.3 billion." [5] He further argued for an engineering education process by "defin(ing) what we want, and then bring(ing) together resources and technology in such a way as to assure those results." [6] After detailing various means of implementing accountability including independent educational audits and performance contracts, Lessinger asked the question "Who is accountable?" He recognized various accountability relationships including teachers,

[5] Lessinger, *Every Kid a Winner*, 8.
[6] Ibid., 12–13.

principals, superintendents and ultimately schools board members. He even pointed out that in "the early nineteenth century . . . teachers in certain schools simply were not paid unless their students could pass muster." [7]

Don Martin, George Overholt and Wayne Urban argued the other side in their 1976 book, *Accountability in American Education: A Critique*. They noted in their introduction that "(t)he primary reason we are writing this book is to counter the all-inclusive claim made by many accountability advocates that their approach should be the only one to education." [8] They contended that the accountability proponents' views reflected a positivist approach that a given input will produce a desired output or outcome. They claimed that education and learning were much more complex than could be described by mechanical solutions and that focusing on a rigid system of accountability would not lead to improved learning. [9] In addition, they contended that learning is not simply a change in behavior that can be measured but rather includes higher order skills such as the ability to form and use concepts. [10] Overall, they concluded that "the accountability movement attempts to apply mechanical solutions to a complex social institution." [11]

Herbert Walberg noted challenges in establishing standards in an accountability system and then developing assessments that measured accomplishment against those standards. Standards had to be aligned with the school's curriculum and the assessments had to serve the dual purpose of providing information to both the student and the teacher

[7] Ibid., 114.
[8] Martin, *Accountability in American Education*, viii.
[9] Martin, *Accountability in American Education*.
[10] Ibid., 16.
[11] Ibid., 76.

to improve learning while providing information to the public and decision makers as to the effectiveness of the school. Determining what was to be tested and how student learning was to be measured and reported was difficult and costly. [12]

The push for accountability in education rocketed to the forefront of educational issues with the release of the 1983 report, *A Nation At Risk*. This report was prepared by the National Commission on Excellence in Education in 1983 to document challenges in the United States education system. The study was undertaken shortly after the establishment of the US Department of Education in 1980. President Ronald Reagan's Secretary of Education, Terrell Bell, chartered this Commission, which found there were widespread declines in educational performance attributable to the educational process itself. It rather bluntly stated in the opening paragraph that ". . . the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people." [13] It categorized its findings in terms of educational content or curriculum, expectations for high student achievement, time spent on education and in the selection, preparation and work environments of teachers thus leading to teacher shortages. [14]

Ensuing policy initiatives attempted to reconcile the limited role of the federal government called for in the U. S. Constitution with the desire of federal lawmakers to improve what many began to refer to as a national problem. At the heart of the response

[12] Walberg, "Real Accountability."
[13] National Commission on Excellence in Education, "A Nation at Risk: The Imperative for Educational Reform," 7.
[14] National Commission on Excellence in Education, "A Nation at Risk: The Imperative for Educational Reform," 1983, http://www.ed.gov/pubs/NatAtRisk/index.html

to this report was a push to make teachers, schools, school districts and states accountable for the performance of their students.

A key aspect of the accountability movement was to establish standards, that is, to define what was to be learned, to what degree it should be mastered, and how performance was to be assessed. Despite objections from some educators such as Martin, and as a result of the *A Nation At Risk* report, President George H.W. Bush put the federal spotlight on education when he became president. He invited the National Governors Association to participate with him in a National Summit on Education in 1989. He convened the summit in Charlottesville, Virginia and 49 of the nation's 50 governors attended. The summit's purpose was to harness the energy of the nation's governors in responding to the need for improvement in K-12 education. Notably, in that summit, the governors endorsed the establishment of national, as opposed to federal, goals. [15] They endorsed Goals 2000—six goals for the nation to achieve by the year 2000. Following this summit, President George H.W. Bush launched America 2000, which was a national strategy to achieve these six goals. Key to this strategy was the fact that the national standards in six core subjects were to be voluntary, rather than imposed by the federal government. His strategy also encouraged market-based competition to improve school quality. Most importantly, President Bush left it up to local communities to develop plans to implement this initiative.[16] A number of states and localities took up the challenge to meet these goals; however, limited funding and coordination hampered the achievement of these goals. The debate in Virginia over participation in the Goals 2000

[15] Jennings, *Why National Standards and Tests? Politics and the Quest for Better Schools*.
[16] Mintrom and Vergari, "Education Reform and Accountability Issues in an Intergovernmental Context."

program stretched out over many years but ultimately Virginia did participate in the program in 1997. [17] Defining the growing federal role in education continued to be a tough task given our nation's system of government. Despite this growing federal role, efforts to promote accountability through voluntary cooperation by state and local officials turned out to be a system with no teeth. [18]

Following President Bush's term in office, President Clinton continued to look for ways to improve accountability in education. Although he pledged in his campaign for the presidency that he would establish tough education standards along with a national examination system, he had to shelve these promises due to political realities. However, President Clinton did sign the Goals 2000: Educate America Act in 1994, which incorporated President Bush's America 2000 goals into legislation. Although these goals remained voluntary for state and local school districts, the federal government did provide block grants to the states to support development of education standards. [19]

Not to be dissuaded, President Clinton continued to recognize the importance of education reform that focused on accountability as he entered his second term. He remained convinced of the importance of national academic standards. However, he recognized that "the adoption of such standards should be encouraged rather than mandated by the federal government." [20]

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[17] Tan, "Schools Board Changes Stance On Goals 2000 - Daily Press." and "Goals 2000: Reforming Education to Improve Student Achievement - History - April 30, 1998."
[18] Peterson and West, "The Politics and Practice of Accountability," 7.
[19] Mintrom and Vergari, "Education Reform and Accountability Issues in an Intergovernmental Context," 153–154.
[20] Ibid., 152.

NCLB

In January 2002, President George W. Bush signed the NCLB Act into law. This was a reauthorization of the Elementary and Secondary Education Act of 1965 (ESEA) and launched a new era of federal involvement in K-12 education, which had been increasing over the years. NCLB contained many provisions, but one of the primary aspects of the law was its emphasis on accountability. "Accountability in education has been described as a 'tripod' made up of standards, tests that measure whether those standards have been reached, and penalties or rewards linked to performance on tests." [21]

"Since the early 1980s, many Americans have expressed concern about the apparently poor performance of public schools in the United States. . . . These expressions of concern about school performance have been accompanied by myriad proposals for reform." [22] Thus, one of the pillars of President Bush's blueprint for education reform was accountability. The NCLB act required assessing students annually publishing those results for parents and other stakeholders in the education system. He would reward schools that improved student achievement while sanctioning those that did not. [23] Although this act represented increased federal government involvement in K-12 education, it was not inconsistent with increased state involvement. NCLB requires states and local education agencies (LEAs) to perform better by establishing their own state standards and then demonstrating that they are meeting those standards. [24] Thus, this law set the stage for many public policy questions regarding the roles of both the

[21] Rudalevige, *Forging A Congressional Compromise*, 25.
[22] Mintrom and Vergari, "Education Reform and Accountability Issues in an Intergovernmental Context," 143.
[23] Bush, "No Child Left Behind."
[24] Jennings, *Why National Standards and Tests? Politics and the Quest for Better Schools*, 299–306.

federal and state governments in the education of children in elementary and secondary schools. Most importantly was the federal government requirement for all students to be proficient in Reading and Mathematics by the year 2014, 12 years after the passage of the law. However, as the year 2014 approached, many states and the federal government realized that they would not achieve the stated goal of proficiency for all students. Secretary of Education Arne Duncan proposed a waiver process for portions of the law. Approval of the waivers required the states to develop and provide to the Department of Education alternative plans. To date, eleven states have received waivers and more than two dozen are awaiting a response to their waiver requests. [25]

Under the NCLB schools would be held accountable for student achievement across all demographic subgroups. In addition, they had to establish standards, measure student achievement against those standards and then report the results to the public, including the parents and other stakeholders of the individual schools and the school districts.

Paul Manna discussed two policy theories that served as the linchpin for NCLB. First, policymakers believed by the theory of accountability that "schools would improve if governments measured their performance, made the results transparent, and confronted poorly performing schools and districts with tough consequences." [26] Under the theory of administration, the NCLB framers recognized the limitations of the federal government in developing solutions to improve education in the states. Therefore, the law gave the states the lead role in developing the individual state accountability systems to include

[25] Brown, "Criticism, Praise for Va., Md. on 'No Child'."
[26] Manna, *Collision Course*, 155.

determining the standards for students to be considered proficient. Manna contended that NCLB did not realize the goals of the NCLB framers because its theories of action were in conflict with the realities of how the American educational system operated in the United States. [27]

Manna pointed out several of the many results of NCLB. On the positive side, the law focused attention on the disparities between the various student subgroups. Second, the emphasis on measuring achievement caused the state and local governments to improve their technical capabilities, both in gathering and analyzing data as well as developing approaches to improve student achievement. The focus on the key metric of Adequate Yearly Progress (AYP) caused districts to improve professional development for teachers in using data to address student weaknesses and led to increased collaboration among teachers. Finally, NCLB provided an environment in which educational entrepreneurs have been able to develop, test and implement innovative ideas. On the negative side, however, the focus on having all students meet minimum requirements led schools to decrease academic quality and expectations by watering down requirements for proficiency. Second, NCLB focused school districts on meeting technical, bureaucratic rules to satisfy the law's requirements by implementing techniques such as 'teaching to the test' in order to assure that their students will demonstrate the required level of proficiency. [28]

Virginia has two distinct measures of holding schools and school districts accountable for student performance. The first measure applies state-determined criteria

[27] Ibid., 155–156.
[28] Ibid., 17, 149 – 155.

to accredit schools and school districts. Virginia established school accreditation prior to the passage of NCLB. The second, and now more important, accountability measure for Virginia schools is the NCLB requirement. The NCLB reports included a myriad of data including information on school safety, graduation rates, dropout rates, teacher licensure rates, rates of participation in the assessment process and, most importantly, assessment results of the state developed and administered SOL assessments.

The key metric for these assessments is the Adequate Yearly Progress (AYP) that schools make toward the objective of having 100 percent of its students pass the SOL assessments by the end of the 2013-14 school year. NCLB required the states to develop their own assessment instruments and to establish their own yearly goals as they progress toward the final objective if 100 percent proficiency by 2014.

As required by NCLB, Virginia disaggregates the assessment the subgroups, in order to focus on the results for all students not just a subset of students who perform well. The school report cards provided student pass rates against the state-established criteria for measuring Adequate Yearly Progress (AYP). These criteria are referred to as the Annual Measurable Objectives. Schools must meet the established standards for all of the disaggregated subgroups to be considered to have demonstrated the federally required AYP.

Specific provisions of NCLB required each state to establish a set of statewide curriculum subject matter content for grades three through eight, developing standardized test to assess proficiency in those subject matters—including a specific proficiency standard for each grade. Perhaps most important, the accountability provisions required

testing all students in grades three through eight with an objective that all students demonstrate proficiency by 2014. Schools demonstrate interim progress by achieving AYP measures, which indicate progress on a path the meet the proficiency objective as required. School districts report their scores annually to the state and federal departments and publish them for the public. In addition, the scores are disaggregated by race / ethnicity, poverty, LEP, and disability in an effort to ensure that students in these categories are improving. [29]

Student Background Factors

Much debate occurred over the effects of family and socio-economic status factors relative to the effects from the resources provided by schools and the programs that these resources enable. The seminal study in this area is the Equality of Educational Opportunity by James Coleman. This report is commonly referred to as the Coleman Report in 1966. This report identified family and other SES factors as predominant in affecting student outcomes relative to school characteristics.[30] Since that time, other researchers attempted to determine other factors that contribute to student outcomes, but Coleman's findings, while still controversial, have been hard to refute.

Due to the unanticipated findings and the challenge in gathering information, researchers conducted further studies and analyses either to validate Coleman's findings or to discover other important factors influencing student achievement. One of the first such studies was a review of the Coleman Report published in 1972 and edited by Frederick Mosteller and Daniel Moynihan. The purpose of this study was to examine the

[29] Jennings, *Why National Standards and Tests? Politics and the Quest for Better Schools*, 1.
[30] Coleman, *Equality of Educational Opportunity*, 9–12.

findings of the Coleman report and either confirm or refute them. The Coleman Report had been prepared under a stringent time constraint imposed by the federal law that both authorized and required the study. Lacking a demanding schedule to conduct the study and to prepare the report, many felt that other researchers should conduct further analysis and that the results made more widely available. The researchers used the same data that the Coleman Report used but used different methods of analysis.[31] This study noted that the Coleman Report shifted the focus on educational opportunity from inputs to the educational system to educational outputs. In general, while developing some additional findings, the re-analysis of the Coleman Report did not support rejecting Coleman's most important findings.

In particular, David Armor reexamined the school and family effects on student achievement. He noted some methodological issues with the collection of the initial data from the Coleman study; however, since he used the same data, his results would have the same limitations that Coleman noted in his report. Armor compared the characteristics of Black and White schools in terms of school facilities, teacher quality and school expenditures. Black schools were schools that had more than 50 percent black students while White schools had 50 percent or more of white students. Schools with majorities of other minorities of other minority groups were excluded. [32] He concluded that the re-analysis supported Coleman's original findings. Similarly, he

[31] Moynihan and Mosteller, *On Equality of Educational Opportunity*, Preface.
[32] Armor, "School and Family Effects on Black and White Achievement: A Reexamination of the USOE Data," 183.

examined student achievement and found that the community input factors, which included family factors, were more important than school factors.[33]

In the same year that Moynihan and Mosteller published their re-analysis of the Coleman data, Christopher Jencks and seven co-authors presented their analysis of various research including the Coleman data in a book titled *Inequality*. He began by examining the distinction between equal opportunity and equal results. Jencks, however, focused his thoughts on the differences between individuals rather than groups and examined long-term outcomes rather than short-term outcomes. He found that the long-term effects of school in adult success are not as important as many thought they were.

Jencks noted that although society has tried to equalize opportunity it did not eliminate inequalities. He noted that there is no evidence that the school system can reduce the extent of cognitive inequality and that differences between schools have little effect on any measurable attribute of those who attend them, thus recognizing the importance of family on student achievement at an early age. In this matter, Jencks supports Coleman's finding of the limited effects of schools on student outcomes. He also claimed that since the differences between schools have trivial long-term effects, society should judge them by their short-term effects.[34]

Jencks' focus on equal opportunity led him to note that access to schools and colleges is unequal, as are the expenditures on individuals in different schools. Thus, he claimed that individuals do not have equal access to society's educational resources.

[33] Ibid., 221–225.
[34] Jencks, *Inequality*, 16–17.

Jencks' analysis differed from Coleman in three respects. First, Jencks' focus was on the individual rather than on groups. Second, he considered these individuals throughout their entire lives, rather than only while they are in K-12 schools. In addition, Jencks considered not just the resources provided to schools but the lack of resources provided to those who drop out of school or who do not attend postsecondary education. [35]

However, in one instance Jencks did limit his analysis to the time in school when discussing inequality in cognitive skills. He claimed that variations in student performance in school depended on what they bring to school, not what the schools do for them. Among Jencks' and his co-authors' many findings and conclusions, they noted that the total environmental factors accounted for 25 to 40 percent of test score inequality.[36] In addition, they noted that overall family background, which includes "all features of the environment that make brothers and sisters alike" explained nearly half the variation in educational attainment.[37] On this point, Jencks agreed with Coleman on the importance of non-school factors.

In discussing these points, however, it is important to note that although Jencks is skeptical of standardized tests in general, he recognized that they provided some useful information. He noted that, "instability of test scores in early childhood and stability of scores once children enter school may mean that preschool and early school

[35] Ibid., 14–17.
[36] Ibid., 108.
[37] Ibid., 143.

environments are more important than later environments."[38] This lent support to Coleman's finding on the relative lesser importance of school effects.

Over the ensuing decades other researchers have routinely confirmed Coleman's results. A consistent finding from multiple assessments was the existence of an achievement gap between minorities, primarily Black, but also including other groups, and White students. Some examined the underlying conditions that resulted in this achievement gap and proposed initiatives to close the achievement gap while others have simply examined student achievement to determine if we are making progress in closing the gap. [39] Closing this gap is the ultimate goal of the Brown vs. the Board of Education to Topeka, Kansas Supreme Court decision. Holding schools and school districts accountable for closing this gap was one of the major goals of NCLB.

In 2001, Alexander, Entwistle and Olson confirmed the continued existence of the achievement gap using data from the Beginning School Study (BSS) of a random sample of children who began first grade in the fall of 1982 in 20 of Baltimore's public schools.[40] Their study examined the role the family played in contributing to seasonal learning in Baltimore's public schools. This study examined the learning of students during the school year and during the summer intercession. They concluded that the results that they observed indicated that the effects of schools were greater than Coleman believed. They concluded that the achievement gap was due to differences in learning both before

[38] Ibid., 61.
[39] Alexander, Entwisle, and Olson, "Schools, Achievement, and Inequality: A Seasonal Perspective."; Ferguson and Mehta, "An Unfinished Journey: The Legacy of Brown and the Narrowing of the Achievement Gap."; Lee, "Racial and Ethnic Achievement Gap Trends: Reversing the Progress Toward Equity?".
[40] Alexander, Entwisle, and Olson, "Schools, Achievement, and Inequality: A Seasonal Perspective," 172.

the students entered first grade and the learning that occurred during the summer intercessions. Minority students did, in fact, learn during the school year. Their findings indicated, however, that lower SES students arrived in first grade less ready to learn than students from higher SES families and that during the summer, the lower SES students learning loss was greater than for higher SES students. Once school started, the lower SES students began learning again. The researchers did not deny the family influence that led to the achievement gap; they simply concluded that the school had greater influence than it had been given credit. They believe that "(s)chools *do matter*, and they matter the most when support for academic learning outside school is weak." [41]

In the introductory chapter of their 2002 book, Bridging the Achievement Gap, Brookings researchers John Chubb and Tom Loveless noted that the achievement gap that Coleman identified in his research in 1966 persisted over the ensuing decades. In fact, Chubb and Loveless contended that in the decade of the 1990's it got worse. They pointed out that at the time of the publication of their book, the average Black or Hispanic student achieved at the same level as the lowest quartile of White students.[42]

Ronald F. Ferguson and Jal Mehta also claimed that while some progress was made in reducing the achievement gap for decades, progress stopped in the 1990s. They contended this was the result of missed opportunities. Further progress toward eliminating the achievement gap must rely upon seizing and exploiting the opportunities presented to society. Many programs, such as the Head Start program and Title I, were developed but did not deliver as hoped. They claimed that research into class-size effects

[41] Ibid., 183.
[42] Chubb and Loveless, *Bridging the Achievement Gap*, 1.

and the most effective types of teacher training and professional development were only beginning to be understood in the early part of this century and that information on these types of programs "has not been developed using high–quality research standards and then widely shared . . ." and that these were the missed opportunities throughout the 1990s. [43] They concluded that continued research is required to identify what works and then to leverage those programs rather than letting initial success go unexploited and lead to no permanent improvement. [44]

In 2003, Armor published results of his analysis of the Children of the National Longitudinal Study of Youth (CNLSY) data. [45] These were children whose mothers were originally surveyed in 1979 as part of the National Longitudinal Study of Youth (NLSY). Surveying these children provided a wealth of data concerning potential factors for child development. Armor examined potential risk factors that influenced development of intelligence and thus academic performance. His analysis confirmed the importance of family factors. Armor demonstrated that intelligence, although it could change to some degree over time, was fairly well established by the time the child entered school. He noted that schools provided uniform effects on students in accordance with the strong family effects.

Armor identified risk factors in the family environment that had the strongest effect on a child's IQ and showed that these risk factors affected the child most

[43] Ferguson and Mehta, "An Unfinished Journey: The Legacy of Brown and the Narrowing of the Achievement Gap," 667.
[44] Ferguson and Mehta, "An Unfinished Journey: The Legacy of Brown and the Narrowing of the Achievement Gap."
[45] Armor, *Maximizing Intelligence*.

substantially in the ages up to three years old. Of particular note, was that several of these family factors were in place even before the child is born. These results certainly supported Coleman's study that identified family factors as more important to student outcomes than school factors.[46]

David Armor continued this research into family factors and their effects on student achievement. He examined data from the NAEP from 1990 to 2005, the Children of the National Longitudinal Study of Youth (CNLSY) and their studies for a 2007 article in which he addressed this gap and the attempt to close it by implementing the provisions of NCLB. [47] He noted that the achievement gap comes into the schools from the students' family and home environments. In effect, the achievement gap is present when a student starts school. The goal of NCLB is to have the schools do what they have not yet been able to do and to determine ways to close this gap while the children are in schools.

To close the achievement gap, schools must improve minority achievement faster than they improve the achievement of White students. However, as Armor and other previous research indicates, family risk factors that operate on children in their early years explain a large portion of the achievement gap, not school factors. Currently there is no agreed to program that promises to close the achievement gap. Educators lacked the technical knowledge to improve one group faster than another group; thus, the achievement gap will be hard to close in the time allotted by NCLB.

[46] Ibid., 6–8 and 25–36.
[47] Armor, "Can NCLB Close Achievement Gaps?," 323.

His recommendations included conducting more research to determine ways that schools can affect student achievement, and modifying the NCLB requirements that state the goal only in terms of equal proficiency by using a growth model or a value-added model in order to better measure progress. [48]

In another effort to explain the observed influence of SES on student achievement, Ream and Palardy examined the role of parental social capital, the capacity to leverage scarce resources using membership in broad social and community structures, on student achievement. They examined whether parental social capital differs among different social classes, whether parental social capital affected educational outcomes and whether the ability to affect educational outcomes differed among the different social classes. In their study, Ream and Palardy affirmed the importance of parental social capital on educational outcomes and that parents in the upper social class possess an abundance of social capital relative to lower social class parents. Since the upper social class parents had more social capital, they were better able to leverage their social capital improved educational achievement. [49]

Results from the National Assessment of Educational Progress (NAEP) presented mixed results over the past decade. The NAEP reports provided the average scores for all students in various subject areas as well as by various racial, ethnic and other categories of interest to policymakers.

[48] Ibid., 323–339.
[49] Ream and Palardy, "Reexamining Social Class Differences in the Availability and the Educational Utility of Parental Social Capital."

In the November 2011 NAEP report, results indicated that average Math scores improved over the past decade in both 4th and 8th grades as shown in Figure 1 from 226 to 241 for 4th graders and from 273 to 284 for 8th graders. [50]

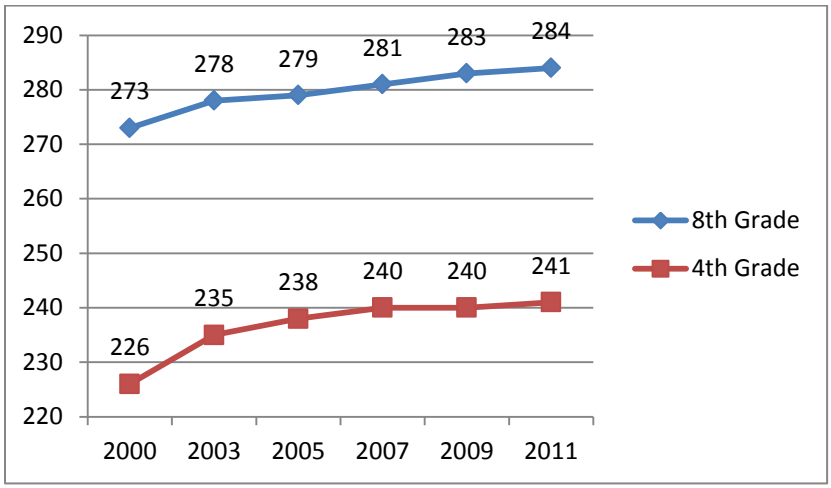


Figure 1 Average Scores on NAEP Math Assessment

The disaggregated results showed substantial achievement gaps between White students and Black, Hispanic and economically disadvantaged students. Although large gap still exists for all three subgroups, the gaps for all three subgroups decreased from 2000 to 2011. In both the 4th and 8th grades, the White-Black gap is the greater than both the White-Hispanic and White-Economically Disadvantaged gaps. These gaps are shown in Tables 2 and 3 and graphically displayed in Figures 2 and 3.

Table 2 Disaggregated 4th Grade NAEP Math Average Scores and Achievement Gaps

	White	Black	Gap	Hispanic	Gap	Economically Disadvantaged	Gap

[50] *The Nations Report Card: Mathematics 2011*.

2000	234	203	31	208	26		
2003	243	216	27	222	21	220	23
2005	246	220	26	226	20	224	22
2007	248	222	26	227	21	225	23
2009	248	222	26	227	21	226	22
2011	249	224	25	229	20	228	21

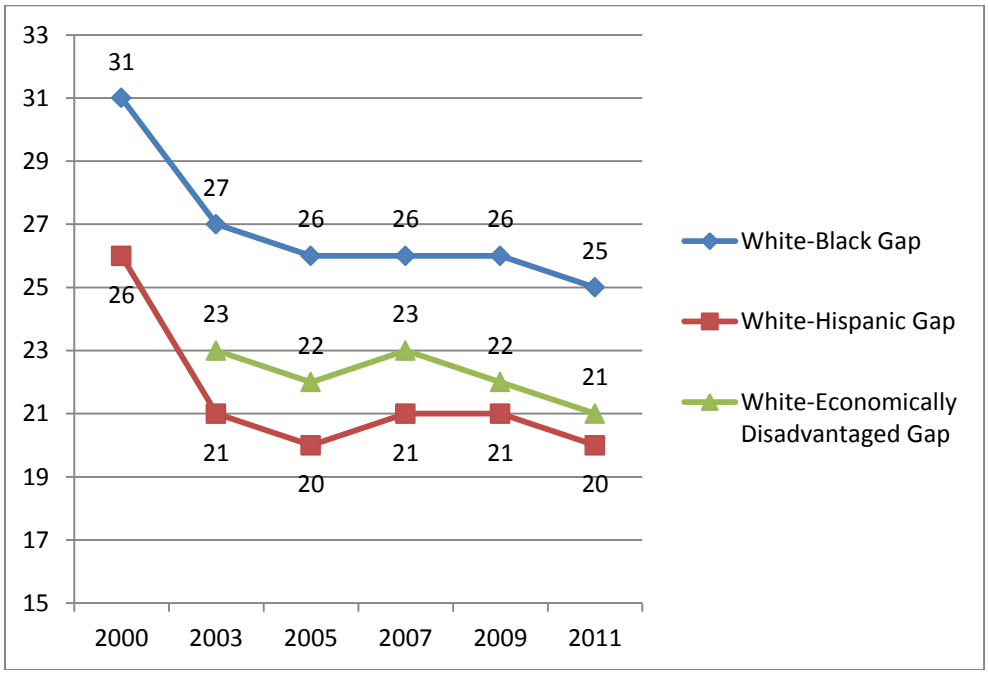


Figure 2 NAEP 4th Grade Math Achievement Gaps

Table 3 Disaggregated 8th Grade NAEP Math Average Scores and Achievement Gaps

	White	Black	Gap	Hispanic	Gap	Economically Disadvantaged	Gap
2000	284	244	40	253	31		
2003	288	252	36	259	29	256	32
2005	289	255	34	262	27	260	29
2007	291	260	31	265	26	263	28
2009	293	261	32	266	27	265	28

2011	293	262	31	270	23	268	25

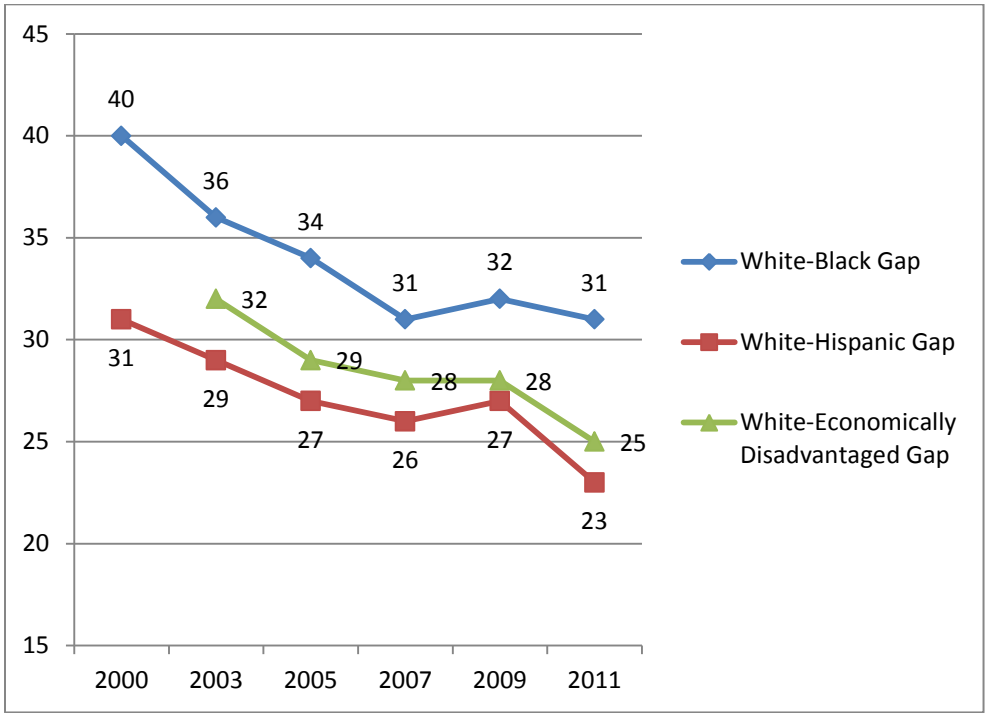


Figure 3 NAEP 8th Grade Math Achievement Gaps

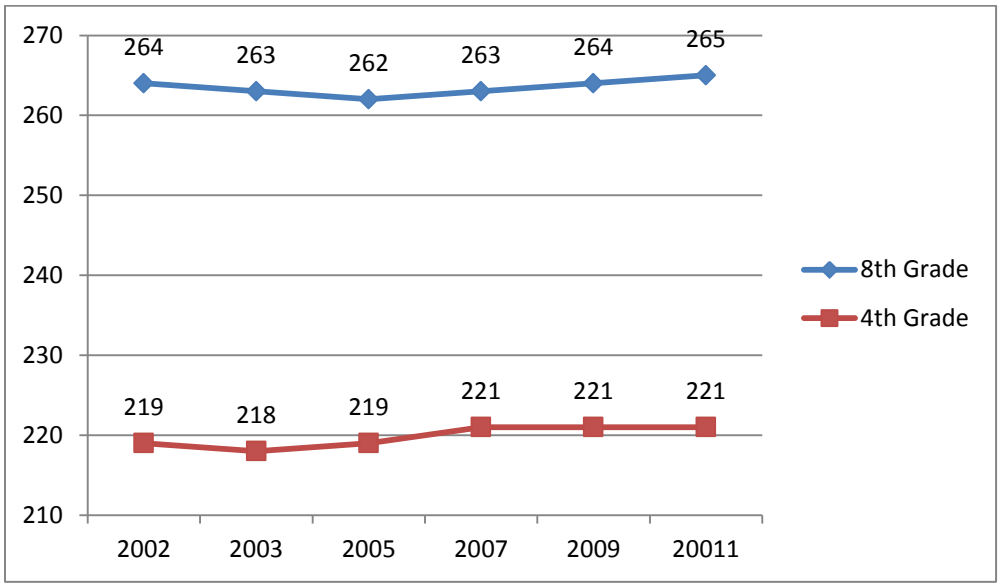
Another way to look at the NAEP results is to examine the percentage of students achieving certain levels of proficiency. The NAEP also reported the percentage of students performing at the three different levels of achievement. The Basic Level denotes partial mastery of prerequisite knowledge and skills fundamental for proficient work at grade level. The Proficient Level represents solid academic performance and demonstrated competency over challenging subject matter. The Advanced Level indicates superior performance. The 2011 NAEP results of percent of students achieving

these three achievement levels also demonstrated the continuing achievement gap identified by Coleman in his seminal report.

Table 4 Percent of Student Scoring Basic, Proficient and Advanced for 2011 Math NAEP

	4th Grade				8th Grade			
	Below Basic	Basic	Proficient	Advanced	Below Basic	Basic	Proficient	Advanced
White	9	39	43	9	16	39	33	11
Black	34	48	16	1	49	38	12	2
Hispanic	28	48	22	2	39	40	18	3

NAEP Reading scores from the 2011 report are shown in Figure 4. [51] These results indicated little, if any, improvement in Reading over the past decade. The 4th grade average score increased from 219 to 221, while the 8th grade average score increased only from 264 to 265.



[51] *The Nations Report Card: Reading 2011*.

Figure 4. Average Scores on NAEP Reading Assessment

As with the Math scores, a substantial gap existed between White students and Black, Hispanic and economically disadvantaged students. Again, this gap has been closing in the last decade but is still rather large.

Table 5 Disaggregated 4th Grade NAEP Reading Average Scores and Achievement Gaps

	White	Black	Gap	Hispanic	Gap	Poverty	Gap
2002	229	199	30	201	28		
2003	229	198	31	200	29	199	30
2005	229	200	29	203	26	201	28
2007	231	203	28	205	26	203	28
2009	230	205	25	205	25	204	26
2011	231	205	26	206	25	206	25

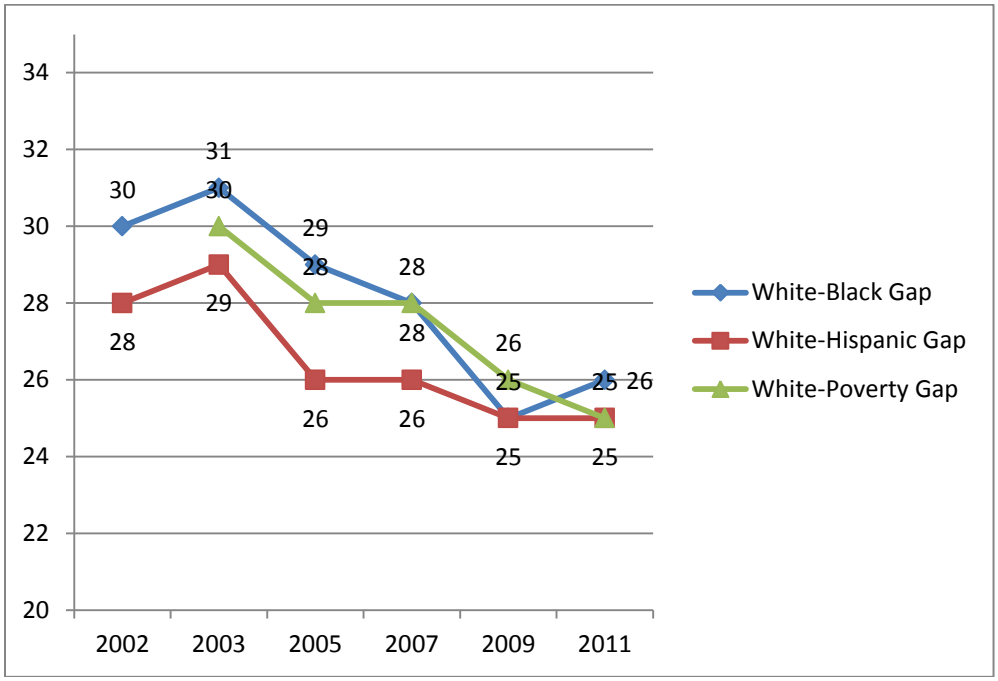


Figure 5 NAEP 4th Grade Reading Achievement Gaps

Table 6 Disaggregated 8th Grade NAEP Reading Average Scores and Achievement Gaps

	White	Black	Gap	Hispanic	Gap	Poverty	Gap
2002	272	245	27	247	25		
2003	272	244	28	245	27	244	28
2005	271	243	28	246	25	245	26
2007	272	245	27	247	25	246	26
2009	273	246	27	249	24	247	26
2011	274	249	25	252	22	250	24

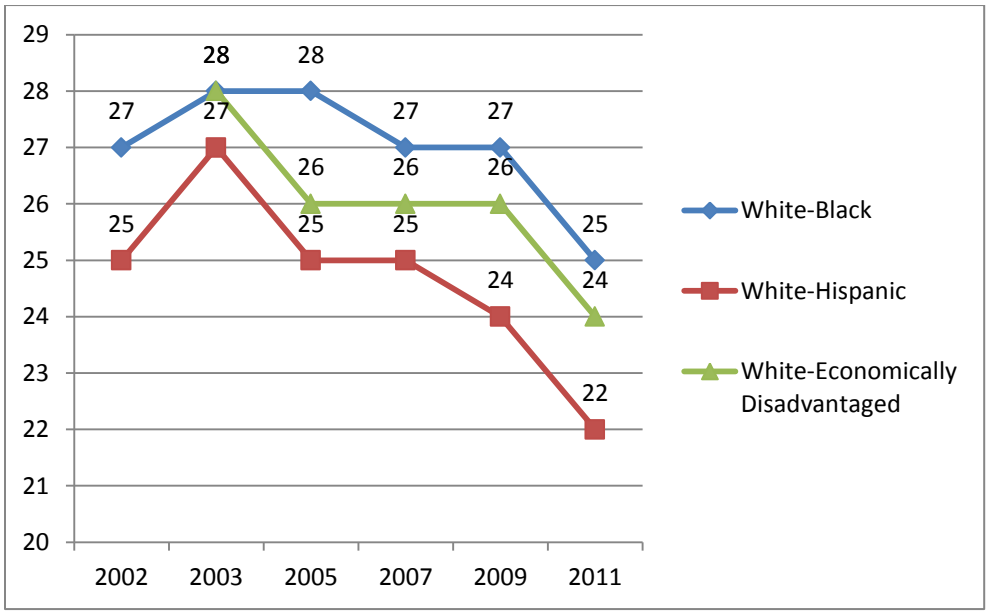


Figure 6 NAEP 8th Grade Reading Achievement Gaps

Once again, the results indicating the percent of students achieving each level of proficiency as described earlier, illustrated in another way the existence of the continuing achievement gap. Table 7 shows that in 4th grade 22 percent of White students scored *Below Basic* while 51 and 49 percent of Blacks and Hispanics, respectively, scored *Below Basic*. In 8th grade, all groups had a lower percentage of students scoring *Below Basic* but the minority students still had more than twice the percentage of students scoring *Below Basic* as did the White students.

Table 7 Percent of Student Scoring Basic, Proficient and Advanced for 2011 English NAEP

	4th Grade				8th Grade			
	Below Basic	Basic	Proficient	Advanced	Below Basic	Basic	Proficient	Advanced
White	22	35	33	11	15	42	38	5
Black	51	33	14	2	41	44	14	1
Hispanic	49	33	16	3	36	45	18	1

Resource Factors

Recognizing the impact of family and SES factors, educators implemented programs to reduce or eliminate this achievement gap. Most of these programs involved providing resources for implementation. [52] These programs included the provision of vouchers to students, changing the school organization and changing how the school interacts with families. Researchers conducted studies and analyses to determine the effect of funding on student performance.

Eric Hanushek examined resource data from 1890 to 1990 and student performance data from the mid-1960s forward. He examined school population, per

[52] Chubb and Loveless, *Bridging the Achievement Gap*, 4.

pupil spending and the growth of spending due to the number of students, the decrease in the student-teacher ratio and the associated input costs. Hanushek used Scholastic Aptitude Test (SAT) and National Assessment of Educational Progress (NAEP) data as measures of student achievement. [53] He also analyzed data provided in 377 other studies conducted and concluded that "no strong or systematic relationship exists between spending and student performance." [54]

Larry Hedges, however, took issue with Hanushek's interpretation of the data. He argued that over that period two important changes occurred. First, the level and comprehensiveness of education had increased. In other words, students are learning more in 1990 than in 1890, as indicated by the rate of secondary school graduation that increased substantially over that period. [55] Hedges also noted that the home environment had changed in recent decades and in order for student performance to remain even level over this period, the schools must have improved their effects on student learning and this is associated with the increase in resources available.

After arguing opposing sides of the question 'do resources matter?', Eric Hanushek and Larry Hedges came closer to agreement than would be expected. Hanushek concluded, "the central issue in all policy discussion is usually not whether to spend more or less on school resources but how to get the most out of marginal expenditures." [56] Hedges similarly concluded, "discussion of school reform should not proceed under a mandate of flat resources but should instead incorporate an assessment

[53] Hanushek, "Does Money Matter?," 47–53.
[54] Ibid., 54–62.
[55] Hedges and Greenwald, "Does Money Matter?," 74–80.
[56] Hanushek, "Does Money Matter?," 69.

of the current relation between inputs and outcomes and determine how to best allocate resources in specific contexts." [57]

David Grissmer conducted a study for RAND in 2000 in which he examined state-level achievement scores on NAEP math and reading tests from 1990 to 1996. He examined state systemic reforms from the 1980s, including the establishment and alignment of standards with assessments, professional development initiatives, accountability, the increase in certification / recertification standards, pre-kindergarten subsidies for low-income families, reduced class sizes, charter schools, choice and contract schools, teacher experience, teacher advanced degrees, and resource allocation as demonstrated by lower pupil-teacher ratios, spending per student and increased teacher salaries. All of these reforms required resources to implement effectively. He noted, "measurements at the state level have shown very consistent and robust positive effects of added resources on educational outcomes, while measurements at lower levels of aggregation show less-positive and more-inconsistent effects" (emphasis added).[58] In other words, increases in resources available for education across the entire state improved student achievement levels, but within state differences in resources did not have the same positive effects on student achievement.

Grissmer believed that resources can make a difference. Between state rather than intra-state differences in resources were the main reasons for inequitable resource levels for low-SES students. He cautioned, however, that the state factors identified explained less than one-half of the differences in achievement. The remaining variance

[57] Hedges and Greenwald, "Does Money Matter?," 90.
[58] Grissmer et al., *Improving Student Achievement: What State NAEP Test Scores Tell Us*, xix.

can be unmeasured family characteristics, unmeasured educational system characteristics, characteristics of other social support systems or other factors creating social capital in the states, i.e., private foundations. In addition, Grissmer warned that these results lag policy implementation substantially. Policy makers should not expect instant results. [59]

In a 2010 book, Linda Darling-Hammond argued strongly that the amount of resources spent on education does affect student achievement. To support this position she examined data from South Carolina and Massachusetts. Her analysis included minority and poverty factors, as well as teacher qualifications, teacher salaries and student-teacher ratios factors. In South Carolina her analysis included four models examining her data. The first model included poverty and demographic factors as independent variables and showed that the poverty index and the percentage of Black students contributed to almost 80 percent of the variance of the percentage of students scoring below basic on the state tests. Model 2 included teacher characteristics and contributed only 64 percent of the variance to the student achievement measure. Model 3 added other resource factors—student-teacher ratio, average teacher salary and percent portable classrooms—to Model 2. None of these three factors was statistically significant and together they only added one percent to the R-squared coefficient. When Darling-Hammond included all of the student qualification and other resource factors to Model 1 to develop Model 4, Model 4 added only five percent to the explanation of variance of the student achievement variable.

[59] Ibid., xxiii – xxxvii.

Her analysis of the Massachusetts results similarly showed that while there may be some relationship between resources and student achievement, the family and SES factors still provided greater effects on student achievement than do the resource factors.[60]

Results for all of these studies are extremely nuanced and examine specific factors. Together these studies and reports demonstrated that in some cases there has been some improvement in performance attributable to the resources provided to the schools over the past decades. However, researchers have not always identified the programs or other factors impacted by the increased resources and that were the root causes of any improved student achievement. In addition, the effects of the resource increase have not been large enough to make the broad general statement that increased resources will increase student performance substantially. Educators and researchers must continue to look for those specific factors and programs tied to the provision of resources that will incontrovertibly improve student performance. Any improvement in student achievement related to increased provision of resources ultimately must be tied to what the resources provide for the students. An increase in resources that are provided to what turn out to be ineffective programs will not improve student performance. However, if resources fund effective programs, student achievement can be expected to improve. Identifying the effective and the ineffective programs becomes the challenge for educators and helps to explain why the studies do not show consistent and large effects on student achievement related to increased resources. In addition, even in studies

[60] Darling-Hammond, *The Flat World and Education*, 113–119.

where some improvement in student achievement was shown to be caused by increased resources, family and SES effects still dwarfed the effects of the resources.

Pupil-Teacher Ratios – A Special Case of Resource Factors

A school factor related to the provision of resources is the Pupil-Teacher Ratio (PTR). This is also referred to as Class Size Reduction (CSR). [61] Brookings Institution publishes an annual volume of papers on education policy. The topic for its 2006/2007 volume was small school and small classes.[62] In a paper in that volume, Doug Harris noted the support of both parents and teachers for decreased class sizes. [63] With this support that CSR programs engender, it is no wonder that many states and localities have focused resources on maintaining small class sizes.

In some cases, these programs were established and supported with no real demonstrable evidence of benefits from these programs. In a 1979 review and meta-analysis of existing studies by Gene Glass and Mary Lee Smith, Glass and Smith state in the introduction that "(t)he notion is wide-spread among educators and researchers that class size bears no relationship to achievement. It is a dead issue in the minds of most instructional researchers. To return to the class-size literature in search of defensible interpretations and conclusions strikes many as fruitless." [64] However, they persevered in this study using advanced statistical techniques that had not previously been applied to this issue and concluded that there was a strong relationship between class size and

[61] Loveless and Hess, "Introduction: What Do We Know About School Size and Class Size?," 1–2., Konstantopoulos ,"Do Small Classes Reduce the Achievement Gap between Low and High Achievers? Evidence from Project STAR" p. 275.
[62] "Brookings Papers on Education Policy: 2006-2007 - Brookings Institution."
[63] Harris, "Class Size and School Size: Taking the Trade-Offs Seriously," 139, 153.
[64] Glass and Smith, "Meta-Analysis of Research on Class Size and Achievement," 2.

student achievement. Due to the criticism this study received [65] and the fact that no other research was conclusive, the Tennessee legislature authorized a "well-designed study of class size before investing in a costly new program." [66]

This study became the Student / Teacher Achievement Ratio (STAR) Project, which is arguably the most notable study of CSR in recent decades. [67] In 1985, the STAR project began a four year study to determine whether students in small classes had greater academic achievement than students in larger classes. Entering kindergarten students in the participating schools were randomly assigned to small classes, regular classes or regular sized classes with a teacher's aide. The students remained in these size-type classes for the four years of the study. The state tracked their performance not only for the four years of the study but for an additional two years through the 5th and 6th grades.[68] Diane Schanzenbach of the Brookings Institution analyzed the results of the Tennessee STAR experiment in 2006, looking at the immediate and some long-term effects. She confirmed the overall benefit to all students of the small class size of approximately .15 standard deviation on the Stanford Achievement Test for each grade. Black students benefited about twice as much as White students and free lunch eligible students benefited about .055 standard deviations more than students not eligible for free lunch. She then examined the rate of the Tennessee STAR students' rate of taking a college entrance exam. While there was no statistical difference for white students there was a five percentage point increase (from 33 to 38 percent) in Project STAR Black

[65] "Class Size Research: A Critique of Recent Meta-Analyses."
[66] Word, Johnston, and Bain, *The State of Tennessee's STAR Project-Final Summary Report*, 2.
[67] Word, Johnston, and Bain, *The State of Tennessee's STAR Project-Final Summary Report*.
[68] "ClassSizeSTAR.pdf."

students' rate of taking a college entrance exam than for no-Project STAR Black students even after the Project STAR students returned to regular size classes in fourth grade. She concluded after her study that "the benefits [of reducing class size] are sizable and long lasting, especially for black students." [69]

Teacher Characteristics

One group of specific factors related to resources that is thought to improve student achievement is that of teacher qualifications. Many studies examined teacher qualification factors and their effects on student achievement.

In 1991, Ronald Ferguson examined nearly 900 school districts in Texas seeking to determine the effect of resources on student test scores. This study encompassed over 2.4 million students. His results showed that between one-third and one-half of the variation in students' scores was due to quality of schooling and that most of the effect of schooling was due to teachers' scores on the state recertification exams, with experience and master's degrees contributing to the schooling effect. Controlling for the correlation between SES and teacher quality, Ferguson demonstrated the separate effect of teacher quality. In addition, Ferguson's analysis showed that since teachers preferred higher salaries, districts that provided those higher salaries got the pick of the better teachers. Therefore, Ferguson confirmed a link between the provision of more resources and teacher quality leading to improved student achievement. He argued that states can equalize teacher quality by focusing their efforts and resources on salary differentials to make the different school districts equally attractive to all teachers.

[69] Schanzenbach, "What Have Researchers Learned from Project STAR?," 224.

Ferguson's analysis indicated statistically significant effects of teacher TECAT scores, teacher experience and percent of teachers with master's degrees on student test scores on the reading and mathematics Texas Educational Assessment of Minimum Skills exams, the Texas statewide exams.

However, Ferguson's results also indicated that parents' education levels, especially the percentage of parents who have some college education and other demographic factors such as female head of households are statistically significant factors of student achievement. After reviewing all of his data, Ferguson concluded that "higher quality schooling produces better reading skills among public school students and that when targeted and managed wisely increased funding can improve the quality of public education." [70]

Abigail and Stephen Thernstrom also examined and discussed the impact of teacher quality on student achievement in their 2003 book, 'No Excuses: Closing the Racial Gap in Learning'. One of the problems they noted is the inability to identify the attributes of what makes a good teacher and thus identify the good teachers. A recent study they cited found only a small contribution to student learning by considering the traditional measures of teacher quality such as teacher experience and advanced degree obtained.

One means that some states use is to identify good teachers is to require teachers to pass minimum competency tests. The tests vary from state to state in degree of difficulty and, at the time of their book, state enforcement of the requirements to pass the

[70] Ferguson, "Paying for Public Education," 488.

tests also varied widely. They also discussed teacher candidate performance on the Praxis I and II standardized tests, which are used across the nation to qualify students for teacher training programs and to then license them to teach in the various states. They contended that the rigor of these tests is insufficient to differentiate among good teachers. The Praxis series of tests simply served to preclude from teaching those candidates who truly would make terrible teachers.

Another measure of teacher quality is experience and the achievement of advanced degrees. The Thernstroms contended that these measures also provided only marginal impacts on student achievement.

Arguing that these traditional measures of teacher quality do not measure what makes a truly good teacher, the Thernstroms do take note of James Coleman's report and a reanalysis that was completed thirty years after the initial issuance of the report. They stated that one indicator of a positive impact on student performance was the vocabulary of the teacher. Students of teachers with a rich vocabulary performed better than students of teachers without the same rich vocabulary.

They also pointed out that several studies found that teachers from prestigious colleges positively impacted student performance more than those teachers that did not attend prestigious colleges. Overall, the Thernstroms discussion led to the conclusion that there are some indications that high quality teachers can affect student achievement but that it is difficult to identify those attributes of teachers that are related to improved student performance.

In 2008 Harris and Sass updated a previously published paper on teacher training, education, experience and education prior to entering the teaching profession. They examined a rich store of data from the Florida Department of Education that allowed them to track individual student achievement on the Florida Comprehensive Achievement Test. A detailed dataset of school administrative linked each student and the teachers assigned to each student throughout the student's academic career. In addition, the Florida data contained extensive data on the pre-service education of the teachers who attended college in the state of Florida. For more recent teachers, this included their college transcripts. [71]

The initial focus of their results was on teachers' experience, advanced degrees earned, in-service professional development and undergraduate education. They found generally positive, but mixed, results for teacher experience. The positive results for teacher experience were in the early years at the elementary level. They found no evidence for improved student achievement tied to a teacher possessing an advanced degree. The exception to this finding was at the middle school level for mathematics teachers. [72]

Harris and Sass found no positive effects for in-service professional development with a notable exception for prior professional development for middle and high school math teachers. They noted that the professional development training that provided the

[71] Harris and Sass, *Teacher Training, Teacher Quality and Student Achievement*, 15–18.
[72] Ibid., 30.

positive effects was training on content areas rather than training in education-focused areas. [73]

The results of their study also indicated, with one exception, no value added by obtaining a degree in education versus a non-education degree. The lone exception was that middle school reading teachers who were English / Language Arts education majors provided better student outcomes than those who are non-education majors. This exception became insignificant when college entrance exam scores are considered. Finally, their results indicated that for high school math teachers in education programs, an increase in the number of content courses taken correlated positively with improved student achievement. [74]

However, schools strove to meet the requirements of AYP. Sarah Fuller and Helen Ladd recently conducted an analysis of schools in North Carolina to determine whether the accountability requirements of NCLB led school administrators to place higher quality teachers in the grades subject to the NCLB assessments, i.e., 3rd - 5th grade and above, to the detriment of the lower grades, K - 2. [75] They gathered information for schools across North Carolina for the years 1995 – 2009. They examined several different measures of teacher quality, including years experience, advanced degrees, possession of elementary education license and licensure test scores, and compared these teacher characteristics for the years 1995 and 2009. They determined that, with the sole exception of teacher experience in 2009, the lower grades had a quality disadvantage

[73] Ibid., 31.
[74] Ibid.
[75] Fuller and Ladd, *School Based Accountability and the Distribution of Teacher Quality Among Grades in Elementary School*.

compared to the upper grades. In 2009, the lower grades had a small quality advantage compared to the upper grades. [76]

Fuller and Ladd then settled on using licensure test scores for the bulk of their analysis. Their results indicated that beginning in 2003, the year that NCLB reporting began, the difference in teacher quality between the upper and lower grades became significantly larger than it previously was. They concluded that the "incentives created by the NCLB accountability system increased the strategic placement of the stronger teachers in the upper grades." [77] Finally, they concluded that when a school failed to meet its AYP objective in a given year, the school reacted and moved stronger teachers to the upper grades. [78]

Qualitative Examples

Although these studies and others describe quantitative results from measurable characteristics taken from the school, family and social environments, there are a number of examples of individual schools and individual programs that have achieved success in today's educational environment and which do not yet demonstrate their success based on a relationship with some measured input.

In 2004, the Education Trust and four other organizations established the Achievement Alliance to publicize schools that had high minority populations and high student achievement. Karin Chenowith authored a book, *It's Being Done*, that described her observations visiting 15 schools that satisfied those two criteria. She explained in the introduction that, while the Education Trust was able to identify these schools, it could

[76] Ibid., 13.
[77] Ibid., 16.
[78] Ibid., 21.

not explain why the schools performed so well. [79] In her conclusion, she came to realize that "there is no single factor that is at the core of a successful school." [80] However, she did identify 25 characteristics and practices of the schools that she believed contributed to the success of these schools. Many of these characteristics were hard to quantify, such as noting that the schools use time wisely or the schools base their decisions on what is good for the children, not the adults. This makes it difficult to include them in any quantitative analysis. She also noted that each of the successful schools had its own character and it would be difficult to change the character of all schools to match any one of the successful schools.

Other examples of the promise of certain schools to overcome the challenges identified initially by James Coleman were documented in the documentary film and the accompanying book *"Waiting For Superman"*. Davis Guggenheim filmed children and their families participating in lotteries for the chance to attend a particularly desired school in their communities, or as Karl Weber stated in the accompanying book, the diamonds that emerged in those cities. He stated that "families are flocking to those few exemplary public schools." [81]

[79] Chenowith, *It's Being Done*, 2–3.
[80] Ibid., 213.
[81] Weber, *Waiting for "Superman,"* 17.

CHAPTER THREE – CONCEPTUAL MODEL AND RESEARCH METHODS

Conceptual Model

The literature review clearly indicates relationships between student background factors with student achievement. The relationship between resources, PTR and teacher characteristics on student achievement is less certain.

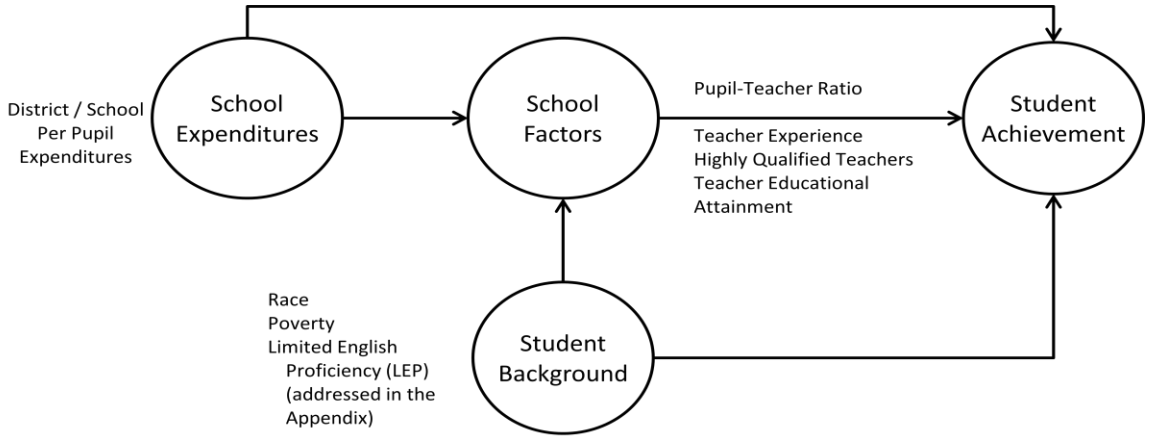


Figure 7 Conceptual Model

The model in Figure 7 describes the relationship between the dependent and independent variables relevant to this study.

The initial approach in this study comprised two distinct components—a quantitative component and a qualitative component. First, the quantitative analysis was to examine the effects of expenditures, student background factors and teacher qualifications on student achievement in the schools. Next, this study was to employ

qualitative analysis to identify individual school classroom practices that may have contributed to the improvement in student achievement. Identification and analysis of these practices did not lend itself to a quantitative approach since objective data identifying different classroom practices over time has not been collected. The qualitative approach was to have elicited from different teachers and principals the policies and practices implemented in the last decade to respond to the strict accountability provisions imposed on them by the NCLB Act.

Based on the model developed in the quantitative analysis, schools were identified that had high poverty and high minority populations and that performed better than predicted by the model. Eight schools in five school districts were identified for the study and five schools in the same districts were identified as control schools for this study. Following identification of those schools, the school district central office representatives were contacted to obtain permission to interview the principals and some teachers in accordance with the school district policies. Only one school district agreed to allow its teachers and principals to be interviewed – and this was only for two of the three requested schools for that district. Following this development the qualitative component of the study was eliminated.

Research Questions and Approach.

This study investigates factors that contributed to improved student achievement since the imposition of the NCLB accountability measures in 2002, as measured by the Virginia SOL assessments. Specifically, this study examines the pass rates in Mathematics and in Reading over the past decade and focuses on three cohorts of 5th

grade students. The study first examines overall changes in student pass rates over time. It then focuses on the improvement in student achievement as measured by 5th grade assessments for SY 2007 – 2009 using regression analysis. It examines the effects on student achievement by student background, teacher characteristics and school resource variables. It uses 5th grade student achievement as the primary dependent variable, and it introduces a lagged 3rd grade covariate for each cohort to control for earlier achievement.

The research question addressed in this study is "What factors influenced student achievement in Virginia for 5th grade students since the passage of NCLB?" Factors to consider include student background factors, school and teacher characteristics and district expenditures. Student background factors include race, poverty and English proficiency. Expenditures include district per pupil expenditures of various categories. Teacher characteristics include percentage of HQTs, teacher educational attainment and teacher experience. A school factor considered is the PTR. These factors are examined by quantitative analysis. The dependent variables are 3rd and 5th grade achievement.

Hypotheses

Based on initial examination of the data and previous research reviewed for this paper, the following hypotheses are proposed.

- Student background factors have large effects on student achievement and growth in achievement for 3rd and 5th graders in Virginia.
- School resources have small effects on improved student academic achievement. The school characteristic of PTR has a small effect on improved student academic achievement for 3rd and 5th graders in Virginia.

- Teacher qualifications have small effects on improved student academic achievement for 3rd and 5th graders in Virginia.
- Student achievement in earlier grades, specifically 3rd grade, has a large effect on student achievement in later grades for 5th graders in Virginia.

Detailed Methodology

Data Collection

The quantitative analysis is a longitudinal study of the relevant factors identified above over an eleven year period at the school level in 3rd and 5th grades in Virginia. Available data is identified in Appendix B – Available Data.

Due to the different sources and databases available for this analysis, all variable data are available only for SY07 through SY09. Those three years comprise the three cohorts that provide the required data for the regression analysis. These years were chosen based on the availability of all data elements from all of the different data sources.

Data are for a school year that begins in June and ends in May of the following year. For example achievement data for the SOL assessments conducted in May 2004 would be identified as School Year 04. The expenditures data for that year is the expenditures of that school district beginning in July2003 through June 2004. The demographic data represent the data compiled for the School Year 2004 membership, which were gathered in the September 2003 Fall Membership reports. Teacher qualification data are for the teacher data gathered for the school year beginning in September 2003.

Achievement Data. The Pass Rate for all students by school for 3rd and 5th grades is the dependent variable in this study. It was obtained from the Virginia Department of Education website (https://p1pe.doe.virginia.gov/datareports/assess_test_result.do). A series of customized reports provided the Pass Rate for all students who attempted the state SOL Assessments at the end of the school year. The data are identified by school district and individual school for the 3rd and 5th grades by school year from School Year 2001 – 2011. [82]

Student Background Data. Student Background data were similarly obtained from the Virginia Department of education website (http://www.doe.virginia.gov/statistics_reports/enrollment/fall_membership/archive_data.shtml). Data were obtained for the school district and school for grades three and five for the various racial group identifiers. The data were collected for School Years 2003 through 2011.

Poverty data were obtained from the Virginia Department of Education website for economically disadvantaged students. [83] Virginia defines an 'economically disadvantaged' student as one who:

- is eligible for Free/Reduced Meals,
- receives Temporary Aid to Needy Families (TANF), or
- is eligible for Medicaid.

Expenditure Data. Educational expenditures data were obtained from the United States Department of Education (US DOE) School District Finance Survey (F-33) Reports.

[82] "Virginia Assessment Results."
[83] "VDOE Fall Membership - Custom Reports.""VDOE :: Data Collections :: Student & School Records :: Student Records Data Definitions."

Expenditure data is provided by school district rather than by individual schools. This data element was divided by the number of pupils in the school districts to obtain per pupil expenditures for each school district. The US DOE School District Finance Survey Reports were available from FY 2001 through 2009. [84]

Teacher Data. Teacher qualification data includes the percentage of teachers in a school that met the requirements to be considered a HQT. This designation was developed by the Virginia DOE as part of its compliance with NCLB provisions. Teacher qualifications also include the percentage of teachers in a school that held advanced degrees, either a Masters or a Doctorate and those who hold only a Bachelor's Degree. The Virginia Department of Education provided this data for FY04 through FY09 in response to a special request.

Teacher characteristics also include the average years of teaching experience for the teachers by school for the years FY2007 through FY2011. Again, these data were provided by the Virginia Department of Education in response to a special request.

Pupil Teacher Ratio (PTR). The final school resource variable, PTR, was obtained from the US DOE website (http://nces.ed.gov/ccd/bat/index.asp). This data is part of the National Center for Education Statistics Common Core of Data. PTR data exhibited aberrations for one district in one school year where PTR was unexpectedly and extremely low. Examining all PTR data led to the exclusion of PTR less than five and greater than 30 to precluded skewing the results.

[84] "Common Core of Data (CCD) - Local Education Agency (School District) Finance Survey (F-33) Data."

Figure 8 Dependent and Independent Variable Listing

Achievement Data (Dependent Variables)	Teacher Characteristics	School Characteristic	Student Background	District Expenditures
Percent of all students passing the SOLs (Reading and Math)	% of teachers with Bachelor's Degree or Advanced Degrees	Pupil-Teacher Ratio	% of students in a grade / school that are White	Per pupil Total Expenditures for the district
	% of Teachers with Advanced Degrees		% of students in a grade / school that are Black	Per pupil Elementary / Secondary Expenditures for the district
	% of Teachers meeting the Virginia definition of Highly Qualified Teacher		% of students in a grade / school that are Hispanic	Per pupil Instructional Expenditures for the district
	Average years of overall teaching experience for teachers in a study school		% of students in a grade / school that are economically disadvantaged	Per pupil Instructional Salary Expenditures for the district
			% of LEP students in a grade / school	

Figure 8 shows all of the data elements in tabular format. A more complete description of the variables is in Appendix A.

Data Preparation

The achievement data provided by the Virginia DOE website customized reports includes all schools in the Commonwealth of Virginia. This listing was reduced to eliminate schools that did not fit the study objectives, i.e., schools that did not have 3rd and 5th grade students or schools that had a low number of students in the grade (fewer than ten students in a grade). School identifying characteristics for each identified school includes the grade configuration, i.e., the high grade and the low grade in each school. A

convention in place by the Virginia Department of Education to protect information for individuals and to preclude any person who uses these reports from identifying individual students and their performance is to suppress any numbers reported that are less than ten.

In examining the data for all students taking the tests, this limitation did not affect the data collection and analysis for the category of 'All Students'. However, in disaggregating the data there was a substantial number of observations that contained information that was suppressed due to low density of students in the 3rd and 5th grades in individual schools in the various categories of disaggregation, i.e., race, poverty and LEP. To conduct the study and address the study questions, the pass rates for all students were used rather than disaggregated rates. The numbers and percentages of students in these subgroups were available from the demographic reports.

The data preparation process for sorting and selecting the study schools began with the 2008 schools provided in the customized report that was provided in an Excel file. This includes every school in Virginia. Four files were obtained for each year of the study—one file each for Grade 3 Reading, Grade 3 Math, Grade 5 Reading and Grade 5 Math.

Schools that had a low grade greater than third or a high grade lower than 5^{th} were deleted. Schools that had fewer than ten students taking the test were deleted. This is an indication of specialized schools that were not identified previously and deleted according to the grade configuration criteria. For example, a school may have had a grade configuration identified as K – 8 but actually been a Middle School with only grade 6 – 8. These instances may have represented schools that recently changed their grade

configurations and the database was not updated to reflect the change or entries that were improperly coded. In addition, these schools did not have an overall pass rate in the grades of interest for *'All Students'* and thus would not have provided an observation of the dependent variable for analysis. This process thus generated the listing of schools to be used in the analysis. Every year the number of schools varied due to schools opening, closing or changing their grade configurations.

To uniquely identify each school and thus enable linkage with the data provided by the other databases, a Unique ID was developed for each school. This was a combination of the district identification number and the individual school identification number used by the Virginia Department of Education. This was rather easily done for the demographic and teacher characteristics reports from the Virginia Department of Education.

As mentioned above, the Virginia Department of Education convention is to suppress data for which the number of students is less than ten. The reports for economically disadvantaged students followed this convention and suppressed data identifying the number of economically disadvantaged students in a grade in a school or the number in the entire school if the number was less than ten. There were a number of grades in a school that met this criterion and thus the number of economically disadvantaged students in the 3^{rd} of 5^{th} grade of the school was not available. Thus the percent of economically disadvantaged students in that grade of the school was not available.

In those cases the number of economically disadvantaged students in the entire school was used with the number students in the school to compute the school percentage of economically disadvantaged students. This percent was used for the grade for which the number of economically disadvantaged students was not available. In some cases, this school percentage was used for both the 3rd and the 5th grade in the school. This assumed that the percentage of economically disadvantaged in each grade was sufficiently close to the percentage of economically disadvantaged students in the entire school, i.e., that the economically disadvantaged students were distributed equally throughout the grade in the school.

The United States Department of Education (US DOE) District Fiscal Reports using the Local Education Agency (School District) Finance Survey (F-33) Data and the PTR reports posed a different problem. The US DOE does not use the same identification numbers in its reports. Linking the resource data to each school was done by attaching the school district Virginia identification number to each of the 134 school districts in the F-33 reports.

Linking the US DOE data for school pupil-teacher ratios for the individual schools was more complex. The schools were sorted in the Excel spreadsheets alphabetically by school names and then manually compared to a listing of schools which was developed from the Virginia databases and had the Unique ID attached.

After all of the date preparation described above, the school listing was complete. Although the number of schools each year changed due to opening and closing of schools

and changes in grade configuration, the number of schools in each year for each grade was approximately 1070.

Analysis

The primary analytic approach for this study is analysis of covariance with Grade 5 achievement as the dependent variable and two-year lagged Grade 3 achievement as the primary covariate. This covariate controls for earlier achievement for the same cohort of children. This analysis will be conducted using the three cohorts for which all of the variables are present, SY 07 - 09. Year is also entered as a fixed effect, thereby controlling for cohort.

Prior to the main covariance analysis, two preliminary models are developed. Model 1 is a cross-sectional regression for both Grade 3 and Grade 5 achievement in order to determine school, teacher and expenditure effects prior to introducing the student background variables. Model 2 adds the student background factors to the factors in Model 1 to determine the school effects while controlling for student background. Model 3 examines the 3rd grade and is then followed by the 5th grade to determine the similarity or difference of the school effects. Model 3 then introduce the lagged 3rd grade achievement variable as a covariate for the Grade 5 achievement variable and examines the 5th grade. Model 3 is the primary model for making inferences for school and student effects on achievement. The Model 3 covariance equation is provided in Equation 1.

Equation 1 Model 3 Analysis of Covariance

$$Grade\ 5\ Achievement = b_0 + b_1 Gr3Ach\ Lag + b_2 Expenditures + b_3 PTR + b_4 \%MA\_Deg + b_5 \%\ HQT + b_6 Yrs\_Exp + b_7 \%Black + b_8 \%Hisp + b_9 \%Pov + School\_year + e$$

Prior to the development and presentation of the regression models, the analysis presents the descriptive statistics—the mean and standard deviation of each of the variables in the study. These are presented overall based on all available data from SY 07 - 09, which are the three years that contain complete datasets for all variables.

Next, the study examines the correlation matrices of all variables using the SY09 data. This examination assists in identifying relationships between and among the variables and assists in choosing variables for the regression analysis, which follows. The correlation matrices allow for an understanding of the different factors that comprise the major categories of student background, expenditures and teacher characteristics. This permits the selection of the expenditure variables that provide the best models for this study.

Following the examination of the correlation matrices, the analysis begins the cross-sectional regression analysis of pertinent variables to develop the models of student achievement described above.

All analyses described in this section will be performed for both the Reading and Math data separately. Quantitative results of the Reading and Math analyses are compared and contrasted subjectively following the quantitative analyses.

CHAPTER FOUR – RESULTS

Overall Achievement

Before examining the individual factors identified in the conceptual model, it is informative to examine the overall performance of Virginia schools in grades 3 and 5 over the period of interest, SY 2001 through SY 2011. Changes in the SOL pass rates over this period are shown in Figure 9 below.[85] This figure displays an increase of almost 20 points in Grade 3 Reading, 14 points in Grade 3 Math, 16 points in Grade 5 Reading and over 20 points in Grade 5 Math. In the last year, 2011, approximately 90% of students passed the Math SOLs in both 3rd and 5th grades. Fifth grade Reading similarly saw a pass rate around 90% while 3rd grade reading lagged at 83%. This level is still a noticeable improvement from the 65% pass rate a decade earlier.

[85] See Tables in Appendix C for the actual pass rates for each of the figures in this chapter.

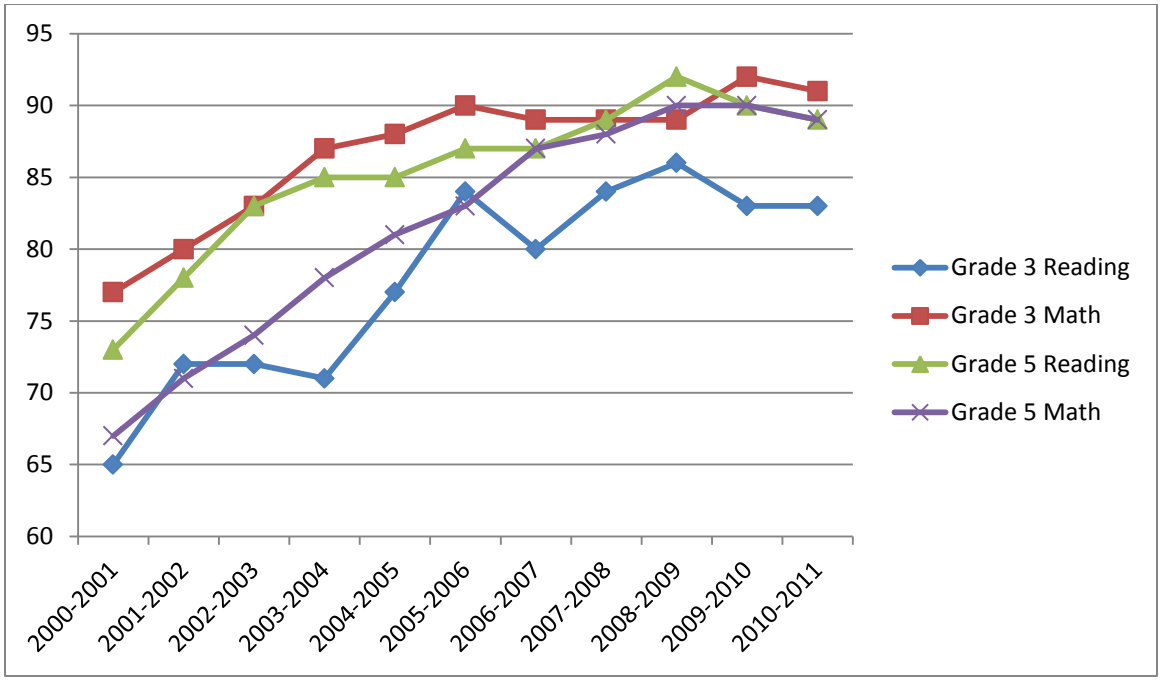


Figure 9 Passing Rates for All Students in Grades 3 & 5 for Reading & Math

Trends in the Student Background Variables

Student background has changed substantially over the past decade in Virginia, although not to the degree of student achievement. Table 8 Changing Demographics in Virginia Schools from 2003 to 2011displays the changing student background factors over time from 2003 to 2011.

Table 8 Changing Demographics in Virginia Schools from 2003 to 2011

School Yr	Percent of Hispanic students	Percent of Black students	Percent of White students	Percent of Students in Poverty
2003	6.1	27.0	61.7	37.6
2004	6.6	26.9	60.9	37.3
2005	7.1	26.6	60.2	37.2
2006	7.8	26.2	59.4	36.0
2007	8.2	25.7	58.6	36.7
2008	8.7	25.2	58.2	39.0

2009	8.8	25.4	57.4	39.9
2010	9.1	25.0	57.2	42.3
2011	10.8	23.9	55.5	37.6

Source: http://www.doe.virginia.gov/statistics_reports/enrollment/fall_membership/index.shtml

The largest change is for the percent of Hispanics in Virginia schools, which rose from 6.1% in 2003 to 10.8% in 2011. Black students declined from 27.0% to 23.9%. Similarly, the percent of White students declined from 61.7% to 55.5%. Alongside these changes in the racial composition of the schools, the percent of children in poverty remained generally stable throughout the period with a just under 10% increase in the latter years of the decade and one noticeable outlier in 2010.

The years considered in the regression models to be developed and presented later in this study are highlighted in Table 8.

Trends in School and Teacher Characteristics

Three characteristics of teachers and their professional achievement are considered in this study. They are the percent of teachers designated as HQTs in accordance with Virginia and federal criteria emanating from the NCLB, the percent of teachers holding advanced degrees, either Masters or Doctorates, and the average years of overall teaching experience of the teachers in each of the study schools. In addition, the study includes measures of pupil teacher ratios and educational expenditures.

NCLB defines a Highly Qualified Teacher as one who:

- "has obtained full State certification as a teacher (including certification obtained through alternative routes to certification) or passed the State teacher licensing examination, and holds a license to teach in such State, and . . . has not had

certification or licensure requirements waived on an emergency, temporary, or provisional basis" and,

- ‘‘when used with respect to an elementary school teacher who is new to the profession, means that the teacher holds at least a bachelor's degree; and has demonstrated, by passing a rigorous State test, subject knowledge and teaching skills in reading, writing, mathematics, and other areas of the basic elementary school curriculum (which may consist of passing a State-required certification or licensing test or tests in reading, writing, mathematics, and other areas of the basic elementary school curriculum) . . ." [86]

Other provisions apply to career changers and to teachers in middle and secondary schools. Generally, however, these requirements for a HQT include the teacher being licensed without a waiver and demonstrating content knowledge in the areas in which the teacher is teaching. The section in NCLB that defines a HQT is extracted in Appendix H, NCLB Highly Qualified Teacher Extract.

Virginia implemented the provisions of NCLB by relying on its stringent licensure program and implementing a program known as the Virginia High Objective Uniform State Standard of Evaluation (HOUSSE) to demonstrate subject matter knowledge. [87] An extract from the Virginia Program is at Appendix I, Virginia Highly Qualified Teachers Designation Extract. [88]

[86] "PLAW-107publ110.pdf," sec. 9101 (23).
[87] "VDOE :: Highly Qualified Teachers and Paraprofessionals."
[88] "Virginia Requirements For Highly Qualified Teacher Designation (Not New Teachers).pdf."

Increasing the percent of HQTs is not an option for most school districts since the mean percent of HQTs in the schools in Virginia is in the high 90's and the median approaches 100 percent in all years in the study. The means and other statistics are in Table 9.

Table 9 Percent Highly Qualified Teachers Statistics

School Year	Mean	Median	Minimum	Maximum
2004	95.58	97	54	100
2005	96.55	100	46	100
2006	96.51	98	68	100
2007	97.72	100	68	100
2008	98.36	100	76	100
2009	98.66	100	77	100

Figure 10 illustrates that the vast majority of school districts have already achieved 100% of their staff being designated as HQTs. Almost 800 of the slightly more than 1,000 schools in the study for 2009 had 100% of their teachers designated as HQTs.

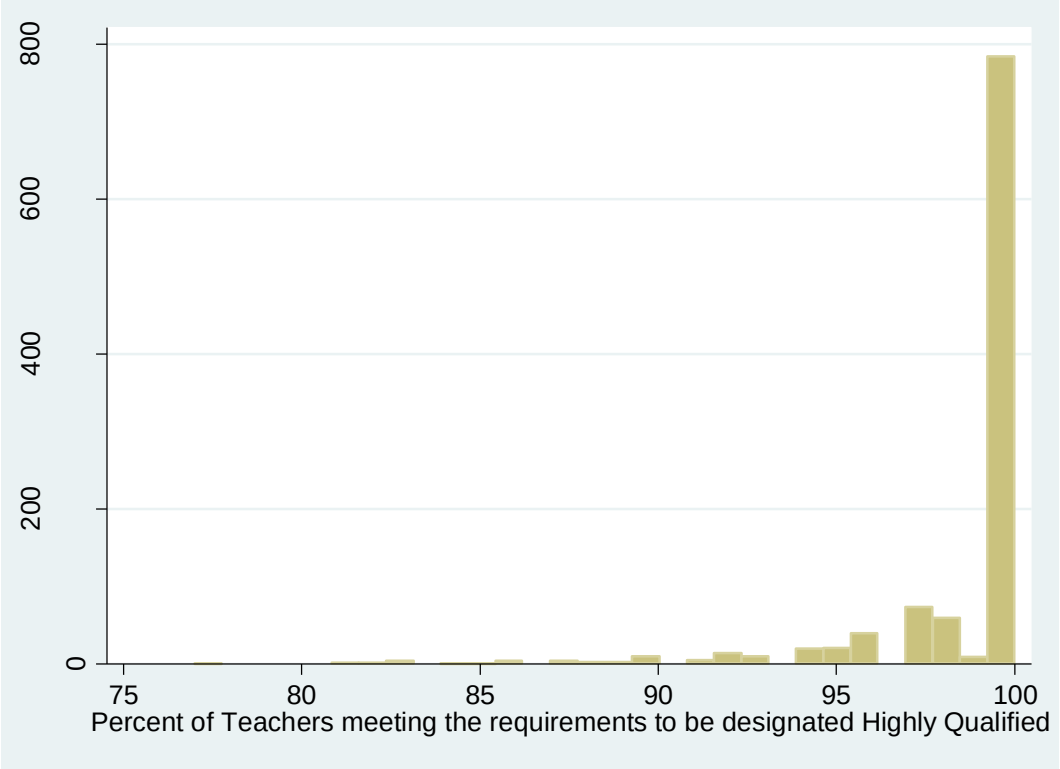


Figure 10 Distribution of Schools and the Percent of Highly Qualified Teachers for SY2009

Teaching experience is another teacher characteristic thought to influence student achievement. Table 10 displays the average years of teaching experience in all of the study schools over the last five years. Note that it is consistent at approximately 12.5 years with a consistent standard deviation. It would be hard to increase the average years of teaching experience to the degree required to have a substantial impact on student achievement without considering other unintended effects. Focusing on retaining senior, experienced teachers in the present limits the opportunities for younger, less experienced teachers. This could lead to future year challenges by creating a 'bow wave' of teachers ready to retire in the coming years.

Table 10 Average Years of Teaching Experience in the Study Schools from 2007 – 2011

School Year	Average Years Teaching Experience		
	Mean	Median	Std. Dev.
2007	12.6	12.4	2.82
2008	12.4	12.3	2.88
2009	12.4	12.3	2.88
2010	12.6	12.6	2.84
2011	12.7	12.6	2.83
Total	12.5	12.5	2.85

While many school districts have an experienced a teacher cadre with a great deal of experience, some school districts have a rather inexperienced school staff with lower average years of experience. Figure 11 illustrates the distribution of the average years of experience in the school districts in this study. Those with less than ten years average teaching experience could increase the experience with programs designed to reduce staff turnover.

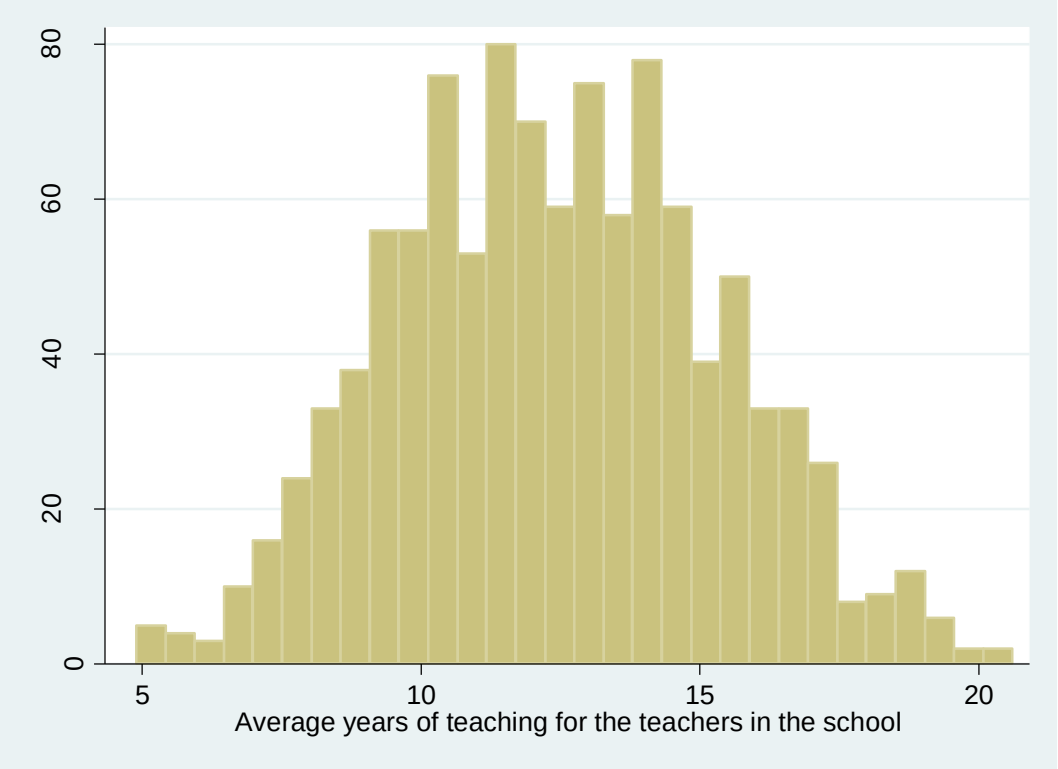


Figure 11 Average Years Teaching Experience in Schools

The mean percent of teachers with advanced degrees in Virginia's schools in this study hovers around 50% from 2004 through 2009. The range of teachers with advanced degrees in the schools in this study during that period is from approximately 10% to almost 90%. Of the three teacher characteristics variables in this study, this one has the greatest potential for improvement.

Table 11 School Districts Percent of Teachers with Advanced Degrees

School Year	Mean	Std. Dev.	Minimum	Maximum
2004	52.7	12.77	5	100
2005	51.9	12.66	13	85
2006	51.7	12.86	8	86
2007	51.0	13.12	9	86
2008	50.2	13.04	9	90

2009	49.6	12.91	9	85

Trends in Expenditures

As mentioned earlier, Per Pupil Total Expenditures vary from $8,000 to $25,000 with a mean of $10, 500. The distribution of the Per Pupil Total Expenditures for all schools is shown in Figure 12. For most school districts, increasing the per pupil expenditures substantially is difficult, if at all possible.

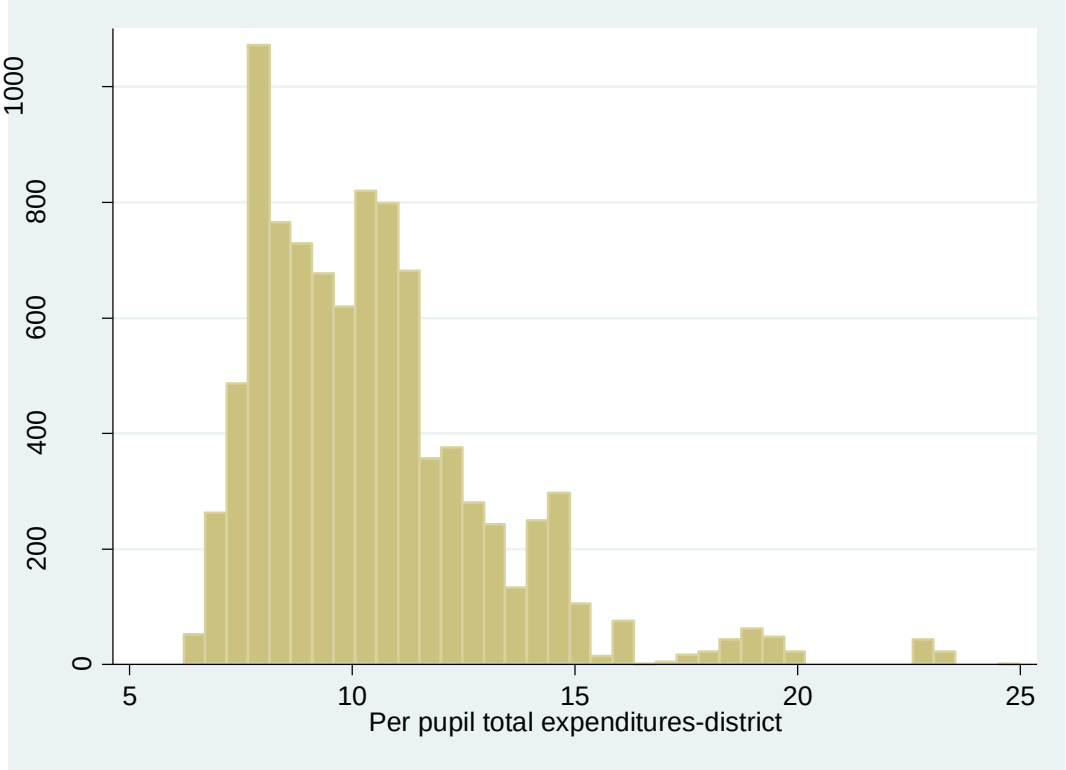


Figure 12 Per Pupil Total Expenditures

Finally, the Pupil-Teacher Ratio over the decade from 2001 to 2010 is shown in Figure 13. There was an effort to reduce the PTR early in the decade; however, the last

three years indicate that the PTR increased from about 12 in 2007 to over 16 in 2008. It remained at that level until the end of the available data in 2010.

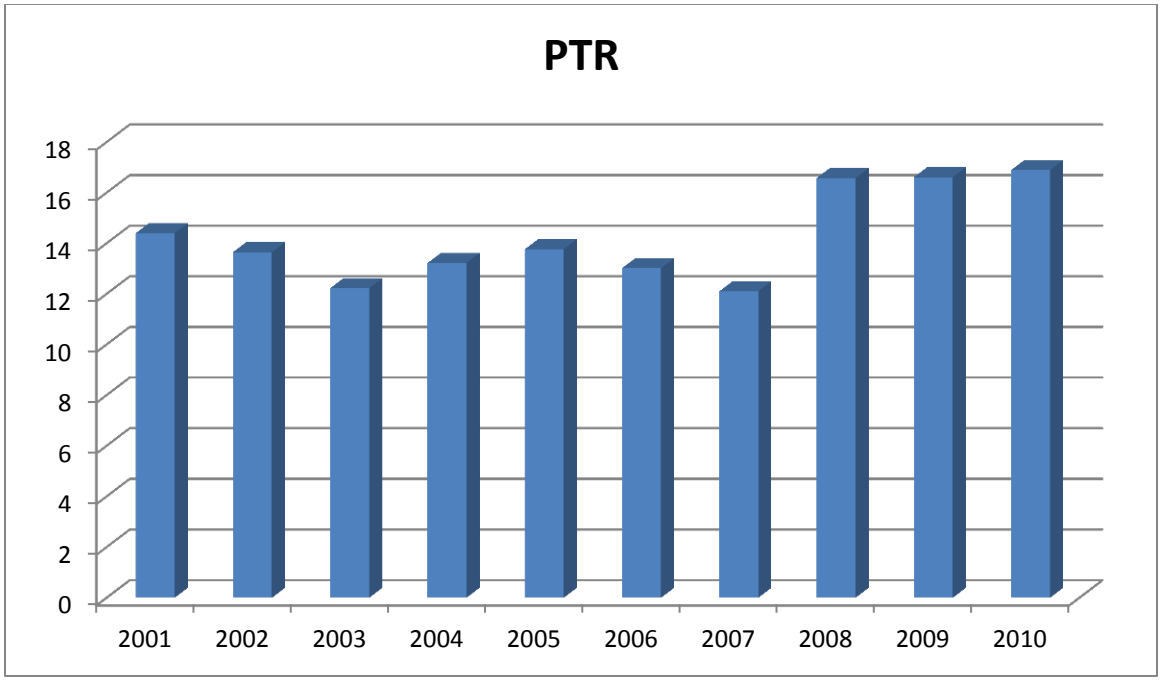


Figure 13 Pupil-Teacher Ratio

Summary of Results for Reading Proficiency

As seen in Figure 2, over the period of 2001 through 2011, Virginia 3rd grade pass rates for all students in Reading improved from 65 to 83 percent. This improving trend was evident in all three demographic subgroups, White, Hispanic and Black, which is illustrated in Figure 3. Similar improvements were also noticed in the economically disadvantaged and LEP subgroups. Although improvement occurred in these subgroups, a gap in achievement still existed between White students and the other subgroups at the end of this period.

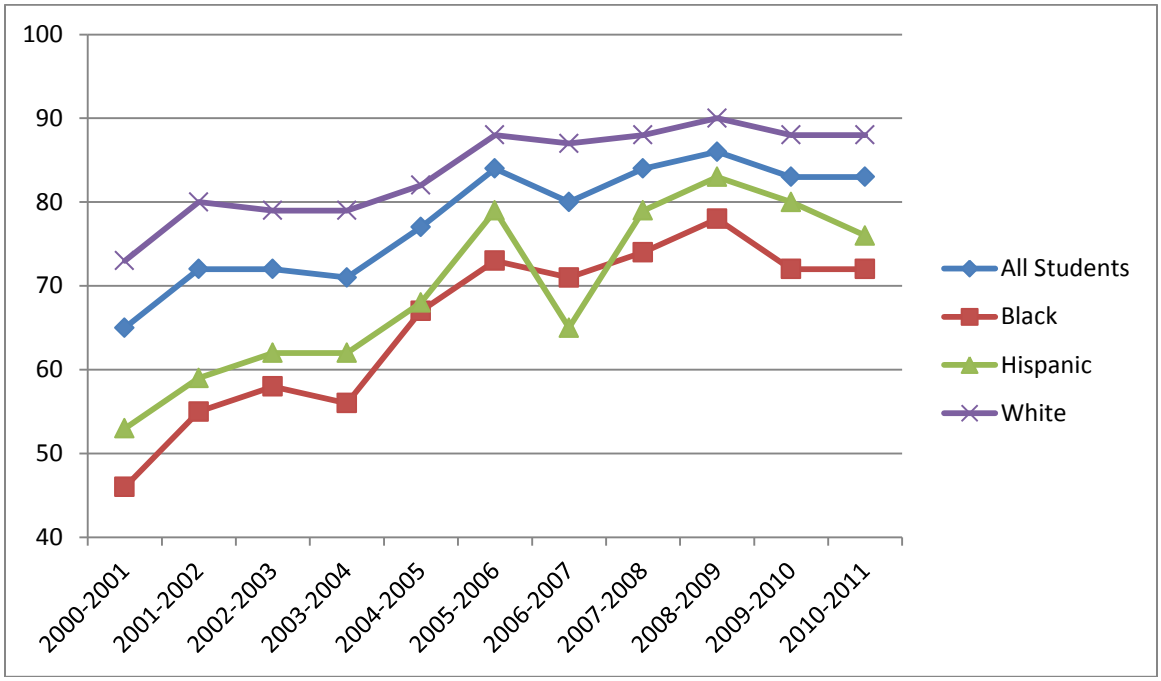


Figure 14 SOL Pass Rates for 3rd Grade Reading for All Students and Selected Subgroups

Over the same period, Virginia 5th grade pass rates for all students improved in Reading from 73 to 89 percent. This improving trend was also evident in all three demographic subgroups, White, Hispanic and Black, as seen in Figure 15. Hispanic students had one year, 2007, in which they did not perform as well and, in fact, seemed to take a step backward with a large drop in the percent of Hispanic students passing the SOL Assessments in that year. This one year aberration was corrected in the ensuing years. Again, similar improvements were also noticed in the economically disadvantaged and LEP subgroups (see Appendix Tables).

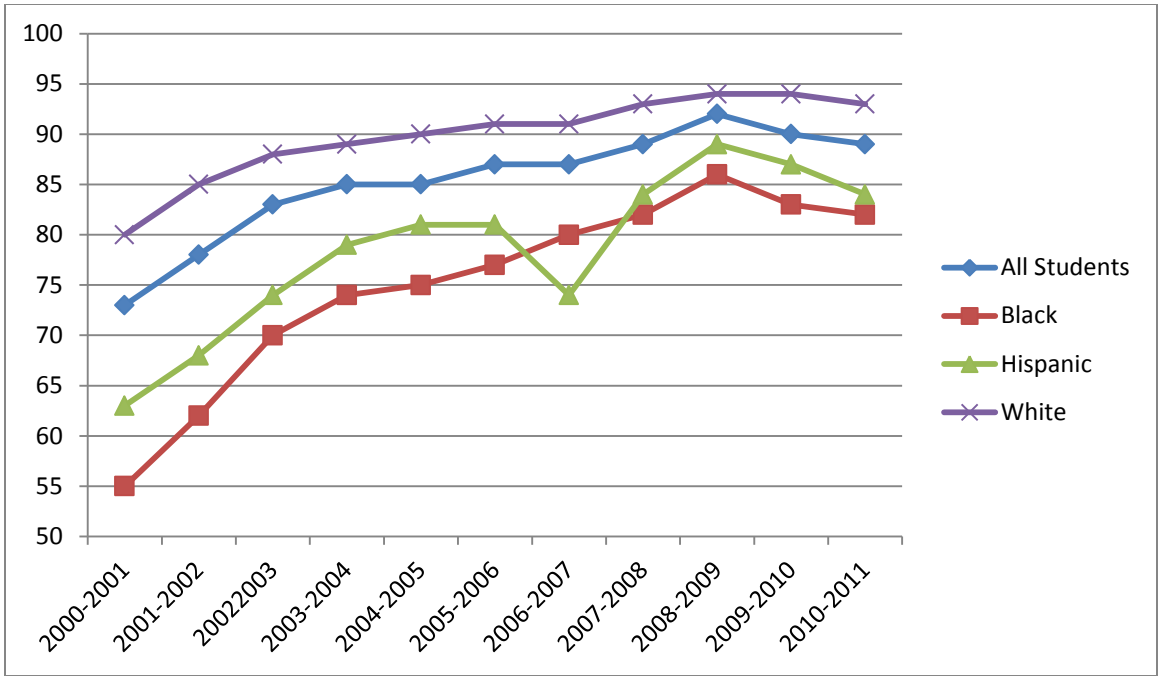


Figure 15 SOL Pass Rates for 5th Grade Reading for All Students and Selected Subgroups

Descriptive Statistics

Table 12 displays the descriptive statistics for SY07 – 09 for the dependent and independent variables used in the analysis of Reading achievement in this study.

Table 12 Descriptive Statistics for the Reading Analysis for SY07-09

Variable	Observations	Mean	Std. Dev.	Min	Max
Reading Achievement	6398	87.23	8.74	41	100
3rd Grade Achievement	3195	85.50	9.16	41	100
5th Grade Achievement	3203	89.95	7.36	46	100
Reading Gain	3103	9.19	9.29	-30	54
Total Expenditures	6386	$12,243	$2,647	$8,096	$24,998
Elementary / Secondary Expenditures	6386	$10,616	$2,092	$7,850	$18,539
Instructional Expenditures	6386	$6,462	$1,254	$4,748	$11,231
Instructional Salary Expenditures	6386	$4,501	$884	$3,288	$8,027
% Black Students	6395	25.44	26.33	0.00	100.00
% Hispanic Students	6395	8.56	12.13	0.00	78.57
% White Students	6395	58.04	29.24	0.00	100.00

% Students in Poverty	6291	37.25	22.49	1.11	100.00
% LEP Students	3623	16.28	17.14	0.87	89.09
Pupil Teacher Ratio	6319	15.11	3.41	5.70	30.00
% Teacher MA+ Degrees	6396	50.25	13.03	9.00	90.00
%High Quality Teachers	6396	98.25	3.39	68.00	100.00
Teaching Experience (avg yrs)	6396	12.46	2.86	4.70	21.50

The percent of all students in a school in grades three and five passing the SOL assessments in years 2007 through 2009 ranged from 41 to 100 percent based on the 6,398 observations during those years. The gain in percent passing from third grade to fifth grade in those years for the fifth grade cohorts in those years ranged from losing 30 percentage points to gaining 54 percentage points with the average gain in a school being about nine percent.

In those years, the per pupil annual spending for the school districts in Virginia ranged from just under $8,100 to almost $25,000 with the mean being approximately $12,250. Other subsets of the total per pupil expenditures (elementary & secondary school expenditures, instructional expenditures, instructional salaries) are displayed in Table 12 and are discussed in detail in Appendix G – Relationship of the Expenditures Variables.

With regard to school and teacher characteristics, the school PTR ranged from less than 6 to as many as 30 students. As mentioned earlier in the Methodology Chapter, PTR values less than six and greater than 30 were removed as questionable. The mean was slightly more than 15 students.

The mean demographics of the schools in those three years were 58% White, 25% Black and 8.6% Hispanic. The percent of White students in a school / grade combination

ranged from zero to 100%, with the mean being 58% and a standard deviation of almost 30%. The percent of Black students in a school / grade combination similarly ranged from zero to 100%, with the mean being 25% and a standard deviation of 26%. The percent of Hispanic students in a school / grade combination ranged from zero to almost 80%, with a mean of 8.6% and a standard deviation of almost 12%.

The percent of students in a school that were economically disadvantaged ranged from almost none (1%) to having the entire school considered to be economically disadvantaged. The mean percentage of students on poverty in a school is 37%. The percent of students enrolled as LEP students ranged from almost none (<1%) to almost 90%. The mean is 16%.

The percent of teachers with advanced degrees ranged from nine to 90 percent while the percent of HQTs ranged from 68 to 100 percent. The mean of the percent of teachers with advanced degrees was 50% with a standard deviation of 13% while the mean of the percent of HQTs in a school was over 98%. The mean years of experience for teachers in a school was about 12.5 years with a range from about five years to over 21 years.

Correlation Matrix

Correlation of the factors identified in the conceptual model identifies those factors that most likely influenced the pass rates. Table 13 displays the correlation coefficients for the dependent variable of Reading Achievement and nine independent variables for expenditures, student background and school & teacher characteristics.

Table 13 Correlation Matrix for Reading Achievement of All Students in Grades 3 & 5 for School Years

	Reading Achievement	Total Expenditures ($000)	% Black Students	% Hispanic Students	% White Students	% Students in Poverty	Pupil Teacher Ratio	% Teacher MA+ Degrees	%High Quality Teachers	Teaching Experience (avg yrs)
Reading Achievement	1									
Total Expenditures	0.0084	1								
% Black Students	-0.2639	-0.0827	1							
& Hispanic Students	-0.1572	0.4441	-0.0847	1						
% White Students	0.2693	-0.2551	-0.7978	-0.4545	1					
% Students in Poverty	-0.3566	-0.1471	0.5178	0.1386	-0.4202	1				
Pupil Teacher Ratio	0.2871	-0.0404	-0.0788	-0.1861	0.1124	-0.315	1			
% Teacher MA+ Degrees	0.0545	0.491	-0.1201	0.3719	-0.2219	-0.25	-0.0207	1		
%High Quality Teachers	0.1848	0.0093	-0.2089	-0.0963	0.2027	-0.1522	0.0747	0.0573	1	
Teaching Experience (avg yrs)	0.1015	-0.3119	-0.1567	-0.327	0.3959	0.0492	-0.0272	-0.2163	0.1554	1

Examination of the matrix reveals a very weak positive correlation between the Total Expenditures and the student achievement. It also shows a moderate positive correlation between student achievement and the percent of White students. It shows a positive correlation between all of the school & teacher characteristics—Pupil Teacher Ratio, percent of teachers with advanced degrees, high quality teachers and the average number of years of experience of the teachers in a school. The correlation between the PTR and student achievement is moderate while the association of the variables high quality teachers and the average years teaching experience, with achievement is modest.

The association between the percent of teachers in a school with advanced degrees and Reading Achievement is weak.

The matrix also reveals a moderately negative correlation between student achievement and the percent of Black students and a moderately negative association between the percent of Hispanic students and student achievement. The percent of economically disadvantaged students and student achievement has a fairly strong negative association and is the highest correlation with student achievement of all of the nine independent variables.

In addition, the percent of economically disadvantaged students has a very strong positive correlation with the percent of Black students but only a modest positive correlation with the percent of Hispanic students. The percent of economically disadvantaged students has a fairly strong negative correlation with the percent of White students. Finally, the percent of Hispanic and Black students have a weak negative correlation.

With regard to the school and teacher characteristics, the percent of percent of high quality teachers has a weak positive correlation with the percent of teachers holding advanced degrees and a modest positive correlation with the average number of years of teaching experience in a school. The percent of teachers with advanced degrees has a moderate negative correlation with the average number of years of teaching experience in a school.

Summary of Results for Math Proficiency

Over the period of 2001 through 2011, Virginia 3rd grade pass rates for all students in Math improved from 77 percent to 91 percent. The magnitude of these improvements was slightly smaller than the Reading improvements since the Math scores started at higher level in 2001 thus limiting the amount of improvement possible. This improving trend was evident in all three demographic subgroups, White, Hispanic and Black. Similar improvements were also noticed in the economically disadvantaged and LEP subgroups.

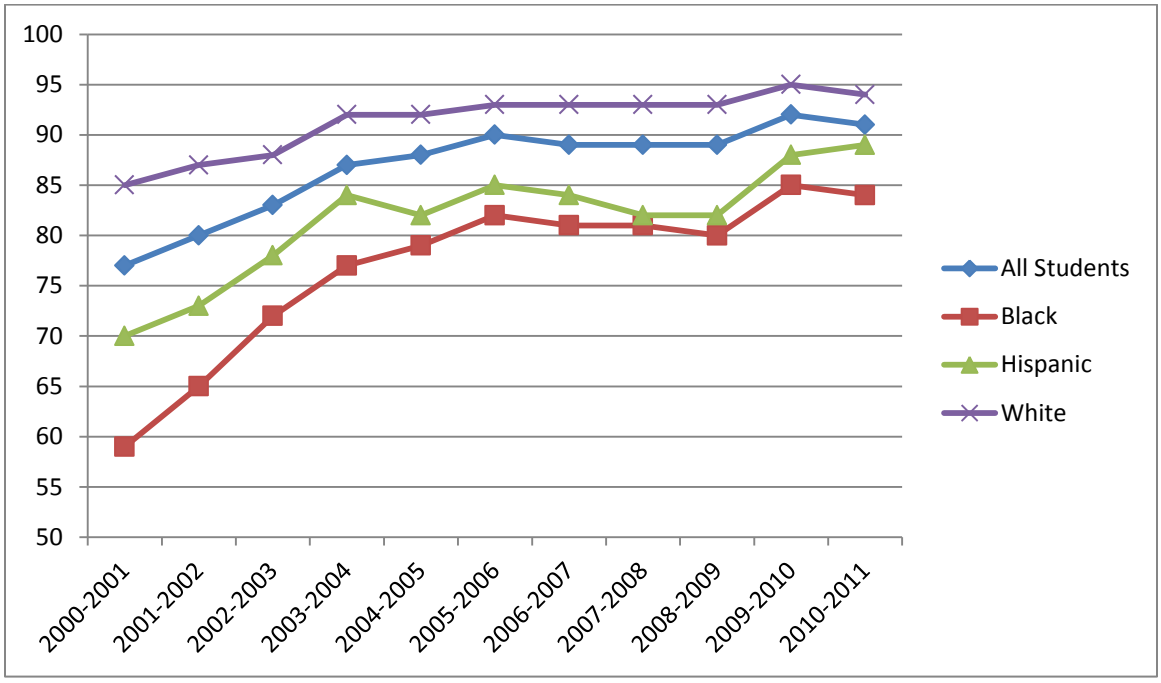


Figure 16 Math SOL Pass Rates for 3rd Grade for All Students and Selected Subgroups

Over the period of 2001 through 2011 Virginia 5th grade pass rates for all students in Math improved from 67 to 89. This improving trend was evident in all three

demographic subgroups, White, Hispanic and Black. Similar improvements were also noticed in the economically disadvantaged and LEP subgroups.

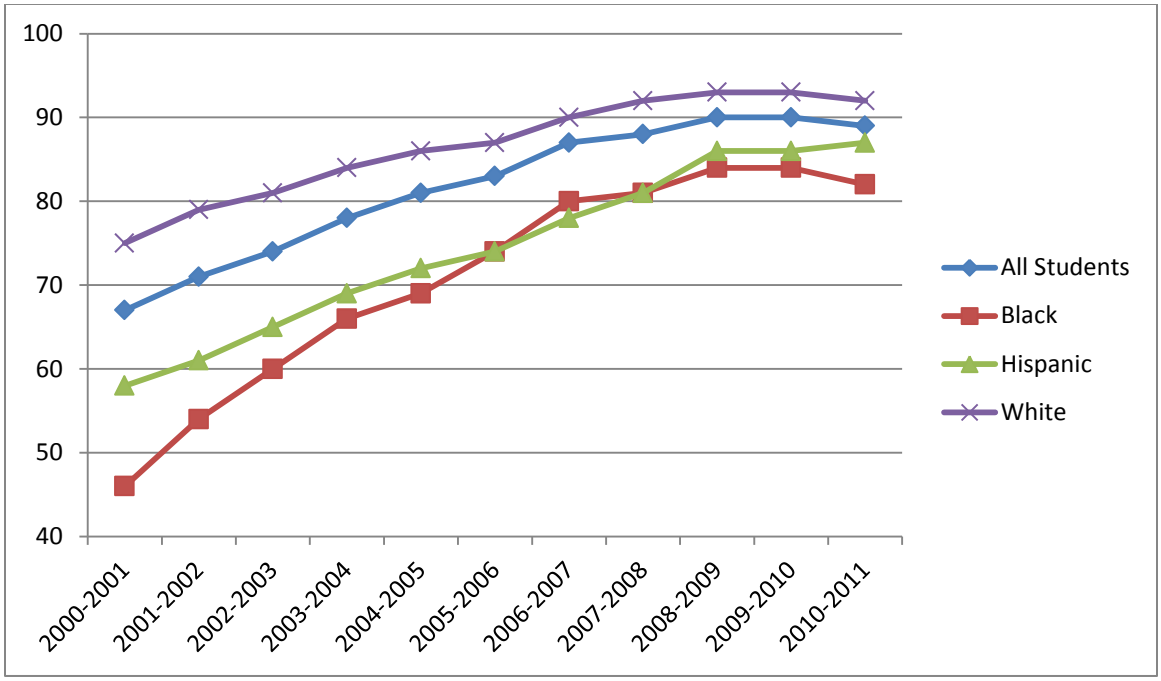


Figure 17 Math SOL Pass Rates for 5th Grade for All Students and Selected Subgroups

Descriptive Statistics

Table 14 displays the descriptive statistics for SY07-09 for the dependent and independent variables used in the analysis of Math achievement in this study. The independent variables are the same ones that were used in the Reading analysis. There are from three to six additional observations in the Math data due to a small number of different schools that met the criteria for inclusion in the study for each analysis. There is only a very small difference in the descriptive statistics of the independent variables between the Math and English datasets. Therefore the discussion of the independent

variables for the Math analysis is identical to the discussion in the Reading section earlier.

Table 14 Descriptive Statistics for the Math Analysis for SY07-09

Variable	Observations	Mean	Std. Dev.	Min	Max
Math Achievement	6404	89.59	7.61	51	100
3rd Grade Achievement	3199	89.91	7.21	51	100
5th Grade Achievement	3205	89.27	7.98	51	100
Math Gain	3110	.01	8.15	-36	39
Total Expenditures	6391	$12,241	$2,646	$8,096	$24,998
Elementary / Secondary Expenditures	6391	$10,614	$2,091	$7,849	$18,538
Instructional Expenditures	6391	$6,460	$1,253	$4,747	$11,231
Instructional Salary Expenditures	6391	$4,500	$883	$3,288	$8,026
% Black Students	6399	25.45	26.33	0	100
% Hispanic Students	6399	8.57	12.14	0	78.57
% White Students	6399	58.02	29.25	0	100
% Students in Poverty	6297	37.25	22.48	1.11	100
% LEP Students	3629	16.28	17.14	0.87	89.09
Pupil Teacher Ratio	6322	15.11	3.41	5.7	30
% Teacher MA+ Degrees	6402	50.25	13.03	9	90
% High Quality Teachers	6402	98.25	3.40	68	100
Teaching Experience (avg yrs)	6402	12.45	2.86	4.7	21.5

Student Math achievement in a school ranges from 51 to 100 percent with a mean of just under 90% based on the 6,404 observations during those years.

The Math Achievement Gain from 3rd to 5th grade was not as strong as the Reading Gains. The Math Gains ranged from losing 36 points to increasing by 39 points. The overall mean was effectively zero.

Correlation Matrix

Table 15 displays the correlation coefficients for the dependent variable of Math achievement and the nine independent variables for expenditures, student background, and school & teacher characteristics.

Table 15 Correlation Matrix for Math Achievement of All Students on Grades 3 & 5 for School Years 2007-2009

	Math Achievement	Total Expenditures ($000)	% Black Students	% Hispanic Students	% White Students	% Students in Poverty	Pupil Teacher Ratio	% Teacher MA+ Degrees	%High Quality Teachers	Teaching Experience (avg yrs)
Math Achievement	1.0000									
Total Expenditures ($000)	-0.0358	1.0000								
% Black Students	-0.2685	-0.0827	1.0000							
% Hispanic Students	-0.1858	0.4441	-0.0847	1.0000						
% White Students	0.3025	-0.2551	-0.7978	-0.4545	1.0000					
% Students in Poverty	-0.3197	-0.1471	0.5178	0.1386	-0.4202	1.0000				
Pupil Teacher Ratio	0.1679	-0.0404	-0.0788	-0.1861	0.1124	-0.3150	1.0000			
% Teacher MA+ Degrees	0.0053	0.4910	-0.1201	0.3719	-0.2219	-0.2500	-0.0207	1.0000		
%High Quality Teachers	0.1668	0.0093	-0.2089	-0.0963	0.2027	-0.1522	0.0747	0.0573	1.0000	
Teaching Experience (avg yrs)	0.1259	-0.3119	-0.1567	-0.3270	0.3959	0.0492	-0.0272	-0.2163	0.1554	1.0000

The data show a weak negative correlation between the Total Expenditures and the student achievement in math. The percent of Black students, the percent of Hispanic students and the percent of economically disadvantaged students are all negatively correlated with student math achievement. The percent of economically disadvantaged students is fairly strongly correlated; the percent of Black students is moderately

correlated and the percent of Hispanic students is modestly correlated. The percent of White students, on the other hand, is fairly strongly positively correlated with student achievement in this analysis.

With regard to the school & teacher characteristics, all four independent variables positively correlated with student achievement in Math. PTR, percent of HQTs and the average number of years of teaching experience have a modest positive correlation, while the percent of teachers with advanced degrees weakly positively correlated with student achievement.

Since the nine independent variables are the same as in the Reading achievement analysis, the correlations between pairs of these variables are the same as for the previous analysis.

Regression Analysis

Multiple regression techniques constitute the primary analytic approach for this study. In this section for both Reading and Math, models are developed to determine the size and statistical significance of the effects of the independent variables in influencing student achievement. First, the study examines the Reading achievement, followed by the Math achievement analysis. For both content areas, 3rd grade achievement is analyzed and then 5^{th} grade achievement in each of the subjects.

Grade 3 Reading Cross-Sectional Regression Analysis

Model 1 includes the Total Expenditures variable to represent expenditures and the school and teacher characteristics shown in Table 16. This model shows a small and statistically insignificant effect for the Total Expenditures on Student Achievement.

Table 16 Regression Results for Reading, Grade 3, FY07-09

Variable	Model 1		Model 2	
	Coefficient	β	Coefficient	β
Total Expenditures ($000)	.13	.04	.02	.01
Pupil Teacher Ratio	.71***	.27	.14	.05
% Teacher MA+ Degrees	.06***	.08	.03	.36
%High Quality Teachers	.40***	.15	.19***	.07
Teaching Experience (avg yrs)	.43***	.13	.27***	.08
% Black Students	-		-.05***	-.14
% Hispanic Students	-		-.08***	-.11
% Students in Poverty	-		-.11***	-.26
Fixed Effects				
School Year				
2008	.35	.02	3.20***	.17
2009	2.16***	.11	5.42***	.28
N	3156		3103	
R^2	.16		.27	

Note: * p < .05; ** p< .01; *** p < .001.

However, all of the School & Teacher Characteristics effects are statistically significant. The PTR result produces the largest effect but is problematic. The result indicates that for a one standard deviation increase in class size, there would be approximately a one quarter standard deviation increase in the percentage of students who pass the Reading SOL Assessment. This runs contrary to conventional belief. Smaller class sizes are expected to produce better student achievement results, not larger class sizes. It is suspected that this result is influenced by the funds that are provided by state funding formulas to school districts with a high number of economically disadvantaged students. This allows the school districts with a large percentage of economically disadvantaged students to lower the Pupil Teacher Ratio more than it would be without the larger amount of state funding. It is expected that the incorporation of the

student background factors, most importantly the percent of economically disadvantaged students, will assist in explaining this aberration in Model 1.

The percent of HQTs and teaching experience result in the next largest effects. Both result in an approximately one-sixth of a standard deviation improvement in student achievement for a one standard deviation increase in these variables. For approximately every two and a half percentage point increase in the percentage of High Quality Teachers in a school, an increase of one point in the percentage of students who pass the Reading SOL Assessment results. Similarly for an approximately three year increase in the average years of teaching experience for the teachers in a school, a one percentage point increase in the percent of students who pass the Reading SOL Assessment results. Although statistically significant, the percentage of teachers who possess advanced degrees provides a very small effect on student achievement in this model. For a ten point increase in the percentage of teachers possessing advanced degrees, student achievement would only increase by half of a percentage point.

This model also controlled for the effects of the school year on the student achievement. The fixed effect of school year 2008 was not statistically significant; however, the regression results indicate that student achievement increased by slightly over two percentage points in 2009. This result is statistically significant.

Model 2 adds the student background factors to the expenditures and school & teacher characteristics and results in the following regressions equation. The student background factors are all statistically significant and have moderate negative effects.

The strongest effect results from the percent of economically disadvantaged students, which is greater than the effects of race in this model. An increase of one standard deviation in economically disadvantaged students results in a one quarter decrease in student achievement.

The effect of the percent of Black students is slightly greater than the percent of Hispanic students. An increase of one standard deviation in the percentage of Black students in the school results in a decrease of one-seventh of a standards deviation in student achievement in that grade / school combination. Similarly, an increase of one standard deviation in the percentage of Hispanic students results in an approximately one tenth of a standard deviation decrease in student achievement.

As in Model 1, the expenditures factor is not statistically significant. PTR was statistically significant, had a large effect and was problematic in Model 1. However, in Model 2, with the introduction of the student background factors, most importantly the percent of students who are economically disadvantaged, the PTR coefficient is substantially smaller indicating a diminished effect. In addition, it is not statistically significant. This result thus supports the earlier explanation that the inclusion of student background factors would mitigate the PTR factor in Model 2.

The percent of HQTs and the Teaching Experience remain statistically significant in Model 2 but now produce lessened effects by about half. A five percentage point increase in the percentage of HQTs in a school will result in a one percentage point increase in student achievement. Similarly, an increase of almost four years in average

teaching experience for the teachers in a school will also result in a one percentage point increase in student achievement.

Grade 5 Reading Cross-Sectional and Covariance Analysis

The Model 1 regression results for the 5th grade are shown in Table 17 and indicate a very small and statistically insignificant negative effect from the Total Expenditure factor.

Table 17 Regression Results for Reading, Grade 5, FY07-09

Variable	Model 1		Model 2		Model 3 (Covariance)	
	Coefficient	β	Coefficient	B	Coefficient	β
Grade 3 Reading Achievement (lagged two years)					.25***	.36
Total Expenditures ($000)	-.06	-.02	-.13*	-.05	-.14**	-.05
Pupil Teacher Ratio	.53***	.25	.02	.01	-.06	-.03
% Teacher MA+ Degrees	.06***	.10	.03**	.06	.04**	.06
%High Quality Teachers	.31***	.14	.15***	.07	.12***	.06
Teaching Experience (avg yrs)	.23***	.09	.12*	.05	.02	.01
% Black Students	-		-.02***	-.07	-.01*	-.04
% Hispanic Students	-		-.07***	-.12	-.05***	-.08
% Students in Poverty	-		-.10***	-.31	-.07***	-.20
Fixed Effects:						
School Year						
2008	.35	.02	2.87***	.18	1.42***	.09
2009	2.47***	.16	5.36***	.35	4.50***	.29
N	3151		3098		3019	
R^2	.16		.26		.35	

Note: * p < .05; ** p< .01; *** p < .001.

In Model 1 for the 5th grade, all of the school & teacher characteristics are statistically significant. Once again, the PTR has a large effect and is problematic in that the result is once again contrary to expected results. An increase of one standard

deviation in the PTR results in a one quarter standard deviation increase in student achievement. Another way of stating this is that a two student increase in PTR results in a one percentage point increase in student achievement. Model 2 may again assist in resolving this inconsistency.

The other school and teacher characteristics are statistically significant and produce results that are approximately the same or smaller than the 3rd grade. The fixed effects of the years again result in an insignificant effect for school year 2008 but a statistically significant effect of almost 2.5 percentage points for school year 2009.

Model 2 again introduces student background factors to the model. Expenditures become statistically significant at the .05 level of significance; however, the effect is small and negative. In Model 2, PTR is not statistically significant. All of the Teacher Characteristics are statistically significant but their effects are very small in this model.

The student background variables are all statistically significant with the poverty variable once again having the largest effect. An increase of one standard deviation in the percent of economically disadvantaged students in a class results in a one-third standard deviation decrease in student achievement. The effects of race, while statistically significant, is not as strong as the poverty variable.

For approximately a one standard deviation increase in the percent of Hispanic students in a school, student achievement decreases by approximately one-ninth of a standard deviation. For the percent of Black students in a class, the effect is even smaller.

Controlling for the school year results in statistically significant fixed effects for both years in this model. School year 2008 produces an effect of almost three points relative to school year 2007 and school year 2009 results in a greater than five point increase in student achievement relative to school year 2007.

Finally, Model 3 introduces the Grade 3 lag variable into the model. This variable represents the percentage of students passing the SOL Assessment in the 3rd grade two years prior to the year of interest for the 5th grade. Since this study is conducted at the grade/school level and not at the student level, it does not account for students who entered or left a school over that two year period. We assume, however, that a large percentage of the students who took the SOL Assessment in 3rd grade are the same students who took the 5th grade SOL Assessment two years later.

The 3rd grade Student Achievement Lag variable is statistically significant and results in the largest effect of all of the variables. A one standard deviation increase in student achievement for the cohort in their 3rd grade scores results in a one-third standard deviation increase in 5th grade achievement. This can also be expressed as a one percent increase in student achievement in the 3rd grade SOL assessments resulting in a one-quarter percent increase in 5th grade achievement.

The three student background factors all remain statistically significant. The percent of students in poverty is results in the largest effect of the three. A one standard deviation increase in the percent of economically disadvantaged students results in a one fifth standard deviation decrease in student achievement.

Expenditures are statistically significant in this model; however, the effects are small and negative. A one standard deviation decrease in expenditures results in a one twentieth increase in student achievement.

PTR remains statistically insignificant in this model, as is the teacher experience. However, two teacher characteristics are statistically significant, percent with MA degree or higher and percent Highly Qualified, but the size of their effects is quite small. Their effect sizes are only .06, which means that a one standard deviation increase in either will result in only a one-twentieth (approximately) standard deviation increase in reading proficiency.

Once again, controlling for the school year results in an almost 1.5% increase in school year 2008 relative to school year 2007 and a 4.5 % increase in school year 2009 relative to school year 2007. Both of these results are statistically significant.

Grade 3 Math Cross-Sectional Regression Analysis

Table 18 shows the Grade 3 Math Cross-Sectional regression results.

Table 18 Regression Results for Math, Grade 3, FY07-09

Variable	Model 1		Model 2	
	Coefficient	β	Coefficient	β
Total Expenditures ($000)	.01	.01	-.02	-.01
Pupil Teacher Ratio	.48***	.23	.04	.02
% Teacher MA+ Degrees	.01	.02	-.00	-.00
%High Quality Teachers	.32***	.15	.13***	.06
Teaching Experience (avg yrs)	.37***	.14	.16***	.06
% Black Students			-.07***	-.25
% Hispanic Students			-.11***	-.19
% Students in Poverty			-.06***	-.18
Fixed Effects:				

School Year				
2008	-1.78***	-.12	.33	.02
2009	-2.166***	-.142	.215	.014
N	3156		3103	
R^2	.082		.218	

Note: * p < .05; ** p< .01; *** p < .001.

The Total Expenditures variable effect for Math Student Achievement is not statistically significant in Model 1. The PTR, the percent of HQTs and the average years experience are all statistically significant in this model. The PTR has a moderate positive effect while the percent of HQTs and teaching experience have modest positive effects. However, the PTR effect is problematic in that it is contrary to expectations. As in the Reading analysis, the introduction of the student background factors may help explain this result. The PTR results are similar to the results for Model 1 in the Reading analysis. The positive coefficient indicates that as PTR increases, student achievement also increases. Again, this is contrary to what is expected. As in the Reading analysis, Model 1 does not include the student background factors, which may affect the influence of the PTR.

For an increase of approximately two students in the PTR, the model provides for just under a one percentage point increase in student achievement. For the percent of HQTs an increase of one standard deviation would lead to an approximately one-seventh standard deviation increase in student achievement. Similarly, for an increase of one standard deviation in average teaching experience in a school, student achievement would increase by approximately one-seventh of a standard deviation. The percentage of

teachers with advanced degrees results in a very small and statistically insignificant effect in this model.

Controlling for the school year, student achievement in years 2008 and 2009 are both lower than achievement in 2007. The fixed effect of student achievement for 2008 is approximately one and three quarters points and for 2009 by slightly more than two points. Both of these results are statistically significant.

Model 2 adds the student background factors to the expenditures and school & teacher characteristics in Model 1. In Model 2, the Total Expenditures variable remains statistically insignificant.

The PTR coefficient is still positive but it is a much smaller effect and is statistically insignificant. The three student background factors are all statistically significant with the percent of Black students producing the largest effect. A one standard deviation increase in percent Blacks results in s a one-quarter standard deviation decrease in student achievement. A one standard deviation increase in the percent of Hispanic students or in the percent of economically disadvantaged students results in a one-fifth standard deviation decrease in student achievement. An increase of ten percentage points in the percent of Hispanic students results in a one percentage point decrease in overall student achievement. For the same ten percentage point increase in either economically disadvantaged student or Black students, there would be an approximately half a percent decrease in student achievement in Math.

In examining the teacher characteristics, the percent of teachers with advanced degrees is not statistically significant. The percent of HQTs and the average years of

teaching experience are both statistically significant; however, they both have very small effects on student achievement.

Controlling for the school year results in no statistically significant effect.

Grade 5 Math Cross-Sectional and Covariance Analysis

Model 1 includes the expenditures and school & teacher characteristics. In this model, the Total Expenditures are not statistically significant. The PTR is statistically significant and has a modest effect. For approximately a two and a half student increase in the PTR, student achievement growth would increase by one percentage point. Alternatively, a one standard deviation increase in PTR results in a one-fifth increase in student achievement.

Table 19 Regression Results for Math, Grade 5, FY07-09

Variable	Model 1		Model 2		Model 3 (Covariance)	
	Coefficient	β	Coefficient	β	Coefficient	β
Grade 3 Math Achievement (lagged two years)					.38***	.37
Total Expenditures ($000)	.00	.00	-.07	-.02	-.07	-.03
Pupil Teacher Ratio	.40***	.17	-.09	-.04	-.16**	-.07
% Teacher MA+ Degrees	.02*	.04	.01	.01	.01	.02
%Highly Qualified Teachers	.30***	.13	.17***	.07	.12**	.05
Teaching Experience (avg yrs)	.23***	.08	.15**	.05	.06	.02
% Black Students	-	-	-.01	-.03	.01	.03
% Hispanic Students	-	-	-.06***	-.09	-.06***	-.09
% Students in Poverty	-	-	-.10***	-.28	-.07***	-.19
Fixed Effects:						
School Year						
2008	-.29	-.02	2.04***	.12	1.57***	.09
2009	1.33***	.08	4.04***	.24	3.66***	.22
N	3153		3098		3020	
R^2	.075		.15		.26	

Note: * p < .05; ** p< .01; *** p < .001.

The percent of teachers with advanced degrees, the average years teaching experience and the percent of HQTs are statistically significant with the percent of HQTs and teaching experience having modest effects. The effect of the percent of teachers with advanced degrees is weak. Controlling for the school year, the year 2008 has an effect of .3 percentage points lower than the base year of 2007 but is not statistically significant. The year 2009 has a statistically significant effect of one and a third percentage points greater than the 2007 base year.

Model 2 adds the student background characteristics to the Model 1 variables. In Model 2, the percent of HQTs, Teaching Experience, percent economically disadvantaged students and percent Hispanic students are statistically significant. The teacher characteristics of HQTs and years of teaching experience both result in very small positive effects. The negative effect of the percent of Hispanic students in the grade is small while the negative effect of the percent of students in poverty is both statistically significant and large. A one standard deviation increase in the percent of students in poverty result in just under a one-third standard deviation decrease in student achievement. The effect of the percent of Black students in the grade is very small and not statistically significant.

The effects of the school years are statistically significant for both 2008 and 2009. Both effects are positive with 2008 having a fixed effect of two percentage points and 2009 having an even larger effect of four percentage points relative to the base year of 2007.

Model 3 introduces the lag variable of 3rd grade Achievement. 3rd grade Achievement is statistically significant and results in the largest effect in this model. A one standard deviation increase in 3rd grade Achievement results in a greater than one third standard deviation increase in 5th grade Student Achievement two year later. The other statistically significant variables in Model 3 are Pupil Teacher Ratio, percent of HQTs, the percent of Hispanic students and the percent of economically disadvantaged students in Poverty. Of these, the largest effect results from the percent of economically disadvantaged students in Poverty. A one standard deviation increase in the percent of students in poverty results in a one-fifth decrease in student achievement in Model 3. The PTR, percent of HQTs and the percent of Hispanic students all result in smaller effects. With the addition of the student background factors, the PTR now results in the expected negative effect on student achievement such that an increase in PTR results in a decrease in student achievement. Similarly, the effect of the percent of Hispanic students is negative. The percent of HQTs results in a positive effect on student achievement.

Once again, the fixed effects of the school year result in positive, statistically significant effects for both 2008 and 2009. In 2008 the results indicate a fixed effect of over one and a half percent and 2009 results in a greater than three and a half percent increase.

Summary of the Main Regression Analyses

Table 20 below summarizes the effects of the independent variables from Model 3 on Reading and Math student achievement. For both subjects, the Grade 3 lag variable is statistically significant and has the largest standardized effect (about .36). In both

subjects, a one standard deviation increase in 3rd grade achievement results in more than a one third standard deviation increase in 5th grade Student Achievement.

Table 20 Summary of Grade 5, Model 3 Effects for Reading and Math

Variable	Reading		Math	
	Coefficient	β	Coefficient	β
Grade 3 Math Achievement lag	.25***	.36	.38***	.37
Total Expenditures ($000)	-.14**	-.05	-.07	-.02
Pupil Teacher Ratio	-.06	-.03	-.16**	-.07
% Teacher MA+ Degrees	.04**	.06	.09	.01
%High Quality Teachers	.12***	.06	.12**	.05
Teaching Experience (avg yrs)	.02	.01	.06	.02
% Black Students	-.01*	-.04	.09	.03
% Hispanic Students	-.05***	-.08	-.06***	-.08
% Students in Poverty	-.07***	-.20	-.07***	-.19

Note: * p < .05; ** p< .01; *** p < .001.

The next most important influence on student achievement in both subjects is the percent of students in poverty. This variable is statistically significant at the .001 level of significance. In both subjects, a one standard deviation increase in the percent of students in poverty results in a one-fifth standard deviation decrease in student achievement, which means that an increase in poverty of 20 percentage points is associated with a 1 ½ point decrease in proficiency. The percent of Hispanic students was also statistically significant in both subjects. In both subjects, a one standard deviation increase in the percent of Hispanic students resulted in approximately a one-twelfth standard deviation decrease in student achievement. The percent of Black students is not significant for math, probably because percent Black is so highly correlated with the poverty measure (.52). Of the school & teacher characteristics variables, the only variable that was statistically significant in both subjects was the percent of HQTs in the school. In both

subjects, a one standard deviation increase in the percent of HQTs (3 percentage points) results in a one-twentieth standard deviation increase in student achievement, or less than half a percentage point in proficiency. Moreover, in most schools this characteristic is already close to 100%, so a 3 point increase is not possible.

The remaining five independent variables in this analysis did not provide consistent results across both subjects, either in the direction of the effect (positive or negative), the size of the effect, of the statistically significance of the effect. The lack of consistency was present in two of these attributes and in two of the variables it was present in all three attributes.

The PTR provided a statistically significant and two and a half times larger result in Math than in Reading. The percent of teachers with advanced degrees provided a statistically significant positive effect in Reading but not in Math. The effect in Reading was small. Teaching experience was statistically insignificant in both subjects. The percent of Black students was statistically significant only in Reading. It resulted in a small negative effect. Finally, expenditures resulted in a negative effect in both subjects; however, it was statistically significant in only Reading. The negative influence of expenditures is not expected. This model indicates that there is no clear benefit to be obtained simply by increasing expenditures for the schools.

Student Background Analysis

The achievement gap between White and Black students and between White and Hispanic students remains a decade after the passage of the NCLB. However, for each group, the gap was narrowed during that time in both Reading and Math in 3rd grade and

in 5th grade. The Black / White achievement gap narrowed by 11 point in 3rd grade Reading and by 16 point in 3rd grade Math. It narrowed by 14 points in 5th grade Reading and by 19 points in 5th grade Math.

The White / Hispanic gap narrowed by eight points in 3rd grade Reading and by ten points in 3rd grade Math. It narrowed by eight points in 5th grade Reading and by 12 points in 5th grade Math. Table 21 shows these results.

Table 21 Decrease in Achievement Gaps from 2001 to 2011

	3rd Grade		5th Grade	
	Reading	Math	Reading	Math
Black Achievement Gap	11	16	14	19
Hispanic Achievement Gap	8	10	8	12

Despite the larger decreases in the Black achievement gaps than the Hispanic achievement gaps, the percent of Black in the student population was not statistically significant while the percent of Hispanics in the student population was statistically significant. This could be explained by the fact that the percent of students in poverty was statistically significant for both Reading and Math and resulted in a larger effect than the percent Hispanic students. However, the correlation between the percent Blacks and percent poverty is .52 while the correlation between the percent Hispanics and the percent poverty is only .14.

CHAPTER FIVE – CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

Conclusions

The passage of the NCLB legislation in 2001 placed renewed emphasis was on accountability for student achievement. Key to this emphasis was the reporting of results on standardized assessments throughout a student's career in school. This study examined the results obtained in selected schools in Virginia. It focused on Reading and Math assessment results obtained since the passage of NCLB using the SOL Assessment results in 3rd and 5th grades. The unit of analysis was the school level.

The study examined factors that influence student achievement and determined that over the past decade, student achievement scores in Virginia have increased in both Reading and Math as shown in percentage of students who passed the SOL Assessments at the end of each school year. The regression analysis then determined the importance of these factors. Factors that were examined fell into four broad categories: expenditures, student background factors, teacher characteristics and school characteristics. In the final model, this study examined the covariance of the Grade 3 student achievement with the Grade 5 student achievement.

Hypotheses

The first hypothesis stated that student background factors have large effects on student achievement and growth in achievement for 3rd and 5th graders in Virginia.

Student background factors were the most important factors influencing student achievement after the Grade 3 student achievement. They are more important than the school and teacher characteristics that were examined. Poverty was the most important of the student background factors. The percent of economically disadvantaged students increased somewhat in recent years and then returned to the level at the beginning of the decade. Also in Virginia during the past decade there was a large increase in the number of Hispanic students in the schools in Virginia. There was a positive correlation between the increase in the number of economically disadvantaged students and the increase in Hispanic students in the schools.

The percent of Black students in the schools, which remained relatively constant throughout the period of study, was not a statistically significant factor influencing student achievement. However, there was a strong association between the percent of Black students in Virginia and the percent of economically disadvantaged students. As Tables 25 and 26 illustrate, an achievement gap between White students and Black students still exists.

The literature and previous studies confirm the importance of student background as important factors in student achievement. The influence of poverty is consistent with previous research. The lack of statistical significance of being Black is not reflected in the literature. However, the statistical significance of the Hispanic ethnicity may be reflective the changing demographics of the country in general and Virginia in particular.

Further analyses and studies may better explain the complex interaction among the percent of Blacks, the percent of economically disadvantaged students and student

achievement. Due to the effects of poverty on student achievement and the lack of a statistically significant effect of Black students on student achievement as shown in the regressions analysis, the first hypothesis is partially accepted.

The second hypothesis was that school resources have small effects on improved student academic achievement and the school characteristic of Pupil Teacher Ratio (PTR) has a small effect on improved student academic achievement for 3rd and 5th graders in Virginia. This study examined the relationship between the per pupil total expenditures in the school and student achievement. The study results show that the per pupil expenditures did not influence student achievement.

In addition, this study examined PTR, which is related to the expenditure variables, as a school characteristic. Importantly, in this study PTR did not have a consistent significant effect on student achievement. PTR was statistically significant in only two of the models and in those two cases, the effects were in opposite directions. The results show a statistically significant positive relationship and a very small positive effect in 3d grade Reading. Yet the PTR factor also results in a statistically significant small negative effect in 5th grade Math. The other two instances do not provide statistically significant results. This study illustrates that PTR did not provide consistent effects on student achievement in Virginia during this period.

The literature on the effects of resources is mixed. Some researchers believe that resources do matter. However, resources need to be tied to programs and in fact it is the program that either improves student achievement or not. Schools should identify the purpose of any additional expenditures and provide additional expenditures only for

specific programs that have been demonstrated to improve student achievement. School leaders should then monitor those programs to ensure goals are met before continuing ineffective programs. The results in this study show that expenditures have no effect on student achievement. Even when applied to reducing the PTR, there is no consistent effect on student achievement. The results for the PTR factor are particularly interesting. These results should be studied in greater detail. The recommendation for further study of the PTR variable is discussed later in this chapter. The second hypothesis is rejected.

The third hypothesis is that teacher qualifications have small effects on improved student academic achievement for 3rd and 5th graders in Virginia. Of the teacher characteristics examined in this study, only the percent High Quality Teachers (HQTs) was statistically significant, and that was specific to the 5th grade. However, most schools are already at or close to having 100% of their teachers designated as HQTs. Even at the early years of this study, most schools had a high percentage of teachers designated as HQTs. The statistically significant results indicate that the efforts of those schools and school districts that did not have a high percentage of their teachers designated as HQTs at the beginning of the decade did, in fact, result in improved student achievement. Unfortunately, the ability of schools to improve that factor is limited. Most of the schools that had room for improvement have done so. For those schools that have not yet achieved the requirement of having all teachers designated as HQTs, they should focus on meeting this requirement.

One of the other teacher characteristics that was examined was the average number of years of overall teaching experience of the teachers in each study school. The

results show that 3rd grade achievement was influenced by teaching experience. This factor, however, did not provide statistically significant result for the 5th grade student achievement. This result indicates that students may benefit more from experienced teachers in the earlier years more than in the later years. This is supported by the literature review, which indicated some small benefit for elementary teachers with experience beyond their first few years of teaching.

Overall, the literature review indicated mixed results for teacher characteristics. One group of teachers identified as benefiting from various measures of higher value teacher characteristics was the middle and high school math teachers who benefited from increased content area development. The HQT requirements in Virginia include demonstrating competency in the subject area for which the teacher is certified to teach. This generally supports the literature indicating that Math teachers with greater content area education provide greater value to their students. Discovering the more nuanced aspect of teacher characteristics that affect student achievement may lead to greater effects on student achievement. Based on the results of this study for schools in Virginia, the third hypothesis is partially accepted.

The final hypothesis stated that student achievement in earlier grades, specifically 3rd grade for this study, has a large effect on student achievement in later grades for 5th graders in Virginia. The most important effect on 5th grade student achievement in both Reading and Math was 3rd grade student achievement. Intensive efforts focusing on student achievement early rather than later has the potential to lead to better outcomes for

students than trying to improve student achievement in later grades. Hypothesis four is accepted.

Additional Findings

Three additional findings were made during this study that are not addressed directly in the hypotheses. First, it is important to recognize that student background factors have greater effects on student achievement than teacher characteristics. No matter the talent, capability and effort that teachers possess and expend, teachers have a great deal to overcome when students arrive in a classroom. While not examined in this study, out of school programs that address the family factors influenced by a student's socio-economic status should be considered in conjunction with school programs to improve student achievement. Overcoming the student's SES is a challenge for teachers.

Second, the data indicate that it is unlikely that school districts in Virginia will achieve the NCLB goal of 100% proficiency for students by 2014. Like the Goals 2000 program endorsed by Presidents George H.W. Bush and Bill Clinton, the NCLB requirement for 100% proficiency has the potential of becoming irrelevant and of being ignored by future national education leaders. Authorization for Goals 2000 was ultimately withdrawn and funding eliminated without having achieved any of the goals. The federal government should judiciously establish goals that are achievable and not engage in wishful thinking. Federal government requirements for the states, local school districts and individual schools must be tough but achievable. For over a decade, schools have been attempting to achieve a goal of 100% proficiency for students that many knew

would be tough, if not impossible, to meet when it was first established. Policymakers must be realistic in establishing policy standards for schools.

Finally, the value of having HQTs as currently classified is uncertain. While it is certainly valid to want the best classroom teachers that society can provide, the fact that 98% of schools have all of their teachers identified as HQTs raises questions of the standards to be a HQT. Certainly not all teachers in Virginia are of equal proficiency. Current standards for designation as a HQT do not allow for differentiation among teachers. This standard appears to be a minimal one rather than an achievement that all teachers seek to obtain.

Limitations of This Study

The most important limitation of this study was the inability to interview or survey teachers and principals in schools that performed better than the quantitative models predicted. Results indicate that there has been improvement in Virginia over the last decade. The improvements are related to the student background and earlier achievement. However, after identifying eight schools with a high percentage of poverty and minority students and that performed better than predicted by the quantitative models, the school districts were not able to make the teachers and/or principals available for interviews or focus groups. The district representatives explained their focus on student instruction and would not release teachers from their classroom responsibilities for this study. In addition, removing a teacher from a classroom for an interview would require finding another teacher, or possibly hiring a substitute teacher, to fill in for the classroom teacher while she was absent for the interview.

Another limitation was the unavailability of data for all school years, although this was not as important a limitation as the inability to interview teachers and principals. Much of the data is now collected and made available to the general public due to the requirements of NCLB. However, as illustrated in Appendix A, not all data are collected or available for all years. This limited the regression analysis to three years, 2007 – 2009.

A final limitation was the limited examination of the student achievement data. The dependent variable is based on student passing the SOL assessments at the end of the year. More detailed examination of the SOL assessment themselves may have uncovered changes to the assessments over the years in question that reduced the rigor of the tests. In addition, a detailed qualitative analysis of the teaching practices in the schools may have revealed teaching practices such as teaching to the test that resulted in higher pass rates without any real improvement in student learning. That level of analysis was beyond the scope of this study.

Recommendations for Further Study

This study identified poverty as a factor influencing student performance; however, it did not examine any programs or school characteristics that specifically addressed achievement for students in poverty. During the conduct of this study, schools were identified that had high rates of students in poverty but had performed better than expected according to the quantitative models developed in this study. Further efforts should be made to examine the programs, techniques and characteristics of those schools to identify what they are doing to realize this better-than-predicted student achievement.

In addition, as more data becomes available additional studies into the factors that influence student achievement should be conducted. Additional data may include additional years for which the data elements used in this study become available and new data elements that are collected, which could potentially influence student achievement.

The PTR analysis presented interesting results. Surprisingly, PTR was not statistically significant and in many models provided results contrary to what was expected. There are some interesting interactions that were not examined between PTR and student background. These should be considered for further research and application to school districts with high percentages of minorities and economically disadvantaged students. Further research is required with regard to the interactions among PTR, race, ethnicity, poverty and student achievement.

Policy Recommendations

The most important finding in this study is the importance of the influence of previous student achievement on later student achievement. This argues for continued emphasis on instruction in the early grades. Of the three teacher characteristics examined in this study, the percent of HQTs in a school was the only teacher characteristic that resulted in a statistically significant positive effect in 3rd and 5th grade Reading and Math. However, the average years teaching experience was a statistically significant factor in Reading and Math in 3rd grade but not in 5th grade. Given this result plus the importance of the Grade 3 Achievement lag variable, to the extent possible, elementary schools should consider putting their most senior teachers in the earlier grades. Establishing a

strong level of student achievement with experienced teachers in the early grades may result in continued strong student achievement in the later grades.

The influence of student background, especially conditions of poverty, was a strong influence on student achievement. Efforts to understand and mitigate the effects of poverty on student achievement should be continued. Insights derived from the studies should then focus on developing policies and programs that are likely to improve student achievement. Programs that schools implement should have a reasonable expectation of success in improving student achievement. However, policy makers must realize that schools can only do so much. Student background, especially poverty provides a large effect on student achievement as shown in many studies going back decades and confirmed in this study.

Expenditures on education did not influence student achievement. However, implementing any policy change will most likely entail expending some resource to implement and possibly maintain the policy. Policy makers should ensure that, prior to providing additional funding for education, programs are designed to focus on areas that will improve student achievement. Simply increasing expenditures will not result in improved student achievement.

APPENDIX A – VARIABLES USED IN THE STUDY

Table 22 Variables Description

Variable	Variable Description
Grade	Grade for the observation - either 3rd or 5th
School Year	School Year - from 2001 to 2011
Reading Pass Rate	Pass rate for all students in the grade/school taking the SOL assessment
Gain in Reading Pass Rate	Difference in school Pass Rate from year n in grade y to year n+2 and grade y+2
Reading Pass Rate for 5th Grade Students only	
Reading Pass Rate for 3rd Grade Students lagged two years	
Total Expenditures	Per pupil total expenditures-district
Elementary / Secondary Expenditures	Per pupil elementary & secondary expenditures-district
Instructional Expenditures	Per pupil instructional expenditures-district
Instructional Salaries	Per pupil instructional salary expenditures-district
% Black Students in a School / Grade	Percent of Black students in a school / grade combination from the Virginia demographic report
% Hispanic Students in a School / Grade	Percent of Hispanic students in a school / grade combination from the Virginia demographic report
% White Students in a School / Grade	Percent of White students in a school / grade combination from the Virginia demographic report
% Economically Disadvantaged Students in a School / Grade	Percent of economically disadvantaged students in a school / grade combination from the Virginia demographic report. In instances where there were fewer than ten students in a school / grade combination, the percent for the school was used.
% LEP Students in a School / Grade	Percent of LEP students in a school / grade combination from the Virginia demographic

	report. In instances where there were fewer than ten students in a school / grade combination, the percent for the school was used.
Pupil-Teacher Ratio	Pupil-Teacher Ratio from the US Department of Education
% Teachers in a School holding Advanced Degrees	Percent of Teachers with Advanced Degrees (Masters or Ph.D.) from the Virginia Department of Education
% of High Quality Teachers in a school	Percent of Teachers satisfying the criteria established by Virginia in accordance with the NCLB to be designated Highly Qualified
Average Years Teaching Experience	Average years of teaching for the teachers in the school
Number of Students Taking the SOL Assessment	Number of students in the grade/school combination taking the SOL assessment
Number of Students in a school district	Student membership from the US DOE F-33 Report
Number of Students in a school / grade combination	Total number of students from the demographic reports

APPENDIX B – AVAILABLE DATA

Table 23 Data Available for Quantitative Analysis

School Year	Achievement	Student Background - % Race	Student Background - % Poverty	Student Background - % LEP	Expenditures	Pupil Teacher Ratio	% Highly Qualified Teacher	Experience (Avg Yrs)	% MA+ Degrees
2001	X				X	X			
2002	X				X	X			
2003	X	X			X	X			
2004	X	X	X	X	X	X	X	X	
2005	X	X	X	X	X	X	X	X	
2006	X	X	X	X	X	X	X	X	
2007	X	X	X	X	X	X	X	X	X
2008	X	X	X	X	X	X	X	X	X
2009	X	X	X	X	X	X	X	X	X
2010	X	X	X	X		X			X
2011	X	X	X	X					X

APPENDIX C – OVERALL ACHIEVEMENT

Table 24 Summary of Passing Rates for All Students in Grades 3 & 5 for Reading & Math

School Year	Grade 3 Reading	Grade 3 Math	Grade 5 Reading	Grade 5 Math
2001	65	77	73	67
2002	72	80	78	71
2003	72	83	83	74
2004	71	87	85	78
2005	77	88	85	81
2006	84	90	87	83
2007	80	89	87	87
2008	84	89	89	88
2009	86	89	92	90
2010	83	92	90	90
2011	83	91	89	89

APPENDIX D – READING DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

Table 25 SOL Pass Rates for 3rd Grade Reading for All Students and Selected Subgroups

School Year	All Students	Black	Hispanic	White	Economically Disadvantaged	LEP
2001	65	46	53	73	Not available	45
2002	72	55	59	80	55	55
2003	72	58	62	79	57	56
2004	71	56	62	79	57	60
2005	77	67	68	82	65	68
2006	84	73	79	88	74	77
2007	80	71	65	87	69	62
2008	84	74	79	88	75	79
2009	86	78	83	90	79	84
2010	83	72	80	88	75	80
2011	83	72	76	88	74	74

Table 26 SOL Pass Rates for 5th Grade Reading for All Students and Selected Subgroups

School Year	All Students	Black	Hispanic	White	Economically Disadvantaged	LEP
2001	73	55	63	80	Not available	50
2002	78	62	68	85	62	57
2003	83	70	74	88	69	66
2004	85	74	79	89	74	78
2005	85	75	81	90	75	80
2006	87	77	81	91	78	81
2007	87	80	74	91	77	70
2008	89	82	84	93	82	83
2009	92	86	89	94	85	89
2010	90	83	87	94	84	87
2011	89	82	84	93	82	81

APPENDIX E – MATH DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

Table 27 SOL Pass Rates for 3rd Grade Math for All Students and Selected Subgroups

School Year	All Students	Black	Hispanic	White	Economically Disadvantaged	LEP
2001	77	59	70	85		66
2002	80	65	73	87	67	70
2003	83	72	78	88	72	75
2004	87	77	84	92	79	84
2005	88	79	82	92	80	82
2006	90	82	85	93	83	85
2007	89	81	84	93	81	83
2008	89	81	82	93	81	82
2009	89	80	82	93	82	83
2010	92	85	88	95	87	88
2011	91	84	89	94	85	89

Table 28 SOL Pass Rates for 5th Grade Math for All Students and Selected Subgroups

School Year	All Students	Black	Hispanic	White	Economically Disadvantaged	LEP
2001	67	46	58	75		50
2002	71	54	61	79	54	56
2003	74	60	65	81	59	60
2004	78	66	69	84	65	67
2005	81	69	72	86	69	70
2006	83	74	74	87	73	72
2007	87	80	78	90	78	78
2008	88	81	81	92	81	80
2009	90	84	86	93	84	85
2010	90	84	86	93	85	85
2011	89	82	87	92	83	86

APPENDIX F – ACHIEVEMENT GAP

Table 29 Achievement Gaps 3rd Grade Students

	Reading			Math		
	2001	2011	Gap Reduction	2001	2011	Gap Reduction
White Students	73	88	[redacted]	85	92	[redacted]
Black Students	46	72		59	82	
White – Black Gap	27	16	11	26	10	16
Hispanic Students	53	76	[redacted]	70	87	[redacted]
White – Hispanic Gap	20	12	8	15	5	10

Table 30 Achievement Gaps for 5th Grade Students

	Reading			Math		
	2001	2011	Gap Reduction	2001	2011	Gap Reduction
White Students	80	93	[redacted]	75	92	[redacted]
Black Students	55	82		46	82	
White – Black Gap	25	11	14	29	10	19
Hispanic Students	63	84	[redacted]	58	87	[redacted]
White – Hispanic Gap	17	9	8	17	5	12

APPENDIX G – RELATIONSHIP OF THE EXPENDITURES VARIABLES

The F-33 report from the US DOE provides a number of variables for expenditures in the school districts. In this study, four were selected for initial examination. Only one was used in developing the models. Since these variables were very strongly associated, their influence would be comparable and when included in the same model would bias the results.

Table 31 Math Achievement and Expenditure Variables Correlation Matrix

	Math Achievement	Total Expenditures	Elementary / Secondary Expenditures	Instructional Expenditures	Instructional Salaries
Math Achievement	1				
Total Expenditures	0.2585	1			
Elementary / Secondary Expenditures	0.2580	0.9309	1		
Instructional Expenditures	0.2737	0.9299	0.9853	1	
Instructional Salaries	0.2520	0.9222	0.9687	0.9811	1

Table 32 Reading Achievement and Expenditure Variables Correlation Matrix

	Reading Achievement	Total Expenditures	Elementary / Secondary Expenditures	Instructional Expenditures	Instructional Salaries
Reading Achievement	1				
Total Expenditures	0.2648	1			
Elementary / Secondary Expenditures	0.2683	0.9309	1		
Instructional Expenditures	0.2823	0.9299	0.9854	1	
Instructional Salaries	0.2640	0.9222	0.9687	0.9811	1

Both correlation matrices above illustrate the high correlation among the four expenditure variables available from the F-33 Reports. It is expected that whichever variable was used in the regression models, the results would not differ substantially. The Total Expenditure variable was used in the regression analyses as it represented the largest of the four variables and was the variable that is most commonly cited when addressing per pupil expenditures in the literature. Had these variables not been so highly correlated, more than the single expenditure would have been considered for the study.

APPENDIX H – EXAMINATION OF THE LIMITED ENGLISH PROFICIENCY (LEP) FACTOR

One major change to the student background in the last decade has been the increase in the number of LEP students in Virginia's schools. Data were collected for this study; however, the number of schools for which data were available was limited. The Virginia Department of Education masked data for any school in which there were fewer than ten students in a grade or a school. Analysis was performed for the available data and is addressed in this study due to its importance; however, it is addressed in an appendix due to the limited data that is available.

Table 33 Descriptive Statistics for the Reading Analysis for SY07-09

Variable	Obs	Mean	Std. Dev.	Min	Max
% LEP Students	3623	16.28	17.14	0.87	89.09

Table 34 SOL Pass Rates for 3rd Grade Reading for All Students and LEP Students

School Year	3rd Grade All Students	3rd Grade LEP	All Student – LEP Gap	5th Grade All Students	5th Grade LEP	All Student – LEP Gap
2001	65	45	20	73	50	23
2002	72	55	17	78	57	21
2003	72	56	16	83	66	17
2004	71	60	11	85	78	17
2005	77	68	11	85	80	5
2006	84	77	7	87	81	6
2007	80	62	18	87	70	17
2008	84	79	5	89	83	6
2009	86	84	2	92	89	3
2010	83	80	3	90	87	3
2011	83	74	9	89	81	6

Reading

The correlation matrix shows the percent of LEP students has a moderate negative association with the Reading Achievement, a modest negative association with the percent of Black students in the school and a very strong positive with the percent of Hispanic students in the school. It has a fairly strong positive association with the percent of economically disadvantaged students in Poverty in the school.

Table 35 Correlation Matrix for Reading Achievement with % LEP Students Included

	Reading Achievement	Total Expenditures ($000)	% Black Students	% Hispanic Students	% White Students	% Economically Disadvantaged Students	% LEP Students	Pupil Teacher Ratio	% Teacher MA+ Degrees	%High Quality Teachers	Teaching Experience (avg yrs)
Reading Achievement	1										
Total Expenditures ($000)	-0.0171	1									
% Black Students	-0.2854	-0.1675	1								
% Hispanic Students	-0.2655	0.3435	-0.0553	1							
% White Students	0.3341	-0.2046	-0.6725	-0.5843	1						
% Economically Disadvantaged Students	-0.3861	-0.103	0.5473	0.4075	-0.5652	1					
% LEP Students	-0.2032	0.4555	-0.1308	0.8511	-0.5631	0.3123	1				
Pupil Teacher Ratio	0.383	-0.155	-0.1215	-0.3489	0.2656	-0.3837	-0.3347	1			
% Teacher MA+ Degrees	0.0528	0.5371	-0.2465	0.2973	-0.1886	-0.2069	0.4447	-0.1009	1		
%High Quality Teachers	0.204	0.0154	-0.1656	-0.1197	0.1469	-0.1371	-0.0345	0.0732	0.087	1	
Teaching Experience (avg yrs)	0.0587	-0.3124	0.0167	-0.3144	0.3297	0.0722	-0.3804	-0.0131	-0.2414	0.1567	1

However, in running the models for 3rd Grade and 5th Grade Reading as was done in the main body of this study, the percent of LEP students in results in very small and negative effects; however, these results are not statistically significant in any of the models, most likely due to the smaller number of observations.

Table 36 Reading Regression Models with % LEP Students Included

Variable	Model 2 – Grade 3		Model 2 – Grade 5		Model 3 (Covariance)	
	Coefficient	β	Coefficient	β	Coefficient	β
Grade 3 Reading Achievement (lagged two years)					.240***	.326
Total Expenditures ($000)	-.102	-.034	-.132*	-.053	-.118*	-.048
Pupil Teacher Ratio	.168	.063	.049	.023	-.028	-.013
% Teacher MA+ Degrees	.044*	.063	.031*	.055	.032*	.056
%Highly Qualified Teachers	.228***	.090	.210***	.100	.173***	.082
Teaching Experience (avg yrs)	.168*	.052	-.008	-.003	-.085	-.032
% Black Students	-.079***	-.18*	-.048***	-.139	-.031***	-.088
% Hispanic Students	-.089***	-.143	-.083***	-.159	-.058**	-.112
% Students in Poverty	-.095***	-.234	-.084***	-.247	-.054***	-.157
% LEP Students	.000	.000	-.006	-.014	-.007	-.017
Fixed Effects:						
School Year						
2008	4.073***	.216	3.619***	.234	2.354***	.151
2009	6.231***	.336	6.026***	.397	5.549***	.362
N	1752		1749		1705	
R^2	.339		.333		.405	

Note: * p < .05; ** p< .01; *** p < .001.

Math

The correlation matrix for the Math Achievement shows that the percent of LEP students in a school has a moderate negative association with Math Achievement. It also has a modest negative association with the percent of Black students and very strong positive association with the percent of Hispanic students. It also has a fairly strong positive association with the percent of students on poverty. Finally, the percent of LEP students has a strong association with the per pupil total expenditures indicating the higher level of expenditures spent by a school district for LEP students.

Table 37 Correlation Matrix for Math Achievement with % LEP Students Included

	Math Achievement	Total Expenditures ($000)	% Black Students	% Hispanic Students	% White Students	% Economically Disadvantaged Students	% LEP Students	Pupil Teacher Ratio	% Teacher MA+ Degrees	%High Quality Teachers	Teaching Experience (avg yrs)

Math Achievement	1										
Total Expenditures ($000)	-0.0451	1									
% Black Students	-0.2772	-0.1675	1								
% Hispanic Students	-0.2776	0.3435	-0.0553	1							
% White Students	0.3566	-0.2046	-0.6725	-0.5843	1						
% Economically Disadvantaged Students	-0.3666	-0.103	0.5473	0.4075	-0.5652	1					
% LEP Students	-0.2263	0.4555	-0.1308	0.8511	-0.5631	0.3123	1				
Pupil Teacher Ratio	0.2338	-0.155	-0.1215	-0.3489	0.2656	-0.3837	-0.3347	1			
% Teacher MA+ Degrees	-0.0031	0.5371	-0.2465	0.2973	-0.1886	-0.2069	0.4447	-0.1009	1		
%High Quality Teachers	0.1604	0.0154	-0.1656	-0.1197	0.1469	-0.1371	-0.0345	0.0732	0.087	1	
Teaching Experience (avg yrs)	0.0923	-0.3124	0.0167	-0.3144	0.3297	0.0722	-0.3804	-0.0131	-0.2414	0.1567	1

However, in running the models for 3rd Grade and 5th Grade Math as was done in the main body of this study and for the Reading Achievement above, the percent of LEP students in results in very small and negative effects; however, these results are not statistically significant in any of the models, most likely due to the smaller number of observations.

Table 38 Math Regression Models with % LEP Students Included

Variable	Model 2 – Grade 3		Model 2 – Grade 5		Model 3 (Covariance)	
	Coefficient	β	Coefficient	β	Coefficient	β
Grade 3 Math Achievement (lagged two years)					.402***	.369
Total Expenditures ($000)	-.030	-.013	-.062	-.024	-.050	-.019
Pupil Teacher Ratio	.091	.043	-.097	-.042	-.226**	-.099
% Teacher MA+ Degrees	.004	.008	-.018	-.030	-.016	-.027
%Highly Qualified Teachers	.141***	.070	.153**	.069	.109*	..049
Teaching Experience (avg yrs)	.141*	.055	.047	.017	-.016	-.004
% Black Students	-.086***	-.253	-.037***	-.101	-.005	-.014
% Hispanic Students	-.068***	-.139	-.080***	-.147	-.058*	-.106
% Students in Poverty	-.063***	-.196	-.081***	-.225	-.060***	-.166
% LEP Students	-.029	-.074	.001	002	-.007	-.015
Fixed Effects:						
School Year						
2008	-.219	-.015	2.174***	.133	1.924***	.116
2009	-.221	-.015	4.313***	.269	4.355***	.271
N	1752		1749		1705	
R^2	.268		.172		.280	

Note: * p < .05; ** p< .01; *** p < .001.

APPENDIX I – NCLB HIGHLY QUALIFIED TEACHER EXTRACT

PUBLIC LAW 107–110—JAN. 8, 2002

‘‘No Child Left Behind Act of 2001’’

TITLE IX – General Provisions

Part A – Definitions

Sec. 9101. Definitions

‘‘(23) HIGHLY QUALIFIED.—The term ‘highly qualified’—

‘‘(A) when used with respect to any public elementary school or secondary school teacher teaching in a State, means that—

‘‘(i) the teacher has obtained full State certification as a teacher (including certification obtained through alternative routes to certification) or passed the State teacher licensing examination, and holds a license to teach in such State, except that when used with respect to any teacher teaching in a public charter school, the term means that the teacher meets the requirements set forth in the State’s public charter school law; and

‘‘(ii) the teacher has not had certification or licensure requirements waived on an emergency, temporary, or provisional basis;

‘‘(B) when used with respect to—

‘‘(i) an elementary school teacher who is new to the profession, means that the teacher—

‘‘(I) holds at least a bachelor’s degree; and

‘‘(II) has demonstrated, by passing a rigorous State test, subject knowledge and teaching skills in reading, writing, mathematics, and other areas of the basic elementary school curriculum (which may consist of passing a State-required certification or licensing test or tests in reading, writing, mathematics, and other areas of the basic elementary school curriculum); or

‘‘(ii) a middle or secondary school teacher who is new to the profession, means that the teacher holds at least a bachelor’s degree and has demonstrated a high level of competency in each of the academic subjects in which the teacher teaches by—

‘‘(I) passing a rigorous State academic subject test in each of the academic subjects in which the teacher teaches (which may consist of a passing level of performance on a State-required certification or licensing test or tests in each of the academic subjects in which the teacher teaches); or

‘‘(II) successful completion, in each of the academic subjects in which the teacher teaches, of an academic major, a graduate degree, coursework equivalent to an undergraduate academic major, or advanced certification or credentialing; and

‘‘(C) when used with respect to an elementary, middle, or secondary school teacher who is not new to the profession, means that the teacher holds at least a bachelor’s degree and—

‘‘(i) has met the applicable standard in clause (i) or (ii) of subparagraph (B), which includes an option for a test; or

‘‘(ii) demonstrates competence in all the academic subjects in which the teacher teaches based on a high objective uniform State standard of evaluation that—

‘‘(I) is set by the State for both grade appropriate academic subject matter knowledge and teaching skills;

‘‘(II) is aligned with challenging State academic content and student academic achievement standards and developed in consultation with core content specialists, teachers, principals, and school administrators;

‘‘(III) provides objective, coherent information about the teacher’s attainment of core content knowledge in the academic subjects in which a teacher teaches;

‘‘(IV) is applied uniformly to all teachers in the same academic subject and the same grade level throughout the State;

‘‘(V) takes into consideration, but not be based primarily on, the time the teacher has been teaching in the academic subject;

‘‘(VI) is made available to the public upon request; and

‘‘(VII) may involve multiple, objective measures of teacher competency.

APPENDIX J – VIRGINIA HIGHLY QUALIFIED TEACHERS DESIGNATION EXTRACT

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF EDUCATION
P.O. BOX 2120
RICHMOND, VIRGINIA 23218-2120

SUPTS. MEMO NO. 43
February 23, 2007

INFORMATIONAL
TO: Division Superintendents
FROM: Billy K. Cannaday, Jr.
Superintendent of Public Instruction
SUBJECT: Revisions in Criteria to Designate Teachers Highly Qualified

In June 2006, the United States Department of Education (USED) reported to the Virginia Department of Education the results of the USED Academic Improvement and Teacher Quality Programs team review of the state's progress in meeting the highly qualified teacher provisions of the *No Child Left Behind Act of 2001* (NCLB) and Virginia's administration of the Title II, Part A, Improving Teacher Quality State Grants program.

In the report, USED cited Virginia on the following two issues related to Virginia's implementation of the highly qualified teacher requirements:

- Virginia's using the Praxis II middle school assessments for newly-hired high school special education teachers to demonstrate content knowledge did not meet the requirements of NCLB or the Individuals with Disabilities Education Improvement Act of 2004 (IDEA); and
- Virginia's High Objective Uniform State Standard of Evaluation (HOUSSE) option of allowing licensed elementary, middle, and secondary teachers not new to the profession to become highly qualified by the completion of an earned advanced degree in any area from an accredited college or university did not meet the requirements of NCLB.

The Virginia Department of Education was advised by USED that these issues regarding highly qualified teachers must be resolved by December 29, 2006, and the approved

definition reflected in the 2005-2006 data reported on highly qualified teachers. Virginia submitted a response, and notification was received on January 25, 2007, that the data fully addressed the requirements, and the conditions on both the ESEA Title I, Part A, and Title II, Part A, grants have been removed.

High school special education teachers new to the profession must meet one of the following options to demonstrate subject-matter competency in the subject(s) they teach. The criteria for highly qualified teachers do not apply to special education consultative teachers who are collaborating with a core academic teacher.

1**. Options provided by the No Child Left Behind Act, including an academic major in the content area, graduate degree in the teaching content area, or coursework equivalent to an undergraduate major.** [New secondary special education teachers who teach two or more academic subjects who are highly qualified in mathematics, language arts, science, or social studies have two years after the date of employment to be highly qualified in the other core academic subject area, which may include HOUSSE. If teaching core academic subjects exclusively to children assessed on alternate achievement standards, the teacher must meet highly qualified requirements for an elementary teacher.]

2. **Rigorous State Academic Subject Test: Pass the appropriate Praxis II assessment(s) in the high school subject(s) they teach.**

3. **Rigorous State Academic Subject Test: Pass the appropriate Middle School Praxis II assessment(s) in the subject(s) they teach** if the special education teacher new to the profession is teaching classes at a high school campus in which the students are not earning standard credit in core academic areas towards a high school diploma.

To address the citation regarding the option of allowing licensed elementary, middle, and secondary teachers not new to the profession to become highly qualified by the completion of an earned advanced degree (with any major) from an accredited college or university, the Board of Education approved an amendment to Virginia's High Objective Uniform State Standard of Evaluation (HOUSSE). The completion of an earned advanced degree from an accredited college or university must be in the subject(s) the teacher is teaching. Attached is the amended HOUSSE reflecting this change.

Each state was required to submit a plan to limit the use of the HOUSSE. Attached is Virginia's plan including specific exceptions. Teachers who have met previously approved criteria by the Virginia Department of Education will continue to be designated highly qualified.

If you have any questions, please do not hesitate to contact Mrs. Patty S. Pitts, assistant superintendent for teacher education and licensure, at (804) 371-2522; Patty.Pitts@doe.virginia.gov.

BKCJr/psp

http://www.doe.virginia.gov/administrators/superintendents_memos/2007/inf043a.pdf

http://www.doe.virginia.gov/administrators/superintendents_memos/2007/inf043b.pdf

VIRGINIA REQUIREMENTS FOR TEACHERS NOT NEW TO THE TEACHING PROFESSION TO MEET THE DEFINITION OF HIGHLY QUALIFIED IN THE FEDERAL CORE ACADEMIC AREAS AND SPECIAL EDUCATION

[Approved by the Board of Education on February 25, 2004; Amended April 20, 2005, and September 27, 2006]

Grade-Level Assignment	Requirements for Teachers Not New to the Profession to Meet the Definition of Highly Qualified
Elementary Education (prek-6)	Experienced elementary school teachers, including those entering the teaching profession through the alternate route, who are licensed in elementary education or special education with an active license may meet the "highly qualified" definition required in the No Child Left Behind Act (NCLB) by completing one of the following requirements: 1. passed a rigorous state-approved academic subject test for elementary education [Section 9101(23)(B)(ii)]; OR 2. designated highly qualified in another state or the District of Columbia; OR 3. met the **High Objective Uniform State Standard of Evaluation (HOUSSE)** definition by the: a. completion of an earned advanced degree from an accredited college or university in the subject(s) the teacher is teaching;* OR b. completion of a nationally recognized certification program in the teaching area or a certificate of advanced graduate studies in the teaching area;* OR c. completion of an institute(s) in the content areas of mathematics, science, language arts/reading/English, and social studies (history, government, geography, and economics) that meets high quality professional development criteria established by the Department of Education, OR d. completion of 180 professional development points from the eight options of college credit, professional conference, curriculum development, publication of article, publication of book, mentorship/supervision, educational project, and professional development activity within the most recent five-year period as outlined in *Virginia's Licensure Renewal Manual* and based on the NCLB Act's definition of high quality professional development;* OR e. completion of three years of successful teaching experience and (1) an academic major or equivalent in a subject area the teacher teaches; OR (2) an interdisciplinary major (or equivalent); OR (3) at least 9 semester hours in each core discipline area of mathematics; science; language arts/reading/English; and social studies (history, government, geography, and economics). ***For special education teachers to become highly qualified under HOUSSE, requirements in options 3a, 3b, and 3d must be completed in the content or academic subjects taught.**

Grade-Level Assignment	Requirements for Teachers Not New to the Profession to Meet the Definition of Highly Qualified
Middle Education (6-8)	Experienced middle school teachers, including those entering the teaching profession through the alternate route, who are licensed in middle education or special education with an active license may meet the "highly qualified" definition required in the NCLB Act by completing one of the following requirements: 1. passed a rigorous state-approved academic subject test in each of the academic subjects in which the teacher teaches [Section 9101(23)(B)(ii)]; OR 2. designated highly qualified in another state or the District of Columbia; OR 3. have an academic major or coursework equivalent to an undergraduate academic major in the subject area(s) the teacher teaches [Section 9101(23)(B)(ii)]; OR 4. earned an advanced degree in a content area (master`s, education specialist, or doctorate) in the teaching area [Section 9101(23)(B)(ii)]; OR 5. completed a nationally recognized certification program in the teaching area or a certificate of advanced graduate studies in the teaching area [Section 9101(23)(B)(ii)]; OR 6. met the **High Objective Uniform State Standard of Evaluation (HOUSSE)** definition by the: a. completion of an earned advanced degree from an accredited college or university in the subject(s) the teacher is teaching;* OR b. completion of an institute(s) in the content areas of mathematics, science, language arts/reading/English, and social studies (history, government, geography, and economics) that meets high quality professional development criteria established by the Department of Education; OR c. completion of 180 professional development points from the eight options of college credit, professional conference, curriculum development, publication of article, publication of book, mentorship/supervision, educational project, and professional development activity within the most recent five-year period as outlined in *Virginia's Licensure Renewal Manual* and based on the NCLB Act's definition of high quality professional development;* OR d. completion of three years of successful teaching experience and (1) an interdisciplinary major (or equivalent); OR (2) a minimum of 18 semester hours in the middle school area(s) taught—mathematics; science; language arts/reading/English; and social studies (history, government, geography, and economics). ***For special education teachers to become highly qualified under HOUSSE, requirements in options 6a and 6c must be completed in the content or academic subjects taught.**

Grade-Level Assignment	Requirements for Teachers Not New to the Profession to Meet the Definition of Highly Qualified
Secondary (6-12)	Experienced secondary school teachers, including those entering the teaching profession through the alternate route, who are licensed in a secondary endorsement area or special education with an active license may meet the "highly qualified" definition required in the NCLB Act by completing one of the following requirements: 1. passed a rigorous state-approved academic subject test in each of the academic subjects in which the teacher teaches [Section 9101(23)(B)(ii)]; OR 2. designated highly qualified in another state or the District of Columbia; OR 3. have an academic major or coursework equivalent to an undergraduate academic major in the subject area(s) the teacher teaches [Section 9101(23)(B)(ii)]; OR 4. earned an advanced degree in a content area (master's, education specialist, or doctorate) in the teaching area [Section 9101(23)(B)(ii)]; OR 5. completed a nationally recognized certification program in the teaching area or a certificate of advanced graduate studies in the teaching area [Section 9101(23)(B)(ii)]; OR 6. met the **High Objective Uniform State Standard of Evaluation (HOUSSE)** definition by the: a. completion of an earned advanced degree from an accredited college or university in the subject(s) the teacher is teaching;* OR b. completion of an institute(s) in the content area(s) in which the teacher teaches that meets high quality professional development criteria established by the Department of Education; OR c. completion of 180 professional development points from the eight options of college credit, professional conference, curriculum development, publication of article, publication of book, mentorship/supervision, educational project, and professional development activity within the most recent five-year period as outlined in *Virginia's Licensure Renewal Manual* and based on the NCLB Act's definition of high quality professional development;* OR d. completion of three years of successful teaching experience and a minimum of 24 semester hours in the area(s) taught. ***For special education teachers to become highly qualified under HOUSSE, requirements in options 6a and 6c must be completed in the content or academic subjects taught.**

Grade-Level Assignment	Requirements for Teachers Not New to the Profession to Meet the Definition of Highly Qualified
Pre-Kindergarten-Grade 12 (such as art, music, or foreign languages)	Experienced teachers, including those entering the teaching profession through the alternate route, who are licensed in a pre-kindergarten through grade 12 endorsement or special education and teaching a prek-12 subject area with an active license may meet the "highly qualified" definition required in the NCLB Act by completing one of the following requirements: 1. passed a rigorous state-approved academic subject test in the subjects the teacher teaches [Section 9101(23)(B)(ii)]; OR 2. designated highly qualified in another state or the District of Columbia; OR 3. have an academic major or coursework equivalent to an undergraduate academic major in the subject area(s) the teacher teaches [Section 9101(23)(B)(ii)]; OR 4. earned an advanced degree in a content area (master's, education specialist, or doctorate) in the teaching area [Section 9101(23)(B)(ii)]; OR 5. completed a nationally recognized certification program in the teaching area or a certificate of advanced graduate studies in the teaching area [Section 9101(23)(B)(ii)]; OR 6. met the **High Objective Uniform State Standard of Evaluation (HOUSSE)** definition by the: a. completion of an earned advanced degree from an accredited college or university in the subject(s) the teacher is teaching;* OR b. completion of an institute(s) in the content area(s) in which the teacher teaches that meets high quality professional development criteria established by the Department of Education; OR c. completion of 180 professional development points from the eight options of college credit, professional conference, curriculum development, publication of article, publication of book, mentorship/supervision, educational project, and professional development activity within the most recent five-year period as outlined in *Virginia's Licensure Renewal Manual* and based on the NCLB Act's definition of high quality professional development; * OR d. completion of three years of successful teaching experience and (1) an academic major or equivalent in the subject area(s) the teacher teaches; OR (2) a minimum of 24 semester hours in the area(s) taught. ***For special education teachers to become highly qualified under HOUSSE, requirements in options 6a and 6c must be completed in the content or academic subjects taught.**

REFERENCES

Alexander, Karl L., Doris R. Entwisle, and Linda S. Olson. "Schools, Achievement, and Inequality: A Seasonal Perspective." *Educational Evaluation and Policy Analysis* 23, no. 2 (July 1, 2001): 171–191.

Armor, David. "Can NCLB Close Achievement Gaps?" In *No Child Left Behind and the Reduction of the Achievement Gap*. New York: Routledge, 2007.

Armor, David J. *Maximizing Intelligence*. New Brunswick, NJ: Transaction Publishers, 2003.

Armor, David J. "School and Family Effects on Black and White Achievement: A Reexamination of the USOE Data." In *On Equality of Educational Opportunity*, 570. 1st ed. New York: Vintage Books, 1972.

"Brookings Papers on Education Policy: 2006-2007 - Brookings Institution", n.d. http://www.brookings.edu/press/Journals/2007/brookingspapersoneducationpolicy20062007.aspx.

Brown, Emma. "Criticism, Praise for Va., Md. on 'No Child'." *Washington Post*. Washington, DC, May 7, 2012, sec. Metro.

Bush, G.W. "No Child Left Behind", 2001. http://www.whitehouse.gov/news/reports/no-child-left-behind.pdf.

Chenowith, Karin. *It's Being Done*. Cambridge, Massachusetts: Harvard Education Press, 2007.

Chubb, John E, and Tom Loveless, eds. *Bridging the Achievement Gap*. Washington, D.C: Brookings Institution Press, 2002.

"Class Size Research: A Critique of Recent Meta-Analyses." *The Phi Delta Kappan* 62, no. 4 (December 1, 1980): 239–241.

"ClassSizeSTAR.pdf", n.d. http://www.aypf.org/publications/rmaa/pdfs/ClassSizeSTAR.pdf.

Coleman, James S. *Equality of Educational Opportunity*. Washington, DC: U.S. Government Printing Office, 1966.

"Common Core of Data (CCD) - Local Education Agency (School District) Finance Survey (F-33) Data", n.d. http://nces.ed.gov/ccd/f33agency.asp.

Cross, Lawrence H. "Are Virginia's Public Schools Failing? Assessing the Assessments." *Virginia Issues & Answers - A Public Policy Forum*, May 1999. http://www.via.vt.edu/spring99/schools.html.

Darling-Hammond, Linda. *The Flat World and Education: How America's Commitment to Equity Will Determine Our Future*. New York: Teachers College Press, 2010.

Ferguson, Ronald F. "Paying for Public Education: New Evidence on How and Why Money Matters." *Harvard Journal on Legislation* 28 (1991): 465.

Ferguson, Ronald F., and Jal Mehta. "An Unfinished Journey: The Legacy of Brown and the Narrowing of the Achievement Gap." *The Phi Delta Kappan* 85, no. 9 (May 1, 2004): 656–669.

Fuller, Sarah, and Helen Ladd. *School Based Accountability and the Distribution of Teacher Quality Among Grades in Elementary School*. Washington, DC: National Center for Analysis of Longitudinal Data in Education Research, April 2012. http://www.caldercenter.org/publications/upload/wp75.pdf.

Glass, Gene V., and Mary Lee Smith. "Meta-Analysis of Research on Class Size and Achievement." *Educational Evaluation and Policy Analysis* 1, no. 1 (January 1, 1979): 2–16.

"Goals 2000: Reforming Education to Improve Student Achievement - History - April 30, 1998", n.d. http://www2.ed.gov/pubs/G2KReforming/g2ch1.html.

Grissmer, David W., Ann Flanagan, Jennifer Kawata, and Stephanie Williamson. *Improving Student Achievement: What State NAEP Test Scores Tell Us*. Santa Monica, California: Rand, 2000.

Hanushek, Eric A. "School Resources and Student Performance." In *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success*, 43–73. Washington, DC: Brookings Institution Press, 1996.

Harris, Douglas N. "Class Size and School Size: Taking the Trade-Offs Seriously." *Brookings Papers on Education Policy*, no. 9 (January 1, 2006): 137–161.

Harris, Douglas N., and Tim R. Sass. *Teacher Training, Teacher Quality and Student Achievement*. Washington, DC: National Center for Analysis of Longitudinal

Data in Education Research, March 12, 2008. http://www.caldercenter.org/PDF/1001059_Teacher_Training.pdf.

Hedges, Larry V., and Rob Greenwald. "Have Times Changed? The Relation Between School Resources and Student Performance." In *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success*, 74–92. Washington, DC: Brookings Institution Press, 1996.

Jamerson, Bruce F. "Constitution of Virginia", January 1, 1971. http://legis.state.va.us/Laws/search/ConstOfVa.pdf.

Jencks, Christopher. *Inequality: A Reassessment of the Effect of Family and Schooling in America*. New York: Basic Books, 1972.

Jennings, J.F. *Why National Standards and Tests? Politics and the Quest for Better Schools*. Thousand Oaks, California: Sage Publications, Inc., 1998.

Kennedy, Edward M. *True Compass*. New York, NY: Twelve, 2009.

Lee, Jaekyung. "Racial and Ethnic Achievement Gap Trends: Reversing the Progress Toward Equity?" *Educational Researcher* 31, no. 1 (January 1, 2002): 3–12.

Lessinger, Leon M. *Every Kid a Winner: Accountability in Education*. New York: Simon and Schuster, 1970.

Loveless, Tom, and Frederick M. Hess. "Introduction: What Do We Know About School Size and Class Size?" *Brookings Papers on Education Policy*, no. 9 (January 1, 2006): 1–14.

Manna, Paul. *Collision Course : Federal Education Policy Meets State and Local Realities*. 2nd ed. Washington, DC: CQ Press, 2011.

Martin, Don T. *Accountability in American Education: A Critique*. Princeton, N. J: Princeton Book Co, 1976.

Mintrom, M., and S. Vergari. "Education Reform and Accountability Issues in an Intergovernmental Context." *Publius* 27, no. 2 (Spring 1997): 143–166.

Moynihan, Daniel P, and Frederick Mosteller, eds. *On Equality of Educational Opportunity*. 1st ed. New York: Vintage Books, 1972.

National Commission on Excellence in Education. "A Nation at Risk: The Imperative for Educational Reform", 1983. http://www.ed.gov/pubs/NatAtRisk/index.html.

Peterson, Paul E., and Martin R. West. “The Politics and Practice of Accountability.” In *No Child Left Behind? The Politics and Practice of School Accountability.*, 1–20. Washington, DC: Brookings Institution Press, n.d.

“PLAW-107publ110.pdf”, n.d. http://www.gpo.gov/fdsys/pkg/PLAW-107publ110/pdf/PLAW-107publ110.pdf.

Ream, Robert K., and Gregory J. Palardy. “Reexamining Social Class Differences in the Availability and the Educational Utility of Parental Social Capital.” *American Educational Research Journal* 45, no. 2 (June 1, 2008): 238–273.

Rudalevige, A. *Forging A Congressional Compromise*. No Child Left Behind? Harrisonburg, Virginia: The Brookings Institution, 2003.

Schanzenbach, Diane Whitmore. “What Have Researchers Learned from Project STAR?” *Brookings Papers on Education Policy*, no. 9 (January 1, 2006): 205–228.

Tan, Sandra. “Schools Board Changes Stance On Goals 2000 - Daily Press”, June 27, 1997. http://articles.dailypress.com/1997-06-27/news/9706270019_1_school-boards-george-allen-virginia-s-terms.

The Nations Report Card: Mathematics 2011. National Center for Education Statistics (2011). Institute of Education Sciences, U.S. Department of Education, Washington, DC, November 2011. http://nces.ed.gov/nationsreportcard/pubs/main2011/2012458.asp.

The Nations Report Card: Reading 2011. National Center for Education Statistics (2011). Institute of Education Sciences, U.S. Department of Education, Washington, DC, November 2011. http://nces.ed.gov/nationsreportcard/pdf/main2011/2012457.pdf.

“VDOE :: Data Collections :: Student & School Records :: Student Records Data Definitions”, n.d. http://www.doe.virginia.gov/info_management/data_collection/student_record_collection/data_definitions.shtml#disadvantaged.

“VDOE :: Highly Qualified Teachers and Paraprofessionals”, n.d. http://www.doe.virginia.gov/teaching/highly_qualified/index.shtml.

“VDOE Fall Membership - Custom Reports.” *VDOE - Fall Membership Reports*, n.d. http://bi.vita.virginia.gov/doe_bi/rdPage.aspx?rdReport=Main&subRptName=Fall membership.

“Virginia Assessment Results”, n.d. https://p1pe.doe.virginia.gov/datareports/assess_test_result.do.

"Virginia Requirements For Highly Qualified Teacher Designation (Not New Teachers).pdf", n.d. http://www.doe.virginia.gov/teaching/licensure/va_requirements_teachers_not-new.pdf.

Walberg, Herbert J. "Real Accountability." In *Our Schools and Our Future : --are We Still at Risk?*, 305–328. Koret Task Force on K-12 Education. Stanford, California: Hoover Institution Press, Stanford University, 2003.

Weber, Karl. *Waiting for "Superman"*. United States: Participant Media, 2012.

Word, Elizabeth, John Johnston, and Helen Pate Bain. *The State of Tennessee's STAR Project-Final Summary Report*, n.d. http://www.misd.k12.wa.us/departments/superintendent/class_size/documents/STARReport.pdf.

Curriculum Vitae

Patrick D. Linehan graduated from the United States Military Academy at West Pint, New York, with a Bachelor of Science in 1977. He received his Masters of Science in Contracting and Acquisition Management from Florida Tech in 1989. He served 21 years of commissioned service in the United States Army, retiring in 1998 at the rank of Lieutenant Colonel. During his career Colonel Linehan served in operational assignments as an Armor officer and in Acquisition assignments, including a tour on the Army Secretariat in the Pentagon. In 1996 Colonel Linehan was selected to serve as the Product Manager for the Improved Army Tactical Missile System, a Major Defense Acquisition Program. Upon his retirement from active duty in 1998, Colonel Linehan provided consulting services to various federal departments through April 2012. At that time Colonel Linehan accepted his current position as the Chief Operating Officer for the Virginia Initiative for Science Teaching and Achievement in George Mason University's College of Education and Human Development.