VALUE-ADDED EFFECTS OF DISADVANTAGED STUDENT SUPPLEMENTAL FUNDING ON STUDENTS IN THE SURRY COUNTY SCHOOLS

A Dissertation
by
JEFFREY CLARK TUNSTALL

Submitted to the Graduate School
Appalachian State University
in partial fulfillment of the requirements for the degree of
DOCTOR OF EDUCATION

December 2010
Doctoral Program in Educational Leadership

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APPROVED BY:

George Olson, Ph.D.
Chairperson, Dissertation Committee

Ken Jenkins, Ed.D.
Member, Dissertation Committee

Barbara Todd, Ed.D.
Member, Dissertation Committee

Jim Killacky, Ed.D.
Director, Doctoral Program in Educational Leadership

Edelma D. Huntley, Ph.D.
Dean, Research and Graduate Studies

ABSTRACT

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(December 2010)

Jeffrey Clark Tunstall, B.S., West Virginia University

M.A., Gardner-Webb University

Ed.S., Appalachian State University

Chairperson: George H. Olson, Ph.D.

This study examined the value-added effects of tutoring funded through Disadvantaged Student Supplemental Funding (DSSF) on the academic achievement growth of students in the Surry County (NC) Schools from 2007-08 to 2009-10 in reading and mathematics. Created in response to a judicially mandated attempt to provide equitable instruction to all students across North Carolina, DSSF tutoring intends to help academically disadvantaged students receive a sound basic education. A sound basic education was legally defined by the Wake County Superior Court as one in which a student receives an academic performance level at or above Level III (proficient) on the End-of-Grade tests (EOG). Students achieving at an academic performance level less than Level III are designated academically disadvantaged. To determine progress toward the goal of a sound basic education, this study sought to determine 1) whether students who participated in DSSF tutoring had higher academic achievement growth rates in reading and mathematics than students who did not participate in tutoring, 2) whether some schools had more effective tutoring programs than others, 3) the characteristics of effective programs. To gather evidence to answer the questions, a three-level model composed of three years of student EOG developmental scale scores was developed. The data were analyzed using the software, Hierarchical Linear and Nonlinear Modeling (HLM). In addition, administrators at each school were interviewed regarding their DSSF tutoring programs. Results of the multi-level analysis showed a significantly increased achievement growth rate for tutored students as compared to non-tutored students in reading, but not in mathematics. Additionally, analysis of residual variance from the multi-level model showed that some schools had significantly more effective tutoring programs than others. Interview data collected from the school administrators indicated similar interventions, procedures, and organizational structures in both effective and less effective schools and therefore did not assist in identifying unique characteristics of the more effective programs.

ACKNOWLEDGEMENTS

Four years ago, when I was admitted to the doctoral program at Appalachian State University, my friend, Barbara Luffman, bought me a beautiful gold and black marble name plate for my desk that was engraved with the words, *Dr. Jeffrey C. Tunstall*. Most of the time, I kept that name plate in a drawer in my office, but occasionally, throughout the doctoral process, when I doubted that I would be able to finish due to various complexities of life that surround us all whether we want them to or not, I took it out and looked at it. That name plate came alive when I held it in my hands and read the simple inscription. I heard my wife's sweet encouragement, my children's loving support, my parents' and grandmother's pride, the faith of my school district leaders, and my own determination. I don't know if Barbara intended all that to happen, but she is a pretty sharp individual, so it wouldn't surprise me.

I can't thank Dr. George Olson enough for his role as my committee chairperson. Dr. Olson has an incredible gift for being able to tell everyone exactly what he thinks. Some may confuse his gift with a curse, but I definitely think it is a gift. His willingness to sit with me for hours and pour over hundreds of pages, making sure that every word in every sentence said exactly what I intended for it to say, was amazing. I will always remember introducing myself to him at the Fuddruckers in Winston-Salem the week before our new doctoral cohort orientation meeting took place and telling him this was the start of a great relationship. It most certainly was.

Dr. Ken Jenkins and Dr. Barbara Todd were the perfect choices to compliment Dr. Olson on my committee. I am honored to be one of Dr. Jenkins last doctoral students and one of Dr. Todd's first. Their support, encouragement, and wisdom allowed me to progress calmly through every stage of this process.

To my superintendent, Dr. Ashley Hinson; my assistant superintendents, Dr. Terri Mosley, Mrs. Pat Widdowson, and Mr. Chuck Graham; and the Surry County Board of Education, thank you for the opportunity to pursue an education that I hope benefits all the children of Surry County. Your leadership is a model for all of us to emulate.

I am blessed with an incredible family. My parents and grandparents provided me with the perfect foundation. Without their support and encouragement, I would never have had the opportunity to pursue this degree. I hope I have demonstrated to my four amazing daughters; Kaitlyn, Courtney, Kelsey, and Anne-Louise, that education is a life-long pursuit. We never stop learning. Finally, I would like to thank my wife, Leah, who, with unconditional love and unmatched abilities to multi-task, leads all of us to be better. G.G. was right; you are St. Leah.

DEDICATION

To my father, Dale Reverdy Tunstall
(1937-2010)

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Chapter One: Introduction

The Surry County School System, located in northwest North Carolina along the Virginia border serves approximately 9000 students. Three traditional high schools, one early college high school, four middle schools, and nine elementary schools employ just over 1300 staff members. The system as a whole is not particularly ethnically diverse, with 77% of the students classified as white, 17% as Hispanic, 3% as black, 3% as multi-racial, and less than 1% as Asian and Native-American (Surry County Schools, 2009). However, dense pockets of English as a Second Language populations across the district make certain schools more diverse than others. The school-age poverty rate, as measured by the number of students qualifying for free- or reduced-lunch prices, is consistent across most of the county at approximately 60%, although two of the elementary schools are statistical outliers at rates of 35% and 85%. The Surry County School System qualifies for and receives Title I, II, III, IV, and Migrant Compensatory funding (Surry County Schools, 2009) through the Elementary and Secondary Education Act. Preschool students have the opportunity to benefit from Head Start and North Carolina More at Four funding in all nine elementary schools. An audit in 2008-09 reported per-pupil expenditures of $7,759, with $5,773 coming from state funds, $542 from federal funds, and $1444 from local funds (Surry County Schools, 2009).

In the recent past, student achievement in the Surry County School System has exceeded the state average performance composite on most End-of-Grade (EOG) and

End-of-Course (EOC) testing. Average performance rates in 2008-09 exceeded the state average in Reading and Mathematics in all grade levels for the EOG tests and in nine out of ten subjects on the EOC tests. Cumulative SAT scores by 2009 graduating seniors were also higher than the state average. On federal measures, students have been equally successful. In 2008-09, the Surry County School System was one of only eight districts in North Carolina to have all schools make No Child Left Behind's AYP measure (adequate yearly progress) and was the largest district to do so (Surry County Schools, 2009).

Statement of the Problem

Despite the perceived success, 20% of Surry County Schools' third through eighth graders do not read on grade level and 10% do not demonstrate understanding in mathematics at grade level proficiency. Almost two thousand Surry County children failed one or more state tests last year, and in keeping with national trends, North Carolina has plans to continue to increase performance standards on its assessments (North Carolina Department of Public Instruction, 2008b). This increase in performance standards will almost certainly make it more difficult for children to attain required proficiency levels in the future.

In addition to general funding from federal, state, and local sources, the Surry County Schools expended over $1,200,000 over the past three years from a special state fund called Disadvantaged Student Supplemental Funding (DSSF), specifically to assist below grade level students in reaching the state proficiency levels in reading and mathematics (Office of State Budget and Management, 2009). Other than isolated anecdotal evidence, it is not known if the district or individual schools have been successful over time in efforts to raise the proficiency levels of targeted students.

Purpose of the Study

The purpose of this study was to determine if evidence exists of improved performance over time for students who participated in DSSF programs of remediation as compared to the general student population in the Surry County Schools.

Evaluation Questions

A set of three evaluation questions were developed to guide this study of the school system's efforts to remediate academically disadvantaged students.

1. Does the expenditure of DSSF funds at the schools lead to increased achievement of targeted students over time as compared to their non-targeted peers in the Surry County Schools?
2. Are some schools' programs, designed to target disadvantaged students, more or less effective than other programs?
3. What are the unique characteristics of successful programs?

The key to determining the answers to the evaluation questions, in my opinion, lies not in whether the children involved in tutoring funded by DSSF were proficient, but rather whether their rate of progress (or growth) from year to year exceeded that of the students who did not receive the benefit of the tutoring. Many children chosen to participate in the DSSF program had a history of being unsuccessful on EOG and EOC tests. In fact, initial consideration for the DSSF program at most schools required students to have failed to reach the state accepted level of proficiency on one or more tests. Many of the students selected for the DSSF program demonstrated above average academic growth through the school year, yet because of their low initial achievement, remained below the accepted state level of proficiency. Simply measuring success as the proficiency level of students in the program rather than by their academic growth is an unfair assessment of the program. The notion, therefore, of comparing the longitudinal growth, or gap in achievement between tutored and non-tutored students on the EOG assessments, was important to determining the effectiveness of the DSSF programs.

Summary of Methodology

To gather evidence to provide possible answers to the first two evaluation questions, this study employed a multi-year, value-added approach utilizing a three-level model in software called Hierarchical Linear and Nonlinear Modeling. Individual student achievement in the form of developmental scale scores on End-of-Grade tests in reading and mathematics comprised the level-1 model; achievement growth over time among children within a school comprised the level-2 model; and the variation among schools was represented in the level-3 model.

Since each school within the district provided slightly different instructional delivery methods and intervention components, a series of interview questions were developed to provide evidence for possible answers to the third evaluation question. The interview questions were designed to provide an extra layer of evaluation that would assist in replicating a model of successful intervention.

Defining Key Terms

Throughout this study, I used a number of key educational and statistical terms that could be misinterpreted if not defined in the intended context. Much misunderstanding results from bringing different meanings to words we hear and read. To avoid this difficulty, this section is intended to clearly explain the key terms in the investigation.

End-of-Grade tests (EOGs). Commonly called EOGs, the End-of-Grade tests are given to third through eighth graders in North Carolina each spring as a summative assessment in reading and mathematics. Fifth and eighth graders are additionally given an End-of-Grade test in science. The tests are part of the state accountability program and the federal No Child Behind legislation.

End-of-Course tests (EOCs). Like EOGs, EOCs are part of the state and federal accountability programs. End-of-Course tests are summative assessments given to students at the end of Algebra I, Algebra II, Biology, Civics and Economics, English I, Physical Science, and U.S. History.

Proficiency. The results of student performances on the EOGs and EOCs are divided into four achievement levels. Level I and II students are performing below grade level standards, while students at Level III and IV are performing at or above grade level standards. Proficiency, both in general terms in North Carolina and more specifically in this study, is defined as a student performance at or above Level III. The state declares that students at Level III "consistently demonstrate mastery of grade level subject matter and skills and are well prepared for the next grade level" (North Carolina Department of Public Instruction, 2009c, p. 2).

Disadvantaged Student Supplemental Funding (DSSF). DSSF is a special funding source for North Carolina school districts designed to tutor and/or remediate students who have historically not performed at or above Level III on EOGs and/or EOCs. The funds were established in response to the findings in the State Supreme Court Case, *Leandro v State*, and subsequent rulings by Wake County Superior Court Judge, Howard Manning, to whom the case was remanded (North Carolina Department of Public Instruction, 2009b).

Disadvantaged students. This study addresses two specific categories of disadvantagement: academically disadvantaged and socio-economically disadvantaged. Although each of these terms has the potential for broad interpretation, each is defined here in relatively simple terms. An academically disadvantaged student has failed to reach proficiency in one or more EOGs and/or EOCs in a given school year or has a history of performance below Level III. A socio-economically disadvantaged student qualifies for free- or reduced-meal prices while at school.

Tutoring and/or remediation. These two terms are used interchangeably throughout this study. Tutoring and/or remediation signify educational services beyond the scope of normal instruction intended to aid disadvantaged students.

Developmental scale scores. The number of questions a student answers correctly on an EOG is called a raw score. For EOG tests, the raw score is converted to a developmental scale score. The developmental scale score allows for comparisons of students' end-of-grade scores by subject from one grade to the next. The developmental scale score is expected to go up each year. This study assumes a linear progression of developmental scale scores over third through eighth grade.

Academic achievement growth. Student growth in this study is mentioned interchangeably as academic growth, achievement growth, and academic achievement growth. There is no differentiation between each of these terms for the purpose of this study. Academic achievement growth is the difference in developmental scale scores between two or more administrations of reading EOGs and/or math EOGs. Measuring and comparing this growth differential for tutored and non-tutored students over time is the main goal of this study.

Longitudinal growth. Longitudinal growth is the mean difference in academic achievement growth over the three-year timeframe of the study.

Multi-level modeling. Multi-level modeling resembles an OLS regression and requires similar assumptions of linearity. Multi-level modeling, however, effectively eliminates problems in OLS regression techniques associated with non-independent and cross-level data by modeling predictor variables at more than one level (Osborne, 2000). Multi-level modeling is an effective statistical technique for dealing with the hierarchical nesting structure of school and student level data.

Hierarchical Linear and Nonlinear Modeling (HLM). HLM is a software package designed to assist researchers with multi-level modeling. In much of the research involving hierarchical nested data, HLM has become synonymous with multi-level models and the terms are often used interchangeably. In this study, however, I have attempted to refer to multi-level models when referring to the statistical techniques and HLM when referring to the specific software and the equation design used in the software.

School effects. School Effects means many different things to many different researchers. In this study, I discussed school effects and tutoring effects within the framework of an increased mathematical difference in developmental scale scores in reading and/or mathematics due specifically to an educational intervention for academically or socio-economically disadvantaged students. Although very specific within the broader context of school effects research, this definition is consistent throughout the study.

Value-Added. Like school effects, the term value-added has many different meanings in various contexts. The term originated in business and economics to refer to a process or procedure that provided additional value for a product without additional cost to the manufacturer or producer. In education, the term generally refers to the academic achievement growth associated with a teacher, program, or school. Specifically, value-added evidence was obtained by comparing current school year developmental scale scores of students to the developmental scale scores of those same students in previous school years.

Chapter Two: Review of Relevant Research

The topic of researching whether schools are effective in their original intent began, inauspiciously, as a response to a report by Coleman et al. (1966) submitted to President Lyndon Johnson and Congress by U.S. Commissioner of Education, Harold Howe II. Written in the context of the Civil Rights Act of 1964, the report intended to evaluate equalities of educational opportunities for students regardless of race, color, religion, or national origin in public schools (Civil Rights Act, 1964), but instead was interpreted by many to conclude that schools do not make a difference in children's academic lives. Instead, circumstances beyond the control of schools like socio-economic condition are the mitigating factors in the success or failure of a child academically. These conclusions were supported further by Jencks et al. (1972) in their reassessment of the Coleman et al. (1966) results. The research in response to these two studies spawned an entire new field – school effectiveness research.

School Effect and Value-Added Research

The notion of whether or not a school effectively directs its efforts to educate young people has developed over the last forty years into two distinct viewpoints of what it means for schools to be effective. Scheerens (2000) calls these two, school-effectiveness research and school-effects research, while Teddlie and Reynolds (2000) use the terms effective schools research and school effects research. In either case, the latter focuses more on the student output side of effective education, while the former focuses on the processes that lead to effective school experiences for young people. Of course, a natural result of either of the two distinct fields of school effectiveness research is the notion of what educators should do with the results of the studies. Subsequently, an entirely different field that Teddlie and Reynolds (2000) call School Improvement Research is the by-product of the two former fields and dominates much of the current research in the school effectiveness field today.

According to Teddlie and Reynolds (2000), researchers throughout the 1970s, 80s, and 90s conducted studies aimed at refuting the claim that schools cannot positively affect children's long-term academic success. Through 40 years of research there is "now a widespread assumption internationally that schools affect children's development, that there are observable regularities in the schools that 'add value'" to a child's education (Teddlie & Reynolds, 2000, p. 3). The question now is not whether schools have an effect, but rather how to measure and define the effect.

Looking at the literature that addresses school effect research, Teddlie and Reynolds (2000) have organized 40 years of studies into six different definitions that fit reasonably together in an almost chronologically developmental fashion, extending from research conducted just after Coleman et al. (1966) until the time this study was completed.

The first of these is to define school effect as whether school – any school at all – is preferable to no school. In effect, this type of research attempts to answer the question as to whether having school at all makes any difference in the achievement of children. Studies regarding dropouts approximate this definition, but the most directly related study is one by Green, Hofman, Hayes, Morse, and Morgan (1964), conducted even before the

Coleman et al. (1966) study, which involved the study of a school system in Prince Edward County, Virginia that shut down in protest to the desegregation ruling in *Brown v. Board of Education*. From 1959 to 1963, many black students in the district did not attend any school and their performance was judged, upon their return, against other black students who had not had a lapse in education during the same time period (Green, Hofman, Morse, Hayes, & Morgan, 1964). As most would expect, the students who did not receive formal education during the lapse lagged far behind their peers who were not deprived of schooling. Few studies exist like Green et al. (1964), where researchers are able to isolate and measure the true effects of schooling. School effect research almost never involves schools and districts where control groups do not receive education. Since students are never withheld education, in most research, "there is necessarily an underestimation of the effects of school on achievement" (Good & Brophy, 1986, p. 571).

Teddlie and Reynolds' second definition relies on the direct unadjusted comparison of average achievement of all students in a school to other schools regardless of student and school background. Louisiana (Teddlie & Reynolds, 2000) and North Carolina are two states which annually produce a state report card for public consumption that compares, in raw percentages, the proficiency of students within each school in the state. Average Yearly Progress reporting to conform to No Child Left Behind legislation across the United States also reports raw proficiencies of students. Not only do the federal reports classify schools as a whole, but also the individual subgroups at schools as identified by the legislation. Teddlie and Reynolds add a scathing criticism to these types of results comparisons: "While no self respecting educational researcher would consider these raw scores to be indicative of the effectiveness status of a school, lay people (such as parents, uninformed government officials, and education critics) often use them for that purpose" (Teddlie & Reynolds, 2000, p. 66).

The third definition of school effect is measuring a school's impact just as in the second definition but adding an adjustment for various difficult family backgrounds and students' prior achievement. This definition also takes into account standard educational legislative policy items like class size and per pupil expenditure. Certainly, the most widely referenced study that falls into this category is the Coleman et al. (1966) study that started the school effect research movement. Although included in this category of research, the Coleman report's "emphasis on the more material school characteristics" limits its usefulness (Scheerens, 2000, p. 38).

Beginning with definition four, a shift occurs toward those types of studies that look for value added to children's education because of the school attended. This fourth definition is the first to bring in a notion of comparing schools by applying regression models to student performance, thus accounting for prior achievement and family background as in the third definition. These types of studies in this definition therefore "give a general idea of the relative importance of schools to the performance of individual students" (Teddlie & Reynolds, 2000, p. 67). Most notable in this category are the early studies authored by Pam Sammons and her colleagues at the University of London. Published in 1995, her review of school effects research resonates many of the same organizational components as Teddlie and Reynolds' work and is important as one of the first works to tie teacher effect and school effect together as one piece of research (Sammons, Hillman, & Mortimore, 1995).

Definition five takes value-added a step further by attempting to measure the "unique effect of each school on their students' outcomes" (Teddlie & Reynolds, 2000, p. 67). Most notable in definition five is an early work by Willms and Raudenbush (1989) that defines two different types of school effects.

> 1) Type A effects refer to how well an 'average' student would perform in School X compared with the average performance of the entire school system, and
> 2) Type B effects refer to how well an 'average' student would perform in School X compared with the performance of schools with similar composition and similar SES contexts (Willms & Raudenbush, 1989, p. 40).

Parents might find Type A effects useful in choosing a school within a specific community, while Type B effects would be useful to school leaders wishing to affect change within a community by modeling programs based on schools with larger positive effects.

The final definition simply adds a longitudinal component to the previous definition. "Growth in student achievement over time is now seen as the most appropriate criterion for assessing the magnitude of school effects" (Teddlie & Reynolds, 2000, p. 68). Through pioneering work by Olson and Webster (1986) and Raudenbush and Bryk (1986), mathematical systems through which districts can identify struggling and/or successful schools, determine the relative effectiveness of teachers within their buildings, and identify students that need extra attention, guide educators into making informed decisions. Borrowed from economics, the term value-added has come to describe evaluation systems like those by Olson and Webster (1986) in the Dallas Independent School District in the 1980s and later in the Tennessee Value-Added Assessment System

(TVAAS) developed by Sanders and Horn (1994) wherein multi-level modeling is used to analyze student growth over time. This longitudinal growth data provides a measurement of district, school, and teacher effects on student achievement. Sanders' work continues with SAS Institute, Inc. in Cary, NC, where development of the extension of the TVAAS research now called EVAAS (Education Value Added Assessment System) occurs. Used in over 20 states, "SAS EVAAS helps state-level officials, district administrators, principals and teachers to determine effective practices that accelerate student learning" (SAS Institute Inc., 2009, para. 3). Four states use the complete software suite to provide student and teacher data to stakeholders. Contrary to what many thought Coleman et al. (1966) found some 43 years ago, school effect measurement systems, like EVAAS, allow informed educators and education stakeholders to make good decisions that help make a difference for children.

The North Carolina End-of-Grade Tests

Used since a pilot program in 1995-96, EOG and EOC tests, as a measure of student proficiency, were developed initially as a response to the North Carolina General Assembly directing "the State Board of Education (SBE) to develop a restructuring plan for public education" (North Carolina Department of Public Instruction, 2009a, para. 1). Beginning in 1996-97, the state of North Carolina assessed all third through eighth graders in the Public School System in reading and mathematics using EOG tests. These tests provide the backbone of the elementary and middle grades accountability system in North Carolina. Both the reading and the mathematics tests are in their 3^{rd} edition, with the mathematics test last updated in 2005-06 and reading, in 2007-08 (North Carolina Department of Public Instruction, 2009a). The new editions, created to maintain alignment with revisions to the North Carolina Standard Course of Study, require higher performance standards for students to meet the required proficiency levels than the earlier editions (North Carolina Department of Public Instruction, 2009a).

The state's technical report (North Carolina Department of Public Instruction, 2009c) gives the results of three types of reliability studies for the EOG tests: alternate form reliability, test-retest reliability, and internal consistency reliability. All three studies showed high coefficients of reliability with coefficient alpha across all grades, genders, and federally defined ethnicities between .87 and.93. The internal consistency is used by the state to "quantify reliability for the NC EOG Tests" (North Carolina Department of Public Instruction, 2009c, p. 43). The technical report concludes that the North Carolina EOG tests "are highly reliable as a whole" (North Carolina Department of Public Instruction, 2009c, p. 44). Standard error of measurements are in the range of 3-5 developmental scale score points for each grade level tested (North Carolina Department of Public Instruction, 2009c).

For EOG tests, the issue of validity is whether educators make warranted inferences from a child's performance in reading comprehension and mathematics. The Technical Report addresses issues of content relevance, relationships of test scores to external variables, and maintaining consistent testing environments by defining and describing three separate evidences collected to support the argument for validity: content validity, instructional validity, and criterion-related validity (North Carolina Department of Public Instruction, 2009c). The state addressed validity in each of the three areas through rigorous methods approved by the federal government in the Elementary and Secondary Education Act Workbook submitted annually and reported in the technical report for each test or subtest. The NCDPI addresses content validity by careful and purposeful linkage to the North Carolina Standard Course of Study. Test items, written by North Carolina teachers, are reviewed in a multi-step internal (NCDPI staff) and external (additional teachers) auditing process that assures content coverage (North Carolina Department of Public Instruction, 2009c). The state establishes instructional validity through a process of form review in the field-testing stage of development and criterion-related validity by correlating student raw test scores with teacher expectations of achievement and classroom and/or subject grade. Pearson correlation coefficients on the order of .50 to .69 suggest a reasonably strong relationship between student scores and external variables such as classroom performance (North Carolina Department of Public Instruction, 2009c).

Disadvantaged Student Supplemental Funding

In the 2008-09 school year, districts in North Carolina received over 500 million dollars in state taxpayers' money, specifically targeted to provide assistance to districts with various disadvantages (Office of State Budget and Management, 2009). In each of the funding sources, the term disadvantaged takes on a slightly different meaning. DSSF monies, for example, are allotted based on a formula that takes into account the percent of students with at least one parent who has less than a high school diploma; the percent of single parent families; and the number of students eligible for Federal ESEA Title I (North Carolina Department of Public Instruction, 2008a).

While each funding source has specific restrictions and requirements on expenditures, only DSSF requires a district plan that needs approval by the North Carolina State Board of Education. DSSF monies are specifically used to "provide intensive in-school and/or after-school remediation" to focus solely on strategies that improve the performance of disadvantaged students on the EOG and EOC tests in Reading and Mathematics (North Carolina Department of Public Instruction, 2008a, p. 17). Additionally, monies from DSSF can monetarily assist with the establishment of Saturday Academies or extra tutoring during semester or grading period inter-sessions. Paying teachers before, during, or after school that are already on the payroll in a full-time capacity, however is not an acceptable use of DSSF. A stipulation also exists that allows use of up to 35% of the funds locally for teacher bonuses and supplements (North Carolina Department of Public Instruction, 2008a). The largest distribution per student was in Northampton County Schools where based on the previously defined formula, the district received $309.82 per child enrolled, whereas the least received was in Wake County, where the district received an average of $24.40 per child enrolled (North Carolina Department of Public Instruction, 2008a). DSSF also has the distinction of being the only funding source that has its origins in a judicially mandated attempt to provide equitable instruction to all students across North Carolina without respect to the wealth, tax-base, size, and demographics of the district.

***Leandro v. State* and a sound, basic education.** The legal impetus for the DSSF originally arose in 1994, when several parents, on behalf of their children who attended numerous low-wealth school systems in North Carolina, filed suit against the state in Superior Court. The suit alleged that lack of funding from the state denied the children their constitutional right to an education as guaranteed in Article I, Section 15 and Article IX, Section 2 of the North Carolina Constitution. The court ruled in favor of the parents. The state appealed and the case was heard by the North Carolina Supreme Court (Lex-IS

Services, 2009a). In 1997 in *Leandro v. State of North Carolina*, which later became known as *Leandro I*, the North Carolina Supreme Court ruled that the state constitution guarantees that every child will have an equal opportunity to receive a sound basic education. *Leandro I* (Leandro, 1997, para. 2) further clarified the constitutional requirement of a sound, basic education as one where students have

1. sufficient ability to read, write, and speak the English language and a sufficient knowledge of fundamental mathematics and physical science to enable the student to function in a complex and rapidly changing society;
2. sufficient fundamental knowledge of geography, history, and basic economic and political systems to enable the student to make informed choices with regard to issues that affect the student personally or affect the student's community, state, and nation;
3. sufficient academic and vocational skills to enable the student to successfully engage in post-secondary education or vocational training;
4. sufficient academic and vocational skills to enable the student to compete on an equal basis with others in further formal education or gainful employment in contemporary society.

Judge Howard Manning of the Wake County Superior Court, to whom the case was remanded, later defined a sound basic education "as one in which a student receives an academic performance level at or above Level III (proficient) on the end-of-grade and end-of-course tests" (North Carolina Department of Public Instruction, 2009a). Judge Manning primarily focused his efforts and investigations on the performance of children in Hoke County, where the original plaintiff, Leandro, resided. Through a series of hearings and rulings, Manning established a set of rulings later termed the Leandro Principles. In 2004, following a series of appeals by the state and counter-suits by the original plaintiffs and later additional plaintiffs in Superior Court, the State Supreme Court once again found itself ruling on a case dealing with the provision of a sound basic education. In *Hoke v. State*, later known as *Leandro II*, the court upheld, as Judge Manning had originally ruled, that Hoke County had denied students their constitutional right to a sound, basic education (Leandro II, 2004). According to Judge Manning's guidance from the combined *Leandro I and II* rulings, North Carolina students are entitled to an equal opportunity to receive a sound basic education with these basic tenants:

1. Students will be prepared for the future with sufficient knowledge and skill in English, math, science, civics and economics, history, geography, and vocational training.
2. Students will have competent, certified, well-trained teachers who teach the standard course of study.
3. Students will have a school led by a well-trained competent principal with the leadership skills and the ability to hire and retain competent teachers.
4. This education will be provided to students in the most cost effective manner possible.
5. The failure of a student to achieve Level III on the State's EOG and EOC tests demonstrates the failure to obtain a sound basic education.
6. The State is responsible for and must correct educational methods and practices that contribute to the failure to provide a sound basic education.

7. The State must sufficiently fund local school systems so they can provide students with the opportunity to obtain a sound basic education (Lex-IS Services, 2009b).

The State of North Carolina responded to the Leandro rulings by establishing both DSSF and a new system of support for failing systems that included direct on-site support from turn-around teams for the most needy school systems. Beginning in the 2004-05 school year, $22.4 million dollars were distributed to 16 of North Carolina's 115 most economically disadvantaged school systems, allotted, as previously described, based on a formula that takes into account the percent of students with at least one parent who has less than a high school diploma; the percent of single parent families; and the number of students eligible for Federal ESEA Title I. Two years later, the North Carolina Legislature expanded the program to the ninety-nine remaining districts (Carolina Institute for Public Policy, 2008). Judge Howard Manning has continued to be involved in the process, holding hearings to address the continued difficulties in specific high-poverty districts.

Who is eligible for DSSF tutoring? Each school district across the state does have the ability to choose which students to target educationally with the funds, although Judge Manning established the definition of disadvantaged as being below proficiency level on EOG and EOC exams as a minimum. Some districts simply choose to remediate students who are not proficient on state assessments, calling them academically disadvantaged students by the strict definition, while others attempt to identify, without violating federal privacy regulations, those students who are both socio-economically as well as academically disadvantaged. Districts attempting the latter remediate and tutor students who are in one of two categories of disadvantagement. The first category is choosing those perceived to be economically disadvantaged and, because of their performance on EOG and/or EOC tests, have not met state accountability standards in Reading and Mathematics. The second method, involves choosing students who are, again, perceived to be economically disadvantaged and who have struggled with either the EOG tests or the precursors to the EOG tests; the K-2 Assessments. K-2 Assessments are state-developed end-of-year constructed-response tests given to Kindergarteners, First Graders, and Second Graders in Reading and Mathematics. The assessments are scored by classroom teachers and curriculum support staff rather than a centralized state scoring system. For many systems, the additional burden of attempting to identify students who are both socio-economically disadvantaged as well as academically disadvantaged is an important component of the DSSF program in the district. These districts understand that rural high-poverty school systems face enormous obstacles in overcoming socio-economic and cultural gaps.

Effective Remediation and Tutoring Programs

Counteracting the disadvantages facing rural impoverished children challenges teachers and administrators on a daily basis. Students eligible for free and reduced-price lunches do not score as well on academic assessments as other students (Provasnik et al., 2007) and students attending rural schools do not perform as well as students who attend suburban schools (Lee, Grigg, & Donahue, 2007). How to use DSSF funds to provide expanded learning opportunities for these children is an on-going discussion in most North Carolina school districts. According to Forbes (2008), schools with effective tutoring and remediation programs for at-risk children have:

1) Strong, committed leadership and quality instructional staff

2) Adult-to-student ratios at levels that are low enough to make realistic the development of supportive staff/student relationships
3) Emphasis on making learning engaging and exciting by providing academic-based enrichment activities while assisting students in meeting achievement standards.

Additionally, Allen and Chavkin (2004) noted the features critical to the success of the tutoring programs:

1) Intensity of tutoring – frequency, session length, and individualized
2) Structured sessions
3) Close coordination with teacher and classroom
4) Extensive tutor training – before and during the course of tutoring
5) Careful monitoring of the effectiveness of tutoring services

The ultimate question, of course, relates not to whether districts spend money on tutoring and remediation, given the potential long-term consequences of neglecting this moral imperative, but rather how to spend the money most effectively. Developing a program that will help children perform at grade-level is the entire premise of DSSF funding and the initial intent of the Leandro rulings. How best to tutor and remediate the children becomes the next decision.

Numerous studies are available to help school systems, schools, and administrators make the difficult decision of how to positively affect their most at-risk children. Elbaum and associates conducted a meta-analysis on 29 studies of supplemental, adult-instructed, one-to-one reading interventions for elementary school students at risk of reading failure, and showed that many of the interventions were highly effective (Elbaum, Vaughn, Hughes, & Moody, 2000). A study involving over 2000 elementary and junior high students in England revealed that students tutored by trained parents and peers improved their reading comprehension and word recognition (Topping & Whitley, 1990). When tutoring is coordinated with effective classroom reading practices, students perform better than when tutoring is unrelated to classroom instruction (Reid, Dobbins, Scherich, & Peters, 2008). The North Carolina State Board of Education's foresight to require a plan from each district in order to receive DSSF funds forces districts to be more cognizant of the relationship between tutoring and regular instruction as Reid and associates describe. Cohen, Kulik, and Kulik (1982) and Wasik and Slavin (1993) found that structured tutorial programs demonstrated higher achievement gains than unstructured programs (Cohen, Kulik, & Kulik, 1982; Wasik & Slavin, 1993). Again, the required plan becomes a framework for a well-structured program. A study of tutoring at-risk first graders reported that successful tutor-tutee relationships characterized by strong reinforcement of progress, high numbers of reading and writing experiences in which the student moved from being fully supported to working independently, and explicit demonstration of appropriate reading and writing processes achieved the greatest success (Juel, 1996). The U.S. Department of Education released a document in 2001 that quantifiably determined what many of the aforementioned studies found as well: Programs that are successfully planned, organized, and implemented make a difference for children at-risk (U.S. Department of Education, 2001).

While experts in the field of school effectiveness may agree on some points and disagree on others, students fall farther and farther behind in a system that call its overarching structure No Child Left Behind. Discourse over whether a family should have to choose between better schools or greater social and economic equality is not relevant to the day-to-day existence of families living in poverty. What is important, however, is that students have teachers who care about them and a school system willing to invest in the students' potential for future success.

Chapter Three: Methods and Procedures

In order to make assumptions regarding the evaluation questions in this study, it was necessary to identify appropriate measures of success and failure. For the purpose of this study, whether or not a child reached the state-designated level of proficiency on his/her Mathematics and Reading EOG Tests determined student success or failure. Showing evidence as a group that participation in DSSF tutoring assisted in closing the achievement gap on the Mathematics and Reading EOG Tests determined success and failure of the tutoring program. As previously mentioned, a legal precedent exists for these choices as Judge Howard Manning defined a sound basic education "as one in which a student receives an academic performance level at or above Level III (proficient) on the end-of-grade and end-of-course tests" (North Carolina Department of Public Instruction, 2009b, para. 5).

Defining a Successful DSSF Program

The key to determining the answers to the evaluation questions, however, lies not in whether the children involved in tutoring funded by DSSF were proficient, but rather whether their rate of progress from year to year exceeded that of the students who did not receive the benefit of the tutoring. Many children chosen to participate in the DSSF program had a history of being unsuccessful on EOG and EOC tests. In fact, initial consideration for the DSSF program at most schools required students to have failed to reach the state accepted level of proficiency on one or more tests. Many of the students selected for the DSSF program demonstrated above average academic growth through the school year, yet because of their low initial achievement, their developmental scale scores remained below the accepted state level of proficiency. Simply measuring success as the proficiency level of students in the program rather than by their academic growth is an unfair assessment of the program. The notion, therefore, of comparing the longitudinal growth, or gap in achievement between tutored and non-tutored students on the EOG assessments, was important to determining the effectiveness of the DSSF programs.

Data Collection

To evaluate longitudinal growth for students, I collected three years of reading and mathematics test scores for all Surry County Schools students in third through eigth grade beginning with the 2006-07 results. I excluded high school data from the study because of the lack of direct subject-to-subject growth relationships between courses with EOC tests. For example, the NCDPI model bases sixth grade reading growth on a comparison of sixth grade reading test scores to fourth and fifth grade reading test scores, whereas high school biology growth, according to the NCDPI model is based on eighth grade reading test scores. This lack of direct relationship between the curricula in eighth grade and the curricula of related high school courses, led me to focus this study on grades with EOG tests.

The student level test data used in this study came from two North Carolina Department of Public Instruction secure data files that are available to the accountability office of each school system following the spring testing cycle. Collected from various state and federal data sources, the first file contains basic student demographic information including students with disabilities status, limited English proficiency status, and economically disadvantaged status. These sources include the Federal Data Collection database, the NCWISE student data management system, the April Exceptional Children's Head Count, and the bi-annual Free-and-Reduced Lunch Count submission. The second file contains current and historical test data in reading and mathematics. Once the information from the two files was merged, an additional column was added to tag students who participated in the DSSF tutoring program at the various schools. This list of students was obtained from the rosters maintained by each school as part of the required state recordkeeping.

At the most basic level of this study, I compared the three-year change in EOG developmental scale scores for students who participated in a DSSF program with those in the general student population. Specifically, an analysis of three years of student test scores traced over time within the framework of a multi-level model determined the effectiveness of the DSSF programs at both the district and school level.

Hierarchical Linear Models

Hierarchical Linear and Nonlinear Modeling (HLM), a statistical software package based on work by Raudenbush and Bryk (1986), uses a multi-level statistical model that takes into account the nested or hierarchical nature of most organizational structures. Hierarchical structures are common in many social and business organizations. Medical practitioners, for example, exist within individual practices, hospitals, regions, states, and countries and businesses have workers who have specific skills and duties that exist within departments and sites within the business as a whole. This nested structure is also fundamental to educational settings. Principals assign children to specific classes within specific schools located in specific communities in specific districts or areas of the state. Hierarchical data structures, however, present two categories of problems for traditional types of analysis: lack of independence of observations and cross-level data (Osborne, 2000).

Most statistical analyses require an assumption of independence of observations (Ordinary Least Squares Regression (OLS), for example), but educational data are rarely independent. In most schools, principals purposely and thoughtfully schedule students and teachers together in classrooms to meet students' needs. Since students throughout a school or school system have different teachers, instruction will most often be inherently different from classroom to classroom. Additionally, classrooms within specific schools share certain demographic characteristics that most certainly differentiate them from other sets of classrooms elsewhere in the district or state. Evaluating student outcomes from a non-random structure like a classroom leads to observations that most likely violate assumptions of independence.

Cross-level data lead to similar problems in traditional analyses. Educational researchers often wish to study how certain environmental or demographic variables affect individual student achievement outcomes. While researchers usually gather outcomes at the student level, they often gather environmental or demographic variables at the classroom, school, or district level. These cross-level data may cause under- or over-estimation of observed relationships between variables (Bryk & Raudenbush, 1988).

HLM eliminates problems associated with non-independent and cross-level data by modeling predictor variables at more than one level. A simple two-level HLM set of equations illustrates this benefit of HLM. At level 1, HLM resembles an OLS regression:

an outcome variable is predicted as a linear function of various level 1 predictor variables plus a y-intercept, such as

$$Y_{ij} = \beta_{0j} + \beta_{1j}(X_{ij}) + r_{ij},$$

where Y_{ij} is the outcome variable of the *i*th individual in group j, β_{0j} is the intercept, β_{1j} is the slope or regression coefficient of *i*th variable *X* for individuals in group j, and r_{ij} represents the error or residual for individual *i* in group *j*. At level 2 and subsequent levels, however, HLM differs from an OLS regression. In a typical HLM level 2 equation, the level 1 intercept (β_{0j}) and slope (β_{1j}) become outcome variables predicted by level 2 predictor variables (W_j) as in

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(W_j) + u_{0j},$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(W_j) + u_{1j},$$

where γ_{00} and γ_{10} are level 2 intercepts, γ_{01} and γ_{11} are level 2 regression coefficients predicting the level 1 slope and intercept from level 2 predictor variable W_j, and u_{0j} and u_{1j} are the level 2 residuals. This multi-level structure of HLM models the effects of level 1 and level 2 variables on the outcome, thus disentangling individual and group effects (Osborne, 2000).

In addition to the typical nesting structure found in most social structures, Raudenbush and Bryk (2002) also discuss another type of data hierarchy of importance to this study: repeated-measures data. Multiple sets of individual student EOG developmental scale scores are nested within students who are then nested within classrooms or schools. This three-level hierarchical growth model has become the basic paradigm for quantitative research on student learning (Bryk & Raudenbush, 1988) and is the model I used to examine the value-added effects of DSSF tutoring.

Designing the HLM Model

The analytical method chosen for the study of DSSF tutoring effects was a three-level multi-level model (HLM) of students' longitudinal achievement growth in reading and mathematics. The process of answering the first two evaluation questions using HLM required consideration of inclusion or exclusion of various possible level 2 and level 3 predictor variables. The level 1 model included individual student developmental scale scores over three years represented as a function of time (grade level). Evaluation of demographic variables was unnecessary in the level 1 model.

The level 1 model. The model for level 1 (student growth over time) was

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}(ADJUSTED\_GRADE_{tij}) + e_{tij},$$

where Y_{tij} is the achievement score for the *i*th student in the *j*th school at time *t* (grade level); π_{0ij} is the initial achievement score for the *i*th student in the *j*th school when the adjusted grade level is equal to zero; π_{1ij} is the growth rate (slope) for the *i*th student in the *j*th school during an average school year; ADJUSTED_GRADE is calculated by subtracting three from the actual grade level of the *ij*th student in order to establish a baseline score at time zero; and e_{tij} is the residual, or the level 1 random effects, representing the deviation of the achievement score for the *ij*th student from the predicted score based on the student-level model.

The level 2 model. Since the first evaluation question of the study was to determine if the expenditure of DSSF funds led to increased achievement over time for targeted students as compared to their non-targeted peers, the growth rate of the *ij*th student, π_{1ij}, was of particular interest. Therefore, an initial linear regression was performed to establish the statistical relevance of each of the potential predictor variables available that might affect Y_{ij} independently of the tutoring intervention. This initial model for reading was

$$Y_{ij} = X_{0j} + X_{1j}(\mathrm{EDS}_{ij}) + X_{2j}(\mathrm{SWD}_{ij}) + X_{3j}(\mathrm{LEP}_{ij}) + X_{4j}(\mathrm{ETH}_{ij}) + X_{5j}(\mathrm{SEX}_{ij}) + X_{6j}(\mathrm{DAYSABS}_{ij}) + r_{ij},$$

and, for mathematics,

$$Y_{ij} = X_{0j} + X_{1j}(\mathrm{EDS}_{ij}) + X_{2j}(\mathrm{SWD}_{ij}) + X_{3j}(\mathrm{LEP}_{ij}) + X_{4j}(\mathrm{DAYSABS}_{ij}) + X_{5j}(\mathrm{ETH}_{ij}) + X_{6j}(\mathrm{SEX}_{ij}) + r_{ij}$$

,

where Y_{ij} is the reading and/or mathematics EOG developmental scale score of the *i*th student in the *j*th school; X_{0j} is the intercept of the regression equation for predicting achievement in the *j*th school; each of the additional X_{xj} factors is a regression coefficient expressing the relationship between current achievement and each of the demographic factors in the *j*th school; ETH follows the 2009 North Carolina state coding scheme for ethnicity (1-American Indian, 2-Asian, 3-Hispanic, 4-Black, 5-White, 6-

Multi-Racial); SEX is a dummy variable for gender (male=1, female =0); similarly, LEP (limited English proficient), SWD (students with disabilities), and EDS (economically disadvantaged) are dummy variables coded 1 for yes and 0 for no as to whether a child is a member of the specific cohort; and r_{ij} is the error, or random effect. The order of inclusion of variables in the regression equation was established by including those with greatest predictive value first and those with least predictive value last as determined by an R^2 change value (see Tables 1 and 2).

Statistics from the prediction model summary are given in Table 1 for reading and in Table 2 for mathematics. Note in both Table 1 and 2 that although five of the six predictors are shown to have made statistically significant contributions to the variance explained ($p < .05$), the demographic predictors accounted for only 15.4% ($R^2 = .154$) of the total variance explained in EOG developmental scale scores for reading and only 11.2% ($R^2 = .112$) of the variance explained for mathematics.

Table 1
Regression Model Summary of Initially Considered Level 2 Student Demographics Variables for Reading

Model	*R*	R^2 Change	*F* Change
1	.272[a]	.074	295.257*
2	.345[b]	.045	189.424*
3	.388[c]	.032	139.826*
4	.390[d]	.001	4.699*
5	.391[e]	.001	4.234*
6	.391[f]	.000	.042

a. Predictors: (Constant), EDS, b. Predictors: (Constant), EDS, SWD, c. Predictors: (Constant), EDS, SWD, LEP, d. Predictors: (Constant), EDS, SWD, LEP, ETH, e. Predictors: (Constant), EDS, SWD, LEP, ETH, SEX, f. Predictors: (Constant), EDS, SWD, LEP, ETH, SEX, DAYSABS.

*$p < .05$

Table 2

Regression Model Summary of Initially Considered Level 2 Student Demographics Variables for Mathematics

Model	*R*	R^2 Change	*F* Change
1	.252[a]	.064	255.517*
2	.308[b]	.031	129.758*
3	.324[c]	.010	43.294*
4	.330[d]	.004	16.751*
5	.334[e]	.003	11.544*
6	.334[f]	.000	.132

a. Predictors: (Constant), EDS, b. Predictors: (Constant), EDS, SWD, c. Predictors: (Constant), EDS, SWD, LEP, d. Predictors: (Constant), EDS, SWD, LEP, DAYSABS, e. Predictors: (Constant), EDS, SWD, LEP, DAYSABS, ETH, f. Predictors: (Constant), EDS, SWD, LEP, DAYSABS, ETH, SEX.

$*p < .05$

When previous test scores are added to the model, the contribution to variance explained by the demographic variables in both the reading and the mathematics model attenuates to less than 1% (see Tables 3 and 4). These results are consistent with Sanders and Horn (1994), who concluded that the majority of variance in any value-added model can be attributed to achievement in previous years. Since three years of previous achievement test scores are included in the level 1 HLM model as measures over time for students, available demographic variables could be excluded specifically from the level 2 model and treated as random effects.

Table 3

Regression Model Summary including a Previous Test Score with Considered Level 2 Student Demographics Variables for Reading

Model	R	R^2 Change	F Change
1	.871[a]	.759	11694.670*
2	.873[b]	.003	46.068*
3	.874[c]	.002	33.193*
4	.875[d]	.001	14.150*
5	.875[e]	.000	.113
6	.875[f]	.000	3.655

a. Predictors: (Constant), PRE_SCORE, b. Predictors: (Constant), PRE_SCORE, EDS, c. Predictors: (Constant), PRE_SCORE, EDS, SWD, d. Predictors: (Constant), PRE_SCORE, EDS, SWD, LEP, e. Predictors: (Constant), PRE_SCORE, EDS, SWD, LEP, ETH, f. Predictors: (Constant), PRE_SCORE, EDS, SWD, LEP, ETH, SEX.

*$p < .05$

Table 4

Regression Model Summary including a Previous Test Score with Initially Considered Level 2 Student Demographics Variables for Mathematics

Model	R	R^2 Change	F Change
1	.858[a]	.736	10491.457*
2	.860[b]	.004	58.108*
3	.862[c]	.003	50.805*
4	.862[d]	.000	.371
5	.864[e]	.003	36.035*
6	.864[f]	.000	2.421

a. Predictors: (Constant), PRE_SCORE, b. Predictors: (Constant), PRE_SCORE, EDS, c. Predictors: (Constant), PRE_SCORE, EDS, SWD, d. Predictors: (Constant), PRE_SCORE, EDS, SWD, LEP, e. Predictors: (Constant), PRE_SCORE, EDS, SWD, LEP, DAYSABS, f. Predictors: (Constant), PRE_SCORE, EDS, SWD, LEP, DAYSABS, ETH.

*$p < .05$

The reduced level 2 model for the HLM analysis was therefore

$$\pi_{0ij} = \beta_{00j} + \beta_{01j}(DSSF_{ij}) + r_{0ij},$$

$$\pi_{1ij} = \beta_{10j} + \beta_{11j}(DSSF_{ij}) + r_{1ij},$$

where from before in level 1, π_{0ij} is the initial achievement score for the *ij*th student when the adjusted grade level is equal to zero and π_{1ij} is the growth rate for the *ij*th student during an average school year; $DSSF_{ij}$ is a dummy variable indicating assignment to the DSSF tutoring for the *ij*th student; β_{00j} and β_{10j} are intercepts for the level 2 equations indicating the mean achievement and mean growth rate respectively at the *j*th school; and the *r*-values are the level 2 residuals or more specifically the level 2 random effects that, now, include all demographic predictors.

The level 2 model was developed to test the hypothesis that participation in DSSF tutoring was related to both initial academic achievement and academic growth rates of students. Since DSSF was coded 0 for students who did not participate in the program, corresponding regression coefficients can be interpreted as differences between students who participated and those who did not participate. This is true for both initial academic achievement and academic growth rate. Specifically, β_{01j} is the difference in mean initial achievement at school *j* and β_{11j} is the difference in mean growth rate for students who participated in DSSF tutoring at school *j* and those who did not participate.

The level 3 model. To determine inclusion/exclusion of potential school-level predictors in the level 3 model, a procedure similar to that used in level 2 was followed.

This initial model was

$$Y_{ij} = X_{0j} + X_{1j}(\mathrm{ADM}_{ij}) + X_{2j}(\mathrm{EDSPERC}_{ij}) + X_{3j}(\mathrm{LEPPERC}_{ij}) + X_{4j}(\mathrm{MOB}_{ij}) + X_{5j}(\mathrm{ATT}_{ij}) + X_{6j}(\mathrm{SUSP}_{ij}) + X_{7j}(\mathrm{TRR}_{ij}) + X_{8j}(\mathrm{PRINX}_{ij}) + X_{9j}(\mathrm{TCHRX}_{ij}) + X_{10j}(\mathrm{OVERALL}_{ij}) + r_{ij},$$

where, as before, Y_{ij} is the reading and/or mathematics achievement of the *i*th student in the *j*th school; X_{0j} is the intercept of the regression equation predicting the achievement in the *j*th school; and each of the additional X_{xj} factors is the regression coefficient indexing the relationship between current achievement and each of the demographic factors in the *j*th school. Table 5 describes the initially considered predictor factors.

Table 5
Initially Considered Level 3 Predictors

ADM	The average daily membership of the school
EDSPERC	The average percent of economically disadvantaged students
MOB	The percent of students transferring in or out of the school
LEPPERC	The average percent of limited English proficient students
ATT	The average school attendance rate
SUS	The average number of suspensions per year
TRR	The teacher retention rate
PRINCX	Each school principal's years of experience
TCHRX	The average years of experience for teachers
OVERALL	The average school composite score over the study

When considered as a whole, the ten predictors contributed significantly to the variance explained (R^2 = .245 for reading; R^2 = .231 for mathematics), but as before, when previous test scores were included in the model, the school-level predictors accounted for less than 1% of the variance explained in reading and/or mathematics. Like the level 2 model, these predictors were treated as random effects and were excluded specifically from the final level 3 model. The final reduced level 3 model was

$$\beta_{00j} = \gamma_{000} + u_{00j}$$

$$\beta_{01j} = \gamma_{010}$$

$$\beta_{10j} = \gamma_{100} + u_{10j}$$

$$\beta_{11j} = \gamma_{110} + u_{11j},$$

where γ_{000} represented the initial district achievement; γ_{010} was the initial achievement district-wide gap for students enrolled in the DSSF tutoring program (considered a constant for the district-wide analysis); γ_{100} was the district growth rate; γ_{110} was the difference in district achievement growth rate between students who participated in DSSF tutoring and those who did not participate; and u_{00j}, u_{10j}, and u_{11j} represented the residual effects for school j.

In the level 3 model, the coefficient γ_{110} is a predictor for the student-level growth slope coefficient, β_{11j}. γ_{110} is used to provide the answer as to whether expenditures of DSSF funds at schools led to increased achievement over time for targeted students as compared to their non-targeted peers. When positive, γ_{110} indicates a higher academic growth rate for students participating in DSSF tutoring.

Evidence for answering the second question of whether some schools' programs, designed to target disadvantaged students, were more or less effective than other programs, was found by comparing the various school values for u_{11j}. Although HLM solves for an overall district γ_{110} value that indicates the difference in the academic growth rate of students who participated in DSSF tutoring and those who did not, each school has a unique residual effect, u_{11j}. I used these residual effects to evaluate the academic growth rate differences at each school.

Shown together, the final HLM model for reading and mathematics achievement over time within schools was as follows:

Level 1

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}(ADJUSTED\_GRADE_{tij}) + e_{tij};$$

Level 2

$$\pi_{0ij} = \beta_{00j} + \beta_{01j}(DSSF_{ij}) + r_{0ij},$$

$$\pi_{1ij} = \beta_{10j} + \beta_{11j}(DSSF_{ij}) + r_{1ij};$$

Level 3

$$\beta_{00j} = \gamma_{000} + u_{00j},$$

$$\beta_{01j} = \gamma_{010},$$

$$\beta_{10j} = \gamma_{100} + u_{10j},$$

$$\beta_{11j} = \gamma_{110} + u_{11j}.$$

School Administrator Interviews

In addition to the quantitative analysis of longitudinal student data, this study involved the collection of descriptive data obtained from school administrators regarding the nature of each school's tutoring and/or remediation program. The intent of these data was to provide an additional framework for answering the third evaluation question by engaging the principals and assistant principals in a discussion of the characteristics of their DSSF programs. The discussion focused on four key interview questions asked of the administrators:

1. Disadvantaged Student Supplemental Funding was established to help close the achievement gap between students with economic hardships and those without. How does your program identify the children the state intends to target?
2. The economic achievement gap is most identified as discrepancies between groups in proficiency on EOGs and EOCs. How does your program address these particular deficiencies?
3. School systems with low-income populations receive multiple state and federal funds designed to target disadvantaged students. Describe how your school has used Disadvantaged Student Supplemental Funding in a manner unique from the other funds such as Low Wealth Funds and Title I Funds.
4. We have discussed many times in our system how EOG and EOC proficiency is a narrow part of the spectrum of overall performance and student academic success. What effects unrelated to EOGs and EOCs, both positive and negative, have you noticed in the students because of your program?

Summary of Research Methodology

For this study, I analyzed three years of student EOG test scores in reading and mathematics to determine the value-added effects of DSSF tutoring. The student EOG test scores were modeled using a three-level model (HLM). Student developmental scale scores were modeled at level 1; individual student growth parameters were modeled at level 2; and school-level variations in developmental scale scores were modeled at level 3. Chosen as the statistical evaluation tool for the study due to the nested, hierarchical nature of student test scores, the three-level HLM model is one of the more accepted methods of educational growth analysis.

Finally, in an effort to ascertain characteristics of successful programs, school administrators responded to a series of interview questions regarding their DSSF tutoring program. Responses were grouped and summarized to analyze patterns of structure and function in the tutoring programs.

Chapter Four: Findings of the Study

The first evaluation question was whether expenditures of DSSF funds at schools led to increased achievement over time for targeted students as compared to their non-targeted peers in the Surry County Schools. To address this question, I evaluated three years of student EOG test scores using a three-level model in Hierarchical Linear and Nonlinear Modeling (HLM) (Raudenbush & Bryk, 2002). The second evaluation question asked whether some schools' programs, designed to target disadvantaged students, were more or less effective than were other programs. The second question was answered by analyzing differences in the achievement growth rate between tutored and non-tutored students at individual schools. With the third and final evaluation question, I intended to determine the unique characteristics of successful programs. The response to the third question required the collection and analysis of interview data from school administrators regarding the nature of their DSSF program.

District-wide Effects of DSSF Tutoring

Figures 1 and 2, showing the mean initial EOG developmental scale scores in reading and mathematics, illustrate the achievement gap between students selected to participate in DSSF tutoring in third through eighth grade and those not chosen. Since program inclusion criteria includes poor past achievement in reading and/or mathematics, results of independent samples *t* tests found in Table 6 are not surprising. As expected, the mean difference between students admitted to the tutoring program and those not admitted was statistically significant across all grade-levels for both subjects ($p < .05$).

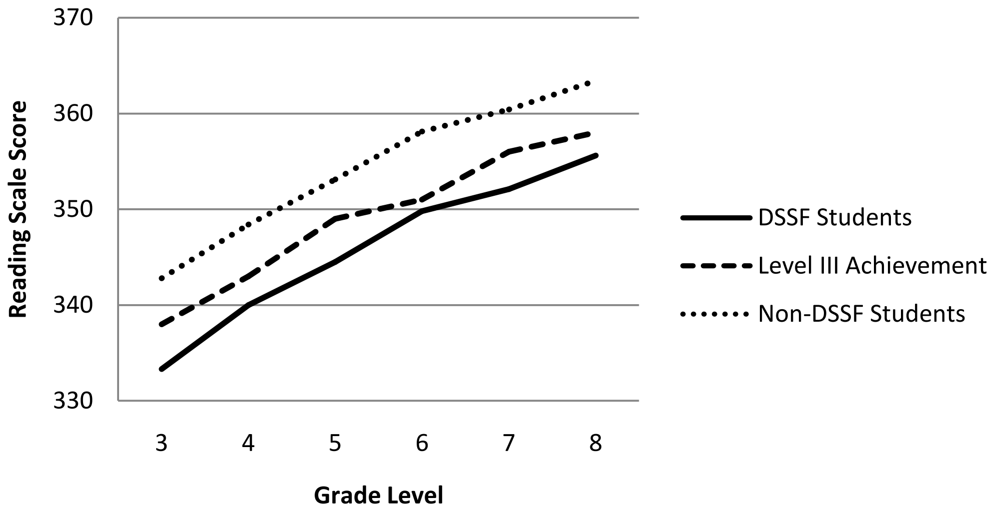

Figure 1. The mean initial reading developmental scale scores for students in the Surry County Schools as compared to the statewide level III achievement.

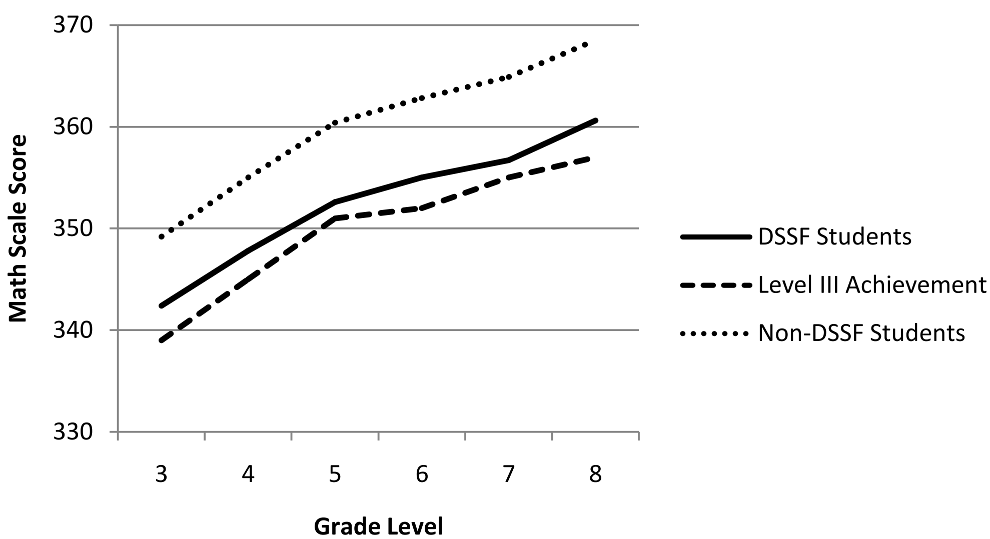

Figure 2. The mean initial mathematics developmental scale scores for students in the Surry County Schools as compared to the statewide level III achievement.

Table 6

Results of Independent Samples t tests for Tutored and Non-tutored Students Initial EOG Developmental scale scores in Reading

	Tutored Students			Non-tutored Students			
Grade	N	Mean	SD	N	Mean	SD	*t*
3	250	333.30	8.746	1623	342.79	10.147	14.003*
4	283	339.97	7.551	1616	348.38	8.862	15.031*
5	292	344.50	6.670	1579	353.09	8.041	17.195*
6	458	349.85	7.295	1379	358.10	7.478	20.596*
7	306	352.07	7.081	926	360.35	7.075	17.742*
8	199	355.56	6.552	406	363.38	6.526	13.823*

*$p < .05$

Additionally, the statistical significance of the achievement difference across all grade levels appeared to indicate a lack of success in closing the academic achievement gap between the two groups over time, but since the data in Figures 1 and 2 are based only on initial scores, additional evidence was required to ascertain the level of success for the tutoring program. The purpose of this study was to use a value-added approach to the evaluation of the effectiveness of tutoring to examine not only the results of initial student achievement, but also the achievement growth over time for participating students.

The HLM Analyses

The unconditional model. To establish the fit of the considered explanatory model, Raudenbush and Bryk (2002) recommend beginning by expressing an unconditional model. This unconditional model excluded the DSSF factor from level 2 to evaluate variance explained for individual initial achievement and academic growth. The unconditional model was

Level 1

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}(ADJUSTED\_GRADE_{tij}) + e_{tij};$$

Level 2

$$\pi_{0ij} = \beta_{00j} + r_{0ij},$$

$$\pi_{1ij} = \beta_{10j} + r_{1ij};$$

Level 3

$$\beta_{00j} = \gamma_{000} + u_{00j},$$

$$\beta_{10j} = \gamma_{100} + u_{10j}.$$

The results of the unconditional model for reading, presented in Table 7, indicate that estimated initial student achievement for reading, γ_{000}, was a developmental scale score of 342.2. The average growth rate for all students in reading during each year from third to eighth grade, represented by γ_{100}, was 4.8 developmental scale score points. A χ^2 goodness-of-fit test was applied to the data and indicated significant variation among children within schools for initial achievement and growth rates (π_{0ij} and π_{1ij}) and significant variation between schools for mean initial achievement and mean growth rate (β_{00j} *and* β_{10j}). Approximately 3% of the variance in initial mean achievement was between schools while over 30% of the variability in growth rate was between schools.

Table 7
Summary of Unconditional Model of HLM Analysis of Reading Achievement and Growth

Fixed Effect	*Coefficient*	*se*	*t Ratio*
Average initial achievement, γ_{000}	324.167	0.516	662.452*
Average annual growth rate, γ_{000}	4.781	0.236	20.268*
Random Effect	*Variance Component*	*df*	χ^2
Level 1			
Individual student variation, e_{tij}	15.143		
Level 2 (students within schools)			
Individual initial achievement, r_{0ij}	87.341	3120	14002.164*
Individual annual growth rate, r_{1ij}	1.510	3120	3749.575*
Level 3 (between schools)			
School mean achievement, u_{00j}	2.993	12	115.792*
School mean annual growth rate, u_{10j}	0.652	12	327.887*

Coefficient	*Percent of Variance Between Schools*
Initial achievement, π_{0ij}	3.3%
Academic growth rate, π_{1ij}	30.2%

Note: *$p < 0.05$
See Table 6 for N counts at each grade level

Table 8 indicates that estimated initial achievement for mathematics, γ_{000}, expressed as a developmental scale score, was 349.2. The average growth rate in mathematics during each year from third to eighth grade, represented by γ_{100} was 4.8 developmental scale score points. Applying a goodness-of-fit test to the mathematics data, χ^2 statistics again indicated significant variation among children within schools for initial achievement and growth rates (π_{0ij} and π_{1ij}) and also significant variation between schools for mean initial achievement and mean growth rate (β_{00j} and β_{10j}). For mathematics, approximately 10% of the variance in initial achievement was between schools, but over 80% of the variability in growth rate was between schools.

Table 8
Summary of Unconditional Model of HLM Analysis of Mathematics Achievement and Growth

Fixed Effect	*Coefficient*	*se*	*t Ratio*
Average initial achievement, γ_{000}	349.168	0.698	499.885*
Average annual growth rate, γ_{000}	4.764	0.389	12.242*
Random Effect	*Variance Component*	*df*	χ^2
Level 1			
Individual student variation, e_{tij}	13.016		
Level 2 (students within schools)			
Individual initial achievement, r_{0ij}	57.106	3158	11291.409*
Individual annual growth rate, r_{1ij}	0.267	3158	3507.767*
Level 3 (between schools)			
School mean achievement, u_{00j}	6.010	12	277.213*
School mean annual growth rate, u_{10j}	1.909	12	1189.072*
Coefficient	*Percent of Variance Between Schools*		
Initial achievement, π_{0ij}	9.5%		
Academic growth rate, π_{1ij}	87.7%		

Note: *$p < 0.05$
See Table 6 for N counts at each grade level

The conditional model for reading and mathematics. Since analysis of the unconditional model for both reading and mathematics indicated the presence of significant variation among children within schools for initial achievement and growth rates (π_{0ij} and π_{1ij}) and significant variation between schools for mean initial achievement and mean growth rate (β_{00j} *and* β_{10j}), a conditional model including the DSSF intervention was applied. This model was used to test the hypothesis that participation in DSSF tutoring had value-added effects on student performance. As previously mentioned, the model was

Level 1

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}(ADJUSTED\_GRADE_{tij}) + e_{tij};$$

Level 2

$$\pi_{0ij} = \beta_{00j} + \beta_{01j}(DSSF_{ij}) + r_{0ij},$$

$$\pi_{1ij} = \beta_{10j} + \beta_{11j}(DSSF_{ij}) + r_{1ij};$$

Level 3

$$\beta_{00j} = \gamma_{000} + u_{00j},$$

$$\beta_{01j} = \gamma_{010},$$

$$\beta_{10j} = \gamma_{100} + u_{10j},$$

$$\beta_{11j} = \gamma_{110} + u_{11j}.$$

As before, γ_{010} is the initial achievement gap for students enrolled in the DSSF tutoring program and γ_{110} is the difference in growth rate between children who participated in the DSSF tutoring and those that did not participate. Tables 9 and 10 show the details of the three-level HLM analysis. Results included a γ_{010}value of -9.1 developmental scale score points for reading and -7.9 developmental scale score points for mathematics. Students were chosen for DSSF tutoring only if they were struggling with grade-level achievement standards, so finding them behind their non-tutored peers by eight or nine developmental scale score points on initial achievement levels was not surprising. This initial gap was consistent with the representation of data in Figures 1 and 2. Contrary to the data in Figures 1 and 2, however, were the results for γ_{110} that showed, in both reading and mathematics, that students who participated in tutoring had higher academic growth rates as compared to their non-tutored peers. In reading, the mean academic growth of non-DSSF students was 4.6 developmental scale score points per year, but results for γ_{110} show that DSSF tutored students had a rate almost one developmental scale score point higher per year ($p < 0.05$). Although results for mathematics were not statistically significant, it should be noted that non-tutored students had a mean achievement growth of 4.7 developmental scale score points per year, while the rate for DSSF students was 0.2 developmental scale score points higher per year.

Additionally, data from Tables 9 and 10 indicate that when considering achievement growth, 26% of the variance in slopes could be attributed to differences among schools. Furthermore, 40% of the between school growth variance was attributed to participation in DSSF tutoring. In the mathematics model, while over 85% of the variance explained for the academic achievement growth rate was between schools, only 4% of the between school variance for the mathematics achievement growth rate was explained by participation in DSSF tutoring.

Table 9

HLM Reading Explanatory Model Including Participation in DSSF Tutoring

Fixed Effect	*Coefficient*	*se*	*t Ratio*
Average initial achievement, γ_{000}	343.349	0.532	645.414*
Average initial achievement gap, γ_{010}	-9.112	0.530	-17.180*
Average annual growth rate, γ_{000}	4.645	0.215	21.584*
Average difference in growth rate, γ_{110}	0.999	0.202	4.951*

Random Effect	*Variance Component*	*df*	χ^2
Level 1			
Individual student variation, e_{tij}	15.224		
Level 2 (students within schools)			
Individual initial achievement, r_{0ij}	78.071	3120	12788.109*
Individual annual growth rate, r_{1ij}	1.371	3120	3705.569*
Level 3 (between schools)			
School mean achievement, u_{00j}	3.180	12	127.804*
School mean annual growth rate, u_{10j}	0.531	12	256.892*
Difference in school mean growth rate, u_{11j}	0.221	12	41.100*

*$p < .05$

Note: The variance in mean growth explained by the DSSF program in reading (40%) was calculated by dividing the difference in school mean growth rate, u_{11j}, by the school mean annual growth rate, u_{10j}.

See Table 6 for N counts for each grade level

Table 10
HLM Mathematics Explanatory Model Including Participation in DSSF Tutoring

Fixed Effect	*Coefficient*	*se*	*t Ratio*
Average initial achievement, γ_{000}	350.197	0.729	480.240*
Average initial achievement gap, γ_{010}	-7.853	0.440	-17.830
Average annual growth rate, γ_{000}	4.727	0.383	12.337*
Average difference in growth rate, γ_{110}	0.218	0.150	1.456

Random Effect	*Variance Component*	*df*	χ^2
Level 1			
Individual student variation, e_{tij}	13.036		
Level 2 (students within schools)			
Individual initial achievement, r_{0ij}	50.655	3157	10380.396*
Individual annual growth rate, r_{1ij}	0.254	3145	3494.324*
Level 3 (between schools)			
School mean achievement, u_{00j}	6.565	12	312.492*
School mean annual growth rate, u_{10j}	1.844	12	1083.387*
Difference in school mean growth rate, u_{11j}	0.070	12	9.940

*$p < .05$
Note: The variance in mean growth explained by the DSSF program in mathematics (4%) was calculated by dividing the difference in school mean growth rate, u_{11j}, by the school mean annual growth rate, u_{10j}.
See Table 6 for N counts for each grade level

Value-Added Effects of DSSF Tutoring

Data from reading and mathematics provided different evidences for answering the first question in this study of whether expenditures of DSSF funds at schools led to increased achievement over time for targeted students as compared to their non-targeted peers. In reading, students who participated in DSSF tutoring showed a significantly higher rate of academic achievement growth than did their non-tutored peers. In mathematics, although not statistically significant, the academic growth rate for tutored students was higher than for non-tutored students. Using the predicted initial achievement and extrapolating with the predicted academic growth rates for tutored and non-tutored students in each subject, I generated Figures 3 and 4 to compare to Figures 1 and 2. In reading, shown in Figure 3, where the difference in achievement growth rate between tutored and non-tutored students was significant, the extrapolation shows the mean developmental scale score of students who participated in DSSF tutoring from third through eighth grade, closing the initial achievement gap. This increased slope for DSSF tutored students in reading is in contrast to the near parallel graph of initial achievement in Figure 1. A continued extrapolation of the line in Figure 3 indicates an intersection of the achievement level of DSSF tutored and non-tutored students around twelfth grade. In mathematics, the decreased achievement gap is not as evident and Figure 4 more closely resembles the near parallel achievement data in Figure 2.

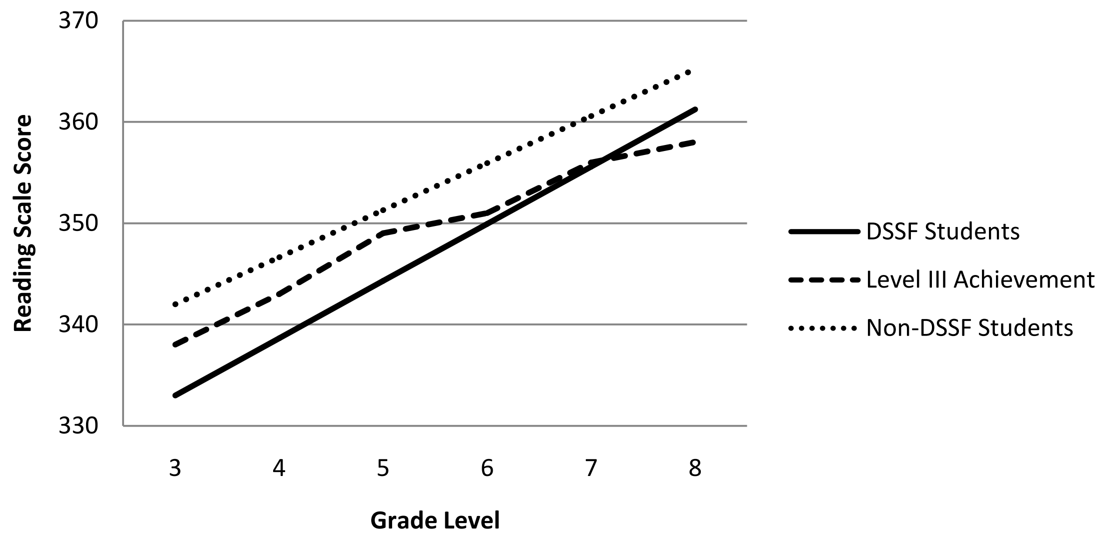

Figure 3. The extrapolation of reading developmental scale scores for students in the Surry County Schools based on HLM predicted initial mean achievement and academic growth rates as compared to the statewide level III achievement.

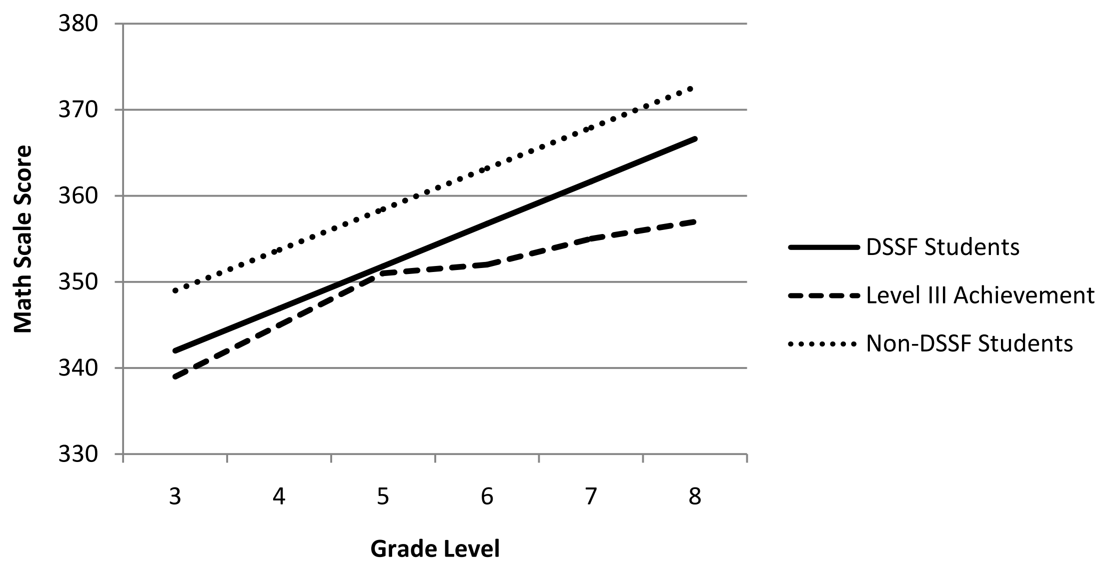

Figure 4. The extrapolation of mathematics developmental scale scores for students in the Surry County Schools based on HLM predicted initial mean achievement and academic growth rates as compared to the statewide level III achievement.

Value-Added Effects of Individual Schools

Evidence for answering the second question of whether some DSSF programs were more effective than others was gathered through comparison of the various school residual effects. Individual school coefficients for u_{11j} contribute to the overall γ_{110} value. γ_{110} is the difference in the academic growth rate of students who participated in DSSF tutoring and those who did not. Each school in the study had a unique residual effect, u_{11j}, that contributed to the mean academic growth rate in each subject. By adding each of the residual effects to the mean district academic growth rate, I was able to determine an individual school value for the academic growth rate difference. The average growth difference between DSSF students and non-DSSF students for each of the thirteen schools is shown in Table 11 for reading and Table 12 for mathematics.

Table 11
Summary of the Average Achievement Growth Rate Difference Between DSSF and Non-DSSF Students in Reading at Each School

School	*Reading Growth Rate Difference*[a]
1	1.365
2	0.388
3	1.396
4	1.067
5	1.298
6	1.520*
7	0.556
8	0.585
9	1.542*
10	0.077
11	0.886
12	1.108
13	1.200

*growth differential more than 1.0 SD above mean
[a]the difference in developmental scale score points increase per year for DSSF tutored students versus non-tutored students

Table 12

Summary of the Average Achievement Growth Rate Difference Between DSSF and Non-DSSF students in Mathematics at Each School

School	*Mathematics Growth Rate Difference*[a]
1	0.455
2	0.216
3	0.522*
4	0.020
5	0.064
6	0.372
7	0.211
8	0.444
9	0.601*
10	-0.032
11	-0.345
12	0.086
13	0.228

*growth differential more than 1.0 SD above mean
[a] the difference in developmental scale score points increase per year for DSSF tutored students versus non-tutored students

Even in mathematics, where the growth differential at the system-wide level was not statistically significant, two schools (schools 3 and 9) had significantly higher academic growth rates for DSSF tutored students as compared to non-tutored students. In reading, where the district-wide average between DSSF students and non-DSSF students was already statistically significant, two schools (schools 6 and 9) had rates more than one standard deviation above the district mean. Tables 11 and 12 present data that indicate that there are schools in the district that have implemented tutoring programs that appear to be more effective.

Unique Characteristics of Successful DSSF Programs

Although administrators from each school responded to the survey questions designed to illuminate the characteristics of successful programs, special attention was paid to the answers of administrators whose schools had growth differentials designated in Tables 11 and 12 as being more than one standard deviation above the mean growth differential for DSSF students. With school 9 the only school having an effect more than one standard deviation above the mean in both reading and mathematics, the qualitative data collected from the principal at school 9 was especially important.

The questions, again, for the school administrators were:

1. Disadvantaged Student Supplemental Funding was established to help close the achievement gap between students with economic hardships and those without. How does your program identify the children the state intends to target?
2. The economic achievement gap is most identified as a discrepancy between groups in proficiency on EOGs and EOCs. How does your program address these particular deficiencies?
3. School systems with low-income populations receive multiple state and federal funds designed to target disadvantaged students. Describe how your school has used Disadvantaged Student Supplemental Funding in a manner unique from the other funds such as Low Wealth Funds and Title I Funds.
4. We have discussed many times in our system how EOG and EOC proficiency is a narrow part of the spectrum of overall performance and student academic

> success. What effects unrelated to EOGs and EOCs, both positive and negative, have you noticed in the students because of your program?

In all responses, the importance of attention from school staff members and self-esteem building for the tutored children was evident. For instance, Sarah, principal of school 9, told a story about James.

> James was living in a home where there was not a father figure. The mother was almost twice as small as he was and he was the man of the house. He had four other siblings that were also in crisis and he was thrown into a lot of responsibility. He was allowed, at that time, for the tutoring to be just about him. It was instrumental that this small amount of time was given to him individually and he could put everything else aside. It was a time to build his self-esteem. He had been in a lot of trouble, but obviously his outbursts were because of the situation he was in at home. You know he was worried about it. He was carrying that responsibility and his time in DSSF tutoring freed him from that.

Sarah talked about the personal nature of interacting with the tutored children in small group settings and used the analogy of her own child. Her views about the basic nature of a parent wanting what's best for his/her child are compelling and echoed across responses from administrators in the system.

> I've been an educator for a long time and not only an educator but a parent. And as a parent if you say to my Charles, who is a middle child, kind of shy, a very good athlete, that would rather be on a four-wheeler than studying science - if you give me a choice between building his self-esteem and him getting an A in that class - I'll choose self-esteem.

These two themes of 1) the benefits of extra small group or one-on-one attention and 2) self-esteem, occurred throughout both the responses from Sandra and the responses from other school administrators. David, an elementary principal, mentioned that, "they enjoy the extra attention they receive" during the tutoring; Tim, a middle school principal, discussed the improvements "academically and emotionally" that he sees in his students; Barry, Tim's assistant principal, commented about the reduction in discipline referrals from DSSF students who had been former discipline problems; and Maggie, an elementary assistant principal, referenced the "higher confidence level" in the DSSF students as a result of the program. Although self-esteem and attitude are not empirically or quantitatively measured or reflected in test scores, each of these administrators was passionate about the difference this program makes in children's lives.

Many of the specific interventions critical to successful DSSF tutoring discussed earlier in this study appeared in the answers to the four administrator-directed questions. Comments from administrators in all 13 schools included the importance of close alignment of tutoring to the North Carolina Standard Course of Study. Each administrator additionally addressed items discussed earlier as described by Forbes (2008): quality instructional staff, low adult-to-student ratios, the development of supportive staff/student relationships, and emphasis on making learning engaging and fun. Eight schools, including schools 3, 6, and 9, cited successful intervention components from Allen and Chavkin (2004), including close coordination between the tutor, teacher, and classroom, and careful monitoring of the effectiveness of tutoring services.

Unfortunately, none of the interview data indicated a specific intervention component in place at the more successful schools that was absent at the less successful schools. No administrator mentioned a purchased program designed to tutor socio-economically and/or academically disadvantaged students such as those found reviewed on the U.S. Department of Education's Institute of Educational Sciences What Works Clearinghouse website (U.S. Department of Education, 2009).

The answer to the third evaluation question in this study regarding the unique characteristics of successful programs, therefore, remains only partially answered. According to the school administrators, while many of the intervention components, procedures, and organizational structures of the tutoring program described in current educational research exist in the successful DSSF programs, those same intervention components, procedures, and organizational structures exist in the less successful programs as well.

Summary of Results

Although their initial academic achievement began over nine developmental scale score points behind, students targeted for reading remediation in the Surry County Schools in DSSF related services, showed a statistically significant increased academic achievement growth rate over the last three years as compared to their non-tutored peers. The mean growth rate per year for non-tutored students was 4.6 developmental scale score points per year, but DSSF tutored students grew at a rate of 5.6 developmental scale score points per year. This rate shows an effective decrease of the academic achievement gap between tutored and non-tutored students in reading of nearly one developmental scale score point per year. DSSF mathematics tutoring was not as successful over the same three years. As compared to their non-tutored peers, the students who received the benefit of tutoring, although achieving a mathematically higher academic growth rate over the three years than non-tutored students, did not show a statistically significantly higher rate of academic growth. The mean mathematics growth rate per year for non-tutored students was 4.7 developmental scale score points per year and the rate of DSSF tutored students rate was 4.9 developmental scale score points per year.

HLM analysis revealed that some schools had DSSF programs that were more effective than others over the course of the study and residual effects variance components of the HLM equations were used to identify those schools for both reading and mathematics.

Collection of interview data from the school administrators identified the inclusion of several intervention components, procedures, and organizational structures found in the research literature characteristic of effective tutoring programs, yet the most successful schools did not have intervention components, procedures, or organizational structures in place that differed greatly from the less successful programs.

Chapter Five: Discussion and Implications

In this study I examined the value-added effects of Disadvantaged Student Supplemental Funding (DSSF) tutoring programs in reading and mathematics in grades three through eight in the Surry County Schools from 2007-08 through 2009-10. During this time, the Surry County Schools had nine elementary schools with grade spans of Pre-Kindergarten through fifth grade and four middle schools with grade spans of sixth through eighth grade. I used changes in student developmental scale scores on Reading and Mathematics EOGs in third through eighth grade to determine value-added effects.

School Effects and Value-Added Effects Research

This study is part of the broader category of school effects research. This overarching field of school research began as a response to a report by Coleman et al. (1966) submitted to President Lyndon Johnson and Congress. The Coleman Report intended to evaluate school inequalities within the context of the Civil Rights Act of 1964. Interpreted by many as concluding that schools do not make a difference in children's academic lives, the Coleman Report stirred a passion among educational researchers intent on proving results of the report wrong. Two unique educational research fields developed as a response. Some researchers chose to attempt to identify characteristics of effective schools, while others chose to measure school effectiveness quantitatively. Statistical advances and software like Hierarchical Linear and Nonlinear Modeling allowed value-added effects research to arise from the latter field. Borrowed from economics, the term value-added describes multilevel models that analyze student growth over time. These longitudinal data provide a measurement of district, school, program, and teacher effects on student achievement.

DSSF Tutoring

The specific goal of DSSF is to improve student performances on EOG and EOC tests in reading and mathematics. In 1997 and again in 2004 in *Leandro v. State*, the North Carolina Supreme Court ruled that the state constitution guarantees that every child has an equal opportunity to receive a sound basic education (Leandro, 1997). The Leandro decisions and subsequent rulings by Judge Howard Manning of the Wake County Superior Court, to whom the Supreme Court remanded the case, defined a sound basic education for students in third through eighth grade three as passing the Reading and Math EOG. The North Carolina State Board of Education and the North Carolina Department of Public Instruction responded in part to the Leandro rulings with the creation of DSSF (North Carolina Department of Public Instruction, 2009b). For the last several years, schools in the Surry County School District have received and expended over $400,000 each year to remediate students through tutoring who, because of their performance on EOG and EOC tests, have not met state accountability standards in reading and mathematics.

Statement of Evaluation Questions

Three questions guided my study of the effects DSSF tutoring:

1. Does the expenditure of DSSF funds at the schools lead to increased achievement of the targeted students over time as compared to their non-targeted peers in the Surry County Schools?

2. Are some schools' programs, designed to target disadvantaged students, more or less effective than other programs?
3. What are the unique characteristics of successful programs?

Specifically, I evaluated whether participation in DSSF tutoring narrowed the academic achievement gap in reading and mathematics between students that participated in tutoring and those that did not. Additionally, I sought to determine which schools were able to provide more effective interventions for the academic growth of identified students. Quantitative data consisted of basic student and school demographic data, three years of reading and mathematics EOG developmental scale scores for each student in fifth through eighth grade, two years of developmental scale scores for students in fourth grade, and one year of developmental scale scores for students in third grade. Student reading and mathematics data were modeled separately in three-level HLM analyses. Collected from administrators at all 13 schools, qualitative descriptive data consisted of answers to interview questions attempting to ascertain intervention components, procedures, organizational structures and benefits of each school's DSSF program.

Overview of the Evaluation Methodology

The method used to determine the value-added effects of DSSF tutoring was multi-level modeling using a three-level HLM analysis. Multi-level analyses like HLM eliminate traditional statistical problems associated with nested structures typical in educational environments such as non-independent and cross-level data by modeling outcome variables at more than one level. The multiple levels of equations were developed in HLM in such a way as to eliminate variables with minimal predictive value and to focus exclusively on the variables in the guiding questions. After first adjusting for previous test scores, all student-level and school-level demographic factors contributed only minimally to the prediction of current test developmental scale scores. In other words, nearly all the variance in current test scores could be attributed to previous test scores. Therefore, since the level 1 HLM equation was comprised of up to three years of student test scores, the student-level and school-level demographic variables were eliminated from the final equations.

Two coefficients from the level 3 model were of particular interest to the study. The first represented the academic achievement growth difference between students who participated in the study and those who did not, while the second allowed for comparisons of value-added effects of the DSSF tutoring between schools.

The qualitative phase of the investigation involved interviewing administrators at all 13 schools with the following four questions and then recording, analyzing, and grouping responses:

1. Disadvantaged Student Supplemental Funding was established to help close the achievement gap between students with economic hardships and those without. How does your program identify the children the state intends to target?
2. The economic achievement gap is most identified as discrepancies between groups in proficiency on EOGs and EOCs. How does your program address these particular deficiencies?
3. School systems with low-income populations receive multiple state and federal funds designed to target disadvantaged students. Describe how your

school has used Disadvantaged Student Supplemental Funding in a manner unique from the other funds such as Low Wealth Funds and Title I Funds.

4. We have discussed many times in our system how EOG and EOC proficiency is a narrow part of the spectrum of overall performance and student academic success. What effects unrelated to EOGs and EOCs, both positive and negative, have you noticed in the students because of your program?

Key Findings of the Evaluation

First guiding question: Growth rates. In reading, the EOG developmental scale scores of students who participated in DSSF increased over the last three years at a faster rate than did their non-tutored peers. The mean growth rate per year for non-tutored students was 4.6 developmental scale score points per year, while DSSF tutored students grew at a rate of 5.6 points. DSSF mathematics tutoring was not as successful over the same three years at the district level, but some schools achieved higher growth rates than others. The mean mathematics growth for non-tutored students was 4.7 points and DSSF tutored students, 4.9 developmental scale score points per year.

Second guiding question: School effects on growth. HLM analysis revealed that some schools had DSSF programs that were more effective over the three years. Each school contributed a unique effect to the district mean academic growth rate in each subject. I used these unique school effects to evaluate the academic growth rate differences between tutored and non-tutored students at each school and calculate an estimate of the individual school effect. For instance, at one of the 13 schools, students' rate of achievement growth, as measured by EOGs, was more than one standard deviation above the district mean growth rate in both subject areas.

Third guiding question: Evidence of effective interventions. Interview data were used to identify intervention components, procedures, and/or organizational structures that research literature suggests are characteristic of effective tutoring programs. Surprisingly, the most successful schools did not have intervention components, procedures, or organizational structures in place that differed greatly from less successful programs.

Discussion of Findings

Understanding the results: Higher growth. In reading, students who participated in DSSF tutoring had a higher academic growth rate than students who did not participate. Unfortunately, in mathematics, there was no discernable district-wide difference in academic growth rates of students who participated and those who did not. Taking a closer look at the results of the first evaluation question, DSSF students start off over nine developmental scale score points behind in reading and seven developmental scale score points behind in mathematics, which is not surprising since students were chosen for the program because they were behind academically. What is surprising is that there appear to be reading interventions in place in Surry County that could allow a third grade student who starts nine points behind his/her peers in reading to catch up to the district mean by the time he/she graduates from high school. The possibility that an eight year old third-grade child deemed at-risk in reading, with continued intervention, can achieve at the same mean academic achievement level as his/her peers by the time he/she graduates is a cause for celebration.

Unfortunately, the current methodology of selecting students for participation in the DSSF tutoring program may prohibit children from ever realizing these potential long-term gains. Once a child reaches the proficient level in both subjects, he/she is no longer considered academically at-risk and therefore is not usually eligible for the DSSF program. In the best-case scenario, the child received the proper guidance to continue progressing on his/her own within the normal educational structures. In the worst-case scenario, after a year without the organizational structures and interventions of the DSSF program, the child's next set of test results warrant a return to the program. This in-the-program/out-of-the-program cycle may explain the lack of growth difference in mathematics for students. The average student in Surry County referred for DSSF tutoring has already achieved the minimum proficiency level established by the state in mathematics. Schools may lack the same sense of urgency in mathematics they feel in reading since according to the guidelines set forth by Judge Manning, most children in Surry County already receive a sound, basic education in mathematics. Since minimum levels are already met in mathematics, the focus for most children shifts naturally to reading, where mean proficiency levels are lower.

Understanding the results: Effective programs. Each school in the Surry County School System has an opportunity to design and structure its own DSSF program to help close the academic achievement gap and provide students with a sound, basic education. With over 25% of variance explained in growth rates between schools in reading and over 80% of the variance explained in growth rates between schools in mathematics, some schools are more effective over the timeframe of this study than others. The process of identifying the more effective schools presented special challenges and raised more questions than it answered. Although an examination of residuals in the multi-level model clearly identified the schools with higher and lower growth rates, with an accepted level of significance set at greater than one standard deviation above the mean growth result, few schools showed significant academic growth in either reading or mathematics. The schools whose achievement growth was more than one standard deviation above the mean in either reading or mathematics were the focus of the qualitative descriptive data. With many of the schools' mean academic growth rates separated by a minimal amount of developmental scale score points per year, it is difficult to say with affinity that any one school is, statistically speaking, most effective.

Although the significance level of a few schools confirmed an affirmative answer to the second evaluation question of this study, the distribution of the growth rates throughout the schools created additional questions. In reading, the four middle schools in the study had the four lowest effects and there is no apparent, outward, and obvious reason for this result based on either the intervention protocols described by the school administrators or the historical performance of the cohort of children in middle school throughout the time span of the study. In mathematics, there is no such pattern with the middle schools, and no real pattern at all presents itself except that one elementary school in the district had the highest effect in both reading and math. Again, however, this school's intervention components, procedures, or organizational structures were not outwardly different as compared to the other schools in the study.

Even though a tremendous amount of the variance explained for growth rates is between schools, the only plausible conclusion to be made in this study is that there is not a school that has a statistically significantly higher growth rate in either reading or mathematics, although some schools are more effective.

Understanding the results: Unique programs. Finding characteristics of the more successful DSSF tutoring programs will require additional research. The principals and assistant principals of schools with less effective programs highlighted many of the same interventions discussed by those who led the most successful programs. Administrators of all 13 schools discussed the close alignment of the DSSF tutoring to the North Carolina Standard Course of Study. Additionally, each administrator mentioned essential components of successful tutoring identified in educational research including quality instructional staff, low adult-to-student ratios, the development of supportive staff/student relationships, and emphasis on making learning engaging and fun (Forbes, 2008). Several specifically mentioned hiring retired teachers with vast experience in presenting the North Carolina Standard Course of Study in unique and innovative ways. Close coordination between the tutor, teacher, and classroom, and careful monitoring of the effectiveness of tutoring services provided checks and balances in many programs.

As exciting as many of the results of this study are, it is disappointing that I was not able to identify unique interventions that led to success. That disappointment, however, is an excellent opportunity for additional study for a researcher who is so inclined.

Relationship to Previous Research and Evaluation

The district-wide success of tutoring children at-risk in reading and the school-specific successes in mathematics are consistent with findings of previous researchers. Elbaum and associates found that many supplemental, adult-instructed, one-to-one reading interventions for elementary school students at risk were highly effective (Elbaum et al., 2000). A study involving over 2000 elementary and junior high students revealed that students tutored by trained parents and peers improved their reading comprehension and word recognition (Topping & Whitley, 1990). Reid et al. confirmed that when tutoring is coordinated with effective classroom reading practices, as it is in Surry County, students perform better than when tutoring is unrelated to classroom instruction (Reid et al., 2008). A study of tutoring at-risk first graders reported that successful tutor-tutee relationships characterized by strong reinforcement of progress, high numbers of reading and writing experiences in which the student moved from being fully supported to working independently, and explicit demonstration of appropriate reading and writing processes achieved the greatest success (Juel, 1996). Finally, the U.S. Department of Education released a document in 2001 that identified similar interventions of effective schools found in the aforementioned studies: Programs that are successfully planned, organized, and implemented make a positive difference for children at-risk (U.S. Department of Education, 2001).

Recommendations for the Current DSSF Program

The key to the successful implementation of any district-wide program is consistency. Although each school in the Surry County School District is required to submit a plan for the remediation of disadvantaged students in reading and mathematics, the structure and implementation of the program can vary from school to school. This study has identified several schools that are more effective in delivering programs that have positive value-added effects on students. Although each school is a unique mix of social, emotional, and academic forces that may differ from year to year, if there are schools that have provided services that deliver positive value-added effects, those services, and the potential for their replication, should be investigated by the district for use in other schools.

Opportunities for Future Research and Evaluation

This study of the value-added effects of DSSF tutoring programs leads researchers to three potential categories of future evaluation. The first category of research would involve performing similar studies in other districts. The second of these categories deals with the nature of the models, specifically, the elimination of demographic variables and the inclusion of a variable in level 2 indicating participation or non-participation in a program. The third category would be for qualitative researchers interested in better understanding the nature of effective programs.

Similar quantitative studies with DSSF as the focus. There are 115 school systems in North Carolina that receive DSSF monies, and each is required to submit a plan detailing how the funds will assist students who are disadvantaged. With so many children affected by this funding, it is imperative that districts know whether their programs are effective. Application of the methodology used in this study could provide districts a longitudinal value-added approach comparison of proficiencies and developmental scale scores for children who participate in the remediation programs.

Similar quantitative studies with a different focus. Building-level administrators, district-level administrators, and school boards, among others, often ask questions regarding the performance or growth of various subgroups of students. The three-level HLM model used for this study allows for replacement of the DSSF participation variable by any yes or no variable that indicates participation or inclusion in a specific program or group. Since the addition of the yes or no variable in level 2 creates comparative data of predicted performance without regard to student demographic background, researchers are able to provide stakeholders with answers to growth-over-time related research questions for the treatment effects of any multi-year program at a school or district that targeted specific groups of students. Researchers could, for example, study the performance over time of any of the nine defined subgroups in the most recent reauthorization of the Elementary and Secondary Education Act, known widely still as No Child Left Behind, as compared to the general population (the tenth and final subgroup in the federal law is defined as all students). Value-added effects of athletic or club participation could be studied as well. The Surry County School System has planned for its next major study to use the methodology presented here to evaluate the long-term effects of participation in the school system's More At Four Pre-Kindergarten program for at-risk four-year-olds. Since children are chosen for the program in order to acclimate and prepare them for a normal Kindergarten and elementary school experience, the Pre-K study hopes to find no discernable difference by grade three in the performance of children who participated in the Pre-K program and the children who did not.

Use of the models similar to the one in this study present opportunities and potential for providing data-rich feedback to school districts and schools regarding the performance of students over time. The ability to eliminate student and school-level demographic data and focus solely on the intervention effects in question affords an important set of statistical tools for educational researchers.

Qualitative studies with DSSF as the focus. The unanswered questions in this study regarding the interventions, procedures, and organizational structures of effective school-level programs present an excellent opportunity for a qualitatively oriented researcher to study in more detail the elements of DSSF tutoring programs that are most successful. Equally important to determining if a program is successful, is the determination of why the program is successful. While this study identified successful programs, it fell short of identifying why some school-level programs outperformed others. Perhaps with more effective initial interview questions and a methodical follow-up procedure, the elements unique to the successful programs could be identified. Identification of successful interventions, procedures, and organizational structures is essential to the success of all students. Although every school is different and exactly the same structures and procedures would never produce exactly the same results in different schools, it is important that an attempt be made to identify why certain programs are successful and if that success can be replicated.

Limitations of the Study

Three categories of limitations for this study included the general level of success of the school system, the lack of data on alternative assessments, and the assumption of linearity for developmental scale scores over time.

Success in mathematics. The first possible limitation of this study dealt with the relative success of the Surry County Schools, especially in mathematics. Over 90% of students in the school system were proficient in mathematics during the years included in the study. This high level of proficiency means that the variance in developmental scale scores was reduced in mathematics. Additionally, since many children who participated in tutoring because of poor reading test scores were already proficient in mathematics, tutoring in mathematics was probably not as high a priority for the tutors involved in the program.

Alternate assessments. The next limitation of the study occurred because students with disabilities who participated in alternate assessments were excluded from the study. In North Carolina, there are two alternate assessments for students with disabilities. These assessments are called NCEXTEND1 and NCEXTEND2. NCEXTEND1 is for students with a significant cognitive disability who are taught through an alternate version of the standard course of study, while NCEXTEND2 is for students whose disability has precluded them from achieving at grade level standards, yet who are taught with the regular standard course of study. Neither of these two tests have developmental scale scores that are linear in nature, and scores from the tests were therefore excluded from the study.

Linearity of developmental scale scores. In order to use any type of regression analysis, whether ordinary least squares regression or multi-level modeling in HLM, a basic assumption of linearity is assumed. This study was no exception. In order to perform the analysis in HLM to determine the value-added effects of tutoring, I had to assume that developmental scale scores over time were linear in nature. While it could be argued that this assumption is true over the course of multiple years for the entire state, the developmental scale scores in any one school system over a short period of time are not necessarily linear across all levels of performance.

Concluding Thoughts

My interest in DSSF tutoring began several years ago when, as principal of a rural elementary school, I ran an afterschool tutoring program funded by DSSF for some of our most at-risk students. I most remember how on the first day, one particular student named Bradley shifted uncomfortably on the couch in the teacher's lounge off the main office hallway, having only been in this back part of the office once before. That one previous time, a disciplinary issue kept him isolated from the other students for half of the day. This day, he was waiting for a dinner of hamburgers and hot dogs, with chips and a drink, served by his principal and assistant principal as a part of the tutoring program. Bradley, like all the students in the program, arrived that morning on the bus for a regular school day, attended all his classes, received two extra hours of instruction from a certified fifth grade teacher, and then waited in the teacher's lounge for his dinner to be served. The hamburgers and hot dogs arrived and Bradley, along with the 15 other students in the highly specific program, absolutely gorged themselves on hamburgers and hot dogs, chips and cookies, and juice and milk. It is hard to say which intervention affected Bradley more throughout the program - the tutoring or the food.

The results presented in this study are encouraging. Data regarding the mean reading growth over time of students in the DSSF program show interventions in place allowing academically disadvantaged students an opportunity to catch to their peers. Math growth results, while not as encouraging, still show progress. It is most important, however, that we always remember that our mean research data is composed of individual students like Bradley.

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APPENDIX A

Gmail by Google

Jeff Tunstall <jeffrey.tunstall@gmail.com>

IRB Notice

IRB <irb@appstate.edu> **Thu, May 20, 2010 at 11:45 AM**
To: jeffrey.tunstall@gmail.com
Cc: olsongh@appstate.edu

To: Jeffrey Tunstall
Les - Leadership & Educational Studies
CAMPUS MAIL

From: Julie Taubman, Institutional Review Board

Date: 5/20/2010

RE: Notice of IRB Exemption

Study #: 10-0237
Study Title: Value-Added Effects of Disadvantaged Student Supplemental Funding on Students in the Surry County Schools
Exemption Category: (1) Normal Educational Practices and Settings

This submission has been reviewed by the IRB Office and was determined to be exempt from further review according to the regulatory category cited above under 45 CFR 46.101(b). Should you change any aspect of the proposal, you must contact the IRB before implementing the changes to make sure the exempt status continues to apply. Otherwise, you do not need to request an annual renewal of IRB approval. Please notify the IRB Office when you have completed the study. Thank you.

CC:
George Olson, Leadership And Edu Studies

APPENDIX B

SURRY COUNTY SCHOOLS

OFFICE OF THE SUPERINTENDENT

To Whom It May Concern:

As Superintendent of the Surry County Schools, I grant Jeffrey Clark Tunstall, Director of Student Accountability, permission to utilize the Surry County Schools' test data at his disposal to evaluate the value-added effects of programs of remediation and/or tutoring provided in each of our thirteen elementary and middle schools through Disadvantaged Student Supplemental Funding for the purpose of his Dissertation Research as a student at Appalachian State University. I additionally grant Mr. Tunstall permission to request that the principals of these thirteen schools complete a short questionnaire regarding the aforementioned remediation and/or tutoring programs at their schools and I certify that Mr. Tunstall does not have a direct supervisory evaluative role in relation to the principals according to the current administrative structure established by our Board of Education. This permission is contingent on the confidentiality and anonymity of the data as related to individual students, staff members, and schools.

Sincerely,

Ashley F. Hinson, Jr., Ed.D.

336•386•8211 *fax* 336•386•4279
209 N. Crutchfield Street • P.O. Box 364 • Dobson, North Carolina 27017

APPENDIX C

TO: Surry County Schools K-8 Principals
FR: Jeff Tunstall
RE: Questionnaire for Principals Regarding DSSF Remediation and/or Tutoring

Principals,

As part of my doctoral studies at Appalachian State University, I am planning to research the value-added effects of Disadvantaged Student Supplemental Funding on students in the Surry County Schools over the past three school years. As a part of this research, I am requesting your input in order to lend some descriptive data to the quantitative data I will collect.

Your participation is completely voluntary and will in no way be tied to any evaluation process that may affect your employability in the future. You may choose to participate fully or withdraw your responses at anytime prior to publication.

The potential benefits of your participation include allowing for a deeper understanding of the test data collected and the potential for replication of a successful program throughout the district in the future.

Your completion of the survey indicates your agreement to participate. Should you choose to participate, please answer the following four questions and reply with your response to tunstallj@surry.k12.nc.us.

Questionnaire for Principals Regarding DSSF Remediation and/or Tutoring

1. Disadvantaged Student Supplemental Funding was established to help close the achievement gap between students with economic hardships and those without. How does your program identify the children the state intends to target?
2. The economic achievement gap is most identified as discrepancies between groups in proficiency on EOGs and EOCs. How does your program address these particular deficiencies?
3. School systems with low-income populations receive multiple state and federal funds designed to target disadvantaged students. Describe how your school has used Disadvantaged Student Supplemental Funding in a manner unique from the other funds such as Low Wealth Funds and Title I Funds.
4. We have discussed many times in our system how EOG and EOC proficiency is a narrow part of the spectrum of overall performance and student academic success. What effects unrelated to EOGs and EOCs, both positive and negative, have you noticed in the students because of your program?

ABOUT THE AUTHOR

Jeffrey Clark Tunstall is the son of Margaret Tunstall and the late Dale Tunstall. He was born in southwestern Pennsylvania, where his mother still resides. He graduated from Bethel Park Senior High School and received his Bachelor of Science degree in Secondary Education from West Virginia University in 1988. In May of 2005, Jeffrey completed a Masters of Arts degree in School Administration from Gardner-Webb University. In May of 2007, he completed the Education Specialist degree at Appalachian State University and then enrolled in the Educational Leadership doctoral program at Appalachian State University in the summer of 2007. He completed his Doctorate of Education in Educational Leadership in December 2010.

Jeffrey began his educational career as a substitute teacher and swimming coach in western Pennsylvania, before moving to North Carolina in 1990 and beginning a full-time position at North Davidson Middle School, where he taught middle grades science and mathematics. In 1995, Jeffrey moved to Mount Airy, NC and began teaching middle grades science and mathematics at Mount Airy Middle School while continuing to coach all levels of competitive swimming. While enrolled in his first course at Gardner-Webb University in 2003, Jeffrey was offered an assistant principal position with the Surry County Schools at Copeland Elementary School. In the fall of 2005, he was chosen as the principal of Cedar Ridge Elementary School. In August of 2007, Jeffrey became the Director of Student Accountability in the Surry County Schools where his responsibilities included all summative test administrations; disaggregation and analysis of all district-wide data; district data management systems; and staff development related to testing and data management for administrators, teachers, and staff.

Jeffrey and his wife Leah, also originally of Bethel Park, PA, have four daughters: Kaitlyn, Courtney, Kelsey, and Anne-Louise.