

## ABSTRACT

Dixie Friend Abernathy. AFFLUENCE AND INFLUENCE: A STUDY OF INEQUITIES IN THE AGE OF EXCELLENCE (Under the direction of Dr. Marjorie Ringler). Department of Educational Leadership, March, 2009.

This study analyzed the impact of school poverty levels on variances in elementary math achievement and preparation-based teacher effects. The research was conducted using data from the Gaston County School District, the seventh largest district in North Carolina with over 32,000 students and 2,000 teachers. For this study, math achievement was determined as the mean academic change, or achievement growth, for each class of students assigned to a particular math teacher. Using an Analysis of Variance (ANOVA) this study examined whether significant differences in student math achievement existed when comparing levels of teacher experience, teacher education, and National Board certification. Factorial analyses were utilized in order to determine any effect from school socioeconomic level.

Results of this study determined that the impact of teacher experience on student math achievement is significant, influencing 5% of the variance in a student's math achievement growth. The variance in this teacher experience effect was determined to be most significant when comparing teachers with 0-3 years of experience to teachers with 10 or more years of experience. Based on the results of this research, it was concluded that teacher education level has no significant impact on student math achievement. This study also determined that National Board certification does have a significant impact on student math

achievement, with a small effect size influencing 3% of the variance in student math achievement.

When these same three teacher effects were analyzed along with school socioeconomic levels, there were no interaction effects that were found to be significant. In analyzing main effects in these two-way analyses, the main effect of teacher experience, when crossed in a factorial analysis with school socioeconomic level, was determined to retain its significant impact on student math achievement, with the significant variance focused on the differences between teachers with 0-3 years of teaching experience and teachers with 10 or more years of experience. The main effects of teacher education and school socioeconomic level were determined to have no significant impact on student achievement. The main effect of National Board certification was determined to have no significant impact, while the main effect of school socioeconomic level, when considered crossed with National Board certification, was determined to have an impact on student math achievement.

In recognizing teacher experience and National Board certification as significant teacher effects, this research provided the foundation for a compelling educational discussion regarding effective teachers and student learning. In addition, this research has substantiated the belief that significant proportions of variation in student achievement lies within schools rather than between schools.

AFFLUENCE AND INFLUENCE:  
A STUDY OF INEQUITIES IN THE AGE OF EXCELLENCE

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by  
Dixie Friend Abernathy

March, 2009

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A STUDY OF INEQUITIES IN THE AGE OF EXCELLENCE

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## DEDICATION

I wish to dedicate this dissertation to my beloved family. To my loving husband of eighteen years, John, I thank you for your humor, your encouragement, and the many hours that you took care of our beautiful children in order to allow time for this research to be conducted. Your support will always be remembered and appreciated.

To my wonderful son, Samuel, I thank you for being my steadfast supporter and for all of the interest you took in my study. The many times you said “Good job, Mom” meant more to me than you will ever realize. You also served as my role model, for you proved to me through your own endeavors the strength it takes to finish the most difficult of challenges. I truly admire you and will always be so proud of all you do.

To my lovely daughter, Rachel, I thank you for your sweet disposition and your ever-present positive attitude towards everything life brings to you. You may not have realized it, but you served as my inspiration for this dissertation. You showed me the importance of enjoying life as it comes, through the ups and the downs. It was your “peace out” attitude that got me through many long nights of work and the many edits needed to bring this research to completion. You truly inspire me, and I will always be so proud of all you do.

And to my precious little one, my daughter Jordan, I thank you for your sweet kisses, your tender hugs, and for the many times you told me “good luck

on your dissertation!" Knowing you were cheering me on made me ever mindful of the joy you bring to me each and every day. You are such a beautiful gift and blessing, and I will love you always.

To my loving parents, Gaylord, and Billie, I thank you for your support, your guidance, and the love you provide to myself and my family. To my dearest mother, Linda, thank you for showing me early on in my life what great teachers look like. For you, dear mother, were the greatest of teachers.

Finally, I wish to dedicate this dissertation to the two sweet people who encouraged me to pursue this dream...Joe and Blanche. This most cherished of gifts that you have given so freely will always mean so very much to me. I am proud to be part of your family and will always be most grateful for your many years of kindness and love.

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## CHAPTER 1: INTRODUCTION

### *Statement of the Problem*

Throughout the majority of the 20<sup>th</sup> century public education was generally regarded as one of the most respected institutions in the United States (Fowler, 2009; West & Peterson, 2003). Though public concern with the quality of teaching was an enduring theme (Good, McCaslin, Tsang, Zhang, Wiley, Bozack, & Hester, 2006), rarely was the entire public educational system criticized, scrutinized, or assumed not to be providing an appropriate education to the nation's school-aged children. Educators, respected as experts in their field, were trusted by the majority of American families in educating the nation's youth (Boyd & Kerchner, 1988; Guthrie & Koppich, 1988; Shanker, 1983; Sykes, 1983). In addition, the United States was viewed globally as a leader in the realm of education, being the first country to enact universal elementary education and the first to create comprehensive schools where children from all backgrounds could learn together in a common framework (West & Peterson). This era of contentment with public education rapidly and dramatically changed, however, with the advent of what Boyd and Kerchner described as "neo-conservative sentiment and political power, with 'Thatcherism' in the UK, echoed by 'Fraserism' in Australia and 'Reaganism' in the USA" (Boyd & Kerchner).

Specifically in the United States, during Reagan's presidency, American public education and educational policy began a dramatic transformation. With the release of the federally-sponsored National Commission on Excellence in

Education report *A Nation at Risk: The Imperative for Educational Reform* (1983), it became evident that what was once assumed to be an adequate system of public education was now scrutinized as a system of broken processes and unrealized goals (Guthrie & Koppich, 1988). The Commission used language that, in the opinion of Noddings, was “alarmist” (Noddings, 2004), and all but predicted that the United States would lose its competitive edge if public education did not improve (Kerchner, Koppich, & Weeres, 1997; Shanker, 1983). With the *Nation at Risk* report acting as the catalyst, and continuing with the *No Child Left Behind* Act of 2001, the most sustained educational reform movements in the history of the United States were implemented (Boyd & Kerchner, 1988).

In response, the focus of education, both in political and social realms, shifted to issues related to increased student achievement and accountability (Betts & Danenberg, 2003; Boyd & Kerchner, 1988; Fowler, 2009; Good et al., 2006; Hanushek & Raymond, 2002; Kerchner et al., 1997; Moe, 2003; Urdan & Paris, 1994). As parents and the public in general became more interested in student achievement gaps as well as disparities in teacher qualifications and school resources, these stakeholder groups demanded higher levels of academic performance as well as more efficiency in the expenditures and allocations of the public investment in education (Boyd & Kerchner; Ladd, 1996; Shanker, 1983).

Thus over the past two decades, since *A Nation at Risk*, public schools have been both motivated and directed to improve. One way public schools have responded to this challenge is by focusing on the quality and preparation of its

educator workforce as well as the identification of the characteristics of high-quality teaching and teachers (Gallagher, 2004; Gimbert, Bol, & Wallace, 2007; Konstantopoulos, 2006; Wenglinsky, 2000; Wright, Horn, & Sanders, 1997). The same assertions from almost 40 years ago by educators such as Lezotte and Edmonds are continuing to be asserted by contemporary researchers such as Dufour, Eaker, Sanders, Marzano, and Schmoker, that the success of our schools and our students depends, more than anything, on the quality of teaching in the classroom (Ding & Sherman, 2006; Dufour, Eaker, & Dufour, 2005; Good, 1983; Kaplan & Owings, 2001; Marzano, Marzano, & Pickering, 2003; Nye, Konstantopoulos, & Hedges, 2004; Rowan, Correnti, & Miller, 2002; Sanders & Horn, 1994; Schmoker, 2005; Sykes, 1999; The Teaching Commission, 2004; Wright et al., 1997). Schmoker (2005) added another dimension to this assertion: “Unfortunately, much of the instruction we provide is not what it should be” (p. 135). The critical role that teaching holds in the success of our schools is magnified when the teaching is not effective in terms of student achievement.

In considering the equity of teacher quality, two studies in particular clearly articulated the impact of individual teacher’s quality to student learning, and, even more significantly, the cumulative and lasting effects that effective or ineffective teachers have on student achievement. The first was the work of Sanders and Rivers at the University of Tennessee (Sanders & Horn, 1994; Sanders & Rivers, 1996; Wright et al., 1997), based upon the Tennessee Value-

Added Assessment System (TVAAS). During a multi-year period of analysis, Sanders and Rivers focused on the effect on students when placed with high performing teachers (those able to produce high student achievement results as compared to the students' predicted performance) as opposed to those students placed with low performing teachers. The study found that when children, beginning with third grade, were placed with three high performing teachers in a row, they scored at the 96<sup>th</sup> percentile on Tennessee's statewide mathematics assessment at the end of fifth grade. When children with similar achievement histories in third grade were placed with three low performing teachers in a row, the end of fifth grade achievement on the same mathematics assessment was at the 44<sup>th</sup> percentile. In comparing these students of comparable abilities and educational backgrounds, it was concluded by Sanders and his associates that the individual teacher's quality accounted for this 52 percentile point difference (Sanders & Horn; Wright et al., 1997).

The second study, conducted by Mendro, Jordan, and Weerasinghe in 1997, concentrated in the Dallas Public Schools and was a replication of Sanders and Rivers' 1996 cumulative effects research. Mendro et al. (1997) completed a multiple linear regression using a Dallas Public Schools model that controlled for the effects of mobility, crowding, family income, family educational level and percent of minority students, as well as other variables (Mendro, 1998). In the Dallas study, students in first grade were placed with three high performing teachers in a row. At the conclusion of their third grade year, their average

performance on the math section of the Iowa Tests of Basic Skills had increased from the 63<sup>rd</sup> percentile to the 87<sup>th</sup> percentile. When their peers in first grade were placed with three low performing teachers in a row, the students' average performance decreased from the 58<sup>th</sup> percentile to the 40<sup>th</sup> percentile. In addition, the Mendro et al. study also looked at reading achievement and found similar results (Mendro).

The Dallas and Tennessee studies both established that the effects on achievement of these early high performing and low performing teachers were significant. Students taught by low performing teachers were later unable to catch up to their peers, even after being placed with high performing teachers for years afterwards (Mendro, 1998; Sanders & Horn, 1994; Sanders & Rivers, 1996; Wright et al., 1997).

In light of this individual teacher influence, school districts analyzed research studies to determine teacher effects that could relate to teacher quality and student learning (Boyd, Grossman, Lankford, Loeb, Michelli, & Wyckoff, 2006; Heck, 2007; Konstantopoulos, 2006). Educational leaders developed policies to retain and recruit teachers who possessed characteristics most likely to positively impact student achievement (Heck). Laws allowing retirees to return to work enabled schools to retain some of its most experienced teachers (Alvy, 2005). Classroom educators were encouraged through pay incentives and grants to pursue advanced degrees (Chubb & Moe, 1988; Turner, Camilli, Kroc, & Hoover, 1986). A new standard of professional expertise was introduced with

National Board Certification, and teachers were enticed with significant salary bonuses as the reward for attaining this distinction (Kelley & Kimball, 2001; Serafini, 2002; Shive, 1988).

As the expectation for improved student achievement increased, the focus was on teacher quality. The inputs that teachers brought to a school, including experience, licensure, professional preparation, teacher examination scores, and professional certifications, were recognized as contributing to the quality of their teaching (Kaplan & Owings, 2001). Credentials and preparation were compared with the value of field experiences in determining the quality of teaching in varying school populations.

In addition to teacher preparation-based effects, the *Nation at Risk* report, and later, *No Child Left Behind*, has helped to identify the achievement gaps seen nationwide between “at-risk” and more affluent populations. The 1965 Elementary and Secondary Education Act (ESEA) was developed to “level the playing field” for these students, providing supplemental services designed to assist them in achieving at comparable rates to their less impoverished counterparts (Guthrie & Koppich, 1988). The law’s intent, however, did not achieve its purpose, as student achievement levels in low socioeconomic schools continued to decrease and the actual number of low socioeconomic schools steadily increased (Kodrzycki, 2002).

While much research was conducted into the impact of poverty on a child’s progress in school (Coleman, Campbell, Hobson, McPartland, Mood,

Weifield, & York, 1966; Fallon, 2006; Vandenberghe, 1999), less attention was given to the influence of certain teacher effects on student learning and whether the impact of these teacher effects changed in significance based on the socioeconomic status of the student population. The analysis of teacher preparation-based effects on student achievement when contrasted against a school's student socioeconomic level provides educational leaders research that will help improve student achievement.

There is conclusive research on student effects and home effects. The studies on teacher effects that may have significant influence on student achievement have not been as conclusive. It is important to understand, according to research and based on standardized student test score results, the qualities or preparations that distinguish a high performing teacher from a low performing teacher. Since public schools are evaluated by student achievement results (Senge, Ross, Smith, Roberts, & Kleiner, 1994), and are dependent upon the assumption that if the inputs are correct, such as high quality teaching, the results will follow (Dufour et al., 2005, p. 20), the identification of the most productive teacher effects on student achievement is key to any future reform success and educational policy (Boyd et al., 2006; Heck, 2007). Therefore, to address the problem of improving student achievement, research on teacher preparation-based effects poses solutions resulting in a positive influence on student achievement.

### *Purpose of Study*

There were two purposes of this study. The first was to expand upon earlier research that analyzed the impact of teacher education and preparation effects on student math achievement. For this study the specific focus was to determine whether any or all of the three teacher effects of teaching experience, teacher education, and National Board certification demonstrated variances in elementary mathematics achievement in the Gaston County, North Carolina, school district. The second purpose of this study was to examine whether any of the established differences in mathematics achievement related to teacher effects were varied when comparing teachers in higher socioeconomic school cultures to teachers in lower socioeconomic school cultures.

In carrying out these two specific purposes, this study examined the multiple interactions between these specified teacher effects and how the influence of these effects varied based on student socioeconomic levels within the Gaston County district schools. The Gaston County school district was selected as the population for this study based on several factors. During the 2007-2008 school year, Gaston County was the seventh largest school district in North Carolina, with 53 schools and a total student enrollment of 33,000 students. The size of this district provided a large data base and provided justification for the generalizing of results to the statewide population. In addition, the ethnic distribution of students in Gaston County was fairly representative of the state as a whole. In the state of North Carolina, African-American students

make up 31.2% of the student population, Hispanic students make up 10%, and Caucasian students make up 55%. In comparison, during the 2007-2008 school year, 20.3% of Gaston County's students were African-American, 7.5% were Hispanic, and 68.2% were Caucasian. The graduation rate of Gaston County was 72.3%, consistent with the state rate of 69.7%. Twenty-three percent of teachers in Gaston County held advanced degrees, as compared to 25.4% in the state of North Carolina. Finally, with approximately 50% of its student population qualifying for free and reduced lunch benefits, Gaston County was representative of the economic challenges facing students across the state. These demographic and quantitative comparisons illustrate the applicability of using Gaston County Schools as the population for this research.

The report of the American Educational Research Association (AERA) Panel called for studies like this one:

Much more research is needed about the relationships between teacher education components, pathways, and experiences, on one hand, and various aspects of pupil's learning, including but by no means limited to learning as measured by standardized test scores, on the other. We need both more studies that closely examine the outcomes of teacher education for pupil's learning and broader views of what constitutes pupil's learning in the first place. We also need studies that try to sort out the many factors, including teacher

preparation, that influence pupil's growth over time (Cochran-Smith & Fries, 2005, p. 33).

Research currently exists that demonstrates compelling conclusions. The 2002 work of Rowan et al. found that professional preparation of teachers can show a substantial correlation to student achievement. Likewise, a 50-state survey analysis conducted by Darling-Hammond resulted in the conclusion that teacher preparation accounts for 40% to 60% of the variance in student achievement, after the removal of student demographic factors such as poverty and language backgrounds (Darling-Hammond, 2000; Kaplan & Owings, 2001). These two brief examples represent a plethora of prior research that exists on this issue and provided the broad foundation for this study's more narrowed framework.

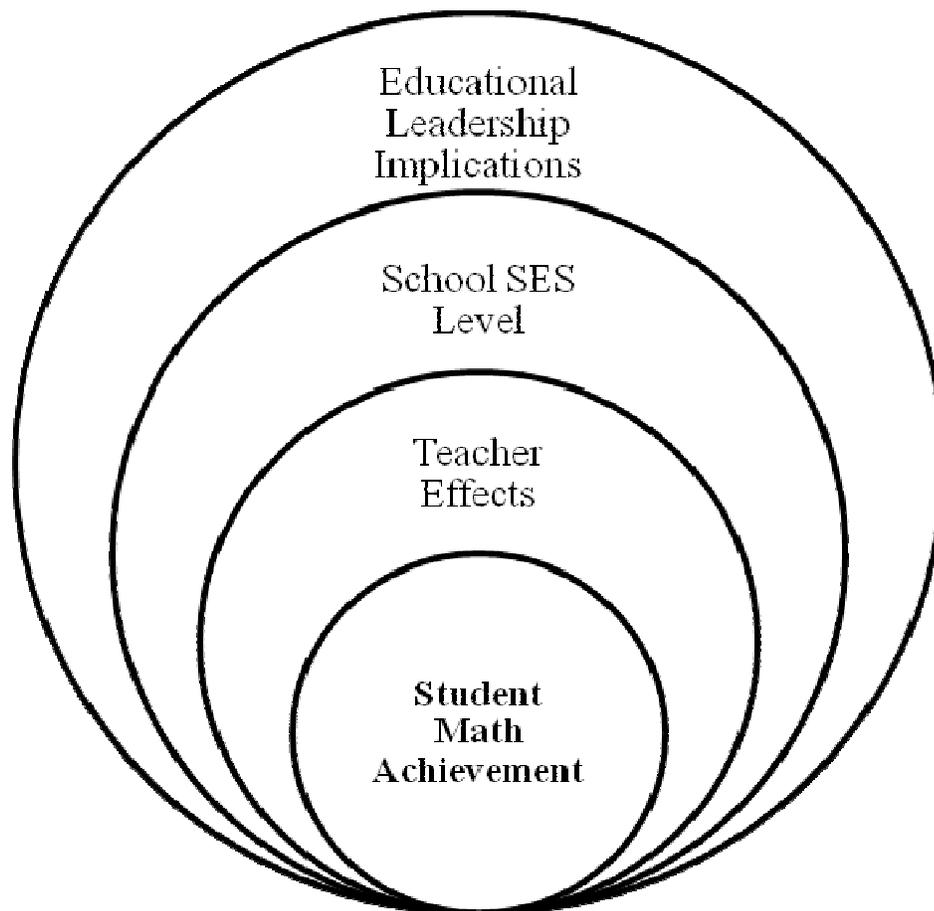
### *Conceptual Framework*

The conceptual framework for this study is illustrated in Figure 1.

### *Design of the Study*

In this dissertation the following questions were posed:

1. What is the impact of teacher's level of experience on mean achievement growth in mathematics for students in grades 3-5?
2. What is the impact of teacher's level of education on mean achievement growth in mathematics for students in grades 3-5?



*Figure 1.* Conceptual framework.

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3. What is the impact of teacher's National Board of Professional Teaching Standards certification on mean achievement growth in mathematics for students in grades 3-5?
4. What is the impact of teacher's level of experience and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?
5. What is the impact of teacher's level of education and school socioeconomic level on mean achievement growth in mathematics for grades 3-5?
6. What is the impact of teacher's National Board of Professional Teaching Standards certification and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?

### *Data Analyses*

Several analyses were utilized in this study in order to establish the acceptability of the null hypotheses and the responses to the research questions. Included here is a description of each of the statistical tests used and a summary of each test's purpose.

*Analysis of variance.* Separate one-way ANOVAs were conducted to determine whether means on the dependent variable of elementary math achievement growth were significantly different among the levels of teacher experience, teacher education, and National Board certification.

*Factorial analysis of variance.* A two-way ANOVA was conducted to evaluate the effects of school socioeconomic level on elementary math achievement growth means among levels of teacher experience, teacher education, and National Board certification. This included a 3 X 2 analysis for teacher experience, a 2 X 2 analysis for teacher education, and a 2 X 2 analysis for National Board certification, each determining the effects on elementary math achievement growth means.

*Post-hoc.* When significant effects were demonstrated in either of the ANOVAs used to evaluate differences in math mean achievement growth among the levels of teacher experience, Post-Hoc comparisons were conducted. Only the teacher experience ANOVAs held the potential for Post-Hoc comparisons, as these involved more than two levels.

### *Population*

The data used for this research was generated from the Gaston County school district in North Carolina for the 2007-2008 school year. At the time the data was generated, this district was the seventh largest in the state and was generally representative of the population of North Carolina. During the 2007-2008 school year, the average school SES level in Gaston County was 52.18%. During this 2007-2008 school year there were 333 elementary teachers who held master's degrees, a full 22% of the elementary teacher workforce. In addition, Gaston County had 185 National Board certified employees during this time, with the elementary schools averaging 3 National Board certified teachers per school.

Also during this time period, the average years of teaching experience of the Gaston County teacher workforce was 13 (Gaston County Schools Human Resource Department, 2008).

Student math achievement data was analyzed for Gaston County's thirty-one elementary schools, for a total of 6,093 student achievement result scores. The large size population produced results that may be generalized to the larger population of elementary public schools across the state and nation.

### *Variables*

In studying the effects of teacher experience, teacher education, and National Board certification on student achievement, this analysis acknowledged a large number of student- and school-related variables. Many of these variables were not under the control of the study and will be described thoroughly in the section *Threats to Validity* in chapter 3 of this report.

The independent variables used as measures of teacher effects included years of experience, level of education, and National Board certification. Regarding school variables, the independent variables included the school's status as a Title I school (50% or higher free and reduced lunch student population) or a non-Title I school. This Title I designation was used to indicate that a school was low SES. The percentages to determine Title I were set by the Gaston County School district during the 2007-2008 school year.

The singular dependent variable in this study was the mathematics achievement growth, or academic change, posted by students as represented by

a class mean for each teacher. This variable was measured by the students' 2008 North Carolina End-of-Grade test results in mathematics, and standardized using the North Carolina growth formula, which has been in place since 2006-2007. The North Carolina End-of-Grade tests were designed and validated by the North Carolina Department of Instruction and are mandated for all students in grades three through eight. For this study, math results from grades three, four, and five were analyzed.

#### *Data Sources*

The data sources used in this study were generated by the school district and were given with permission from the district's superintendent to the researcher for analysis and study (see Appendix B). The following is a brief summary of the data sources that were analyzed in this research. A full description of the intended use and possible limitations associated with each is provided in chapter 3.

*Student standardized test results.* The first data source was the Gaston County 2008 End-of-Grade math test results for third, fourth, and fifth grades. The mean academic change, or growth, of each teacher's class of students was calculated from the data.

*Teacher experience level.* The second data source utilized in this study was information on the teacher experience level of each Gaston County teacher in grades 3-5, in values of cumulative years of classroom teaching. Teacher experience was analyzed in three categories: new teachers (in years 0-3 of their

teaching careers); established teachers (in years 4-9 of their teaching careers); and career teachers (in year 10 or more of their careers).

*Teacher education level.* The third data source analyzed in this research were the levels of education obtained by the teacher. This information was grouped into two different categories: teachers who hold a bachelor's degree only and teachers who hold an advanced degree. The advanced degree category included master's, educational specialist, and doctorate degrees because very few Gaston County teachers hold degrees beyond a master's degree.

*National board certification.* The fourth data source analyzed in this research was the attainment of National Board certification. This information was grouped into two different categories: teachers who have obtained this National Board certification and teachers who have not.

*School Title I status.* The final data source analyzed in this research were the Title I/low SES schools (those schools with 50% or more students qualifying for free and reduced lunch) and non-Title I/high SES schools. Each teacher and set of mean math achievement growth (c-scores) were designated in terms of whether the teacher was assigned to a Title I/low SES school or a non-Title I/high SES school.

### *Significance of the Study*

The need for this research is timely and may provide significant implications in the global, national, state and local educational arenas. Factors that may affect the success of low socioeconomic schools would be significant

information for educational leaders to utilize in planning. As the achievement in low SES schools increases, the achievement gaps that currently exist between children from poverty and their student counterparts begin to decrease. Teacher effects that may show specific differences in terms of student achievement will provide educational leaders specific information to consider when hiring and retaining quality teachers for the specific context of each school.

This research also holds considerable implications for the human resource function of educational leadership. Inferences drawn from this research could potentially be used in assessing the effectiveness of teacher support programs, the wisdom of placing less experienced teachers at lower socioeconomic schools, and the need for specific professional development for beginning teachers and experienced teachers. If the poorest students do most often get the least experienced teachers (Ayala & Claassen, 2007; Betts, Reuben, & Danenberg, 2001; Zumwalt & Craig, 2005b), this research could provide valuable implications for past successes or failures in the implementation of *No Child Left Behind* and a new direction in strategic placement of personnel in struggling schools. Decisions on recruitment, hiring, placement, and support may all be potentially affected by the conclusions of this study.

The research in this study could also be used to either support or refute the considerable funding devoted to encouraging and rewarding teachers who obtain National Board for Professional Teaching Standards (NBPTS) certification and advanced degrees. In the past, lucrative packages have been offered at the

state level to encourage teachers to pursue such endeavors. While it may be true that newer and more veteran teachers are reportedly leaving the profession to avoid what National Education Association president Bob Chase described as the “instructional straightjacket” imposed by testing (Gorman, 2001), it is relevant to question the existence of any teacher effects that may result in increased success on standardized tests.

On the local level, this study holds potentially significant implications for the leadership of the Gaston County school district. At the time of this study, seven low socioeconomic elementary schools had entered into state sanctions as a result of low student achievement. Research that examines the differences in certain teacher effects and student achievement in low as well as high SES schools could have a significant impact on hiring patterns within the Gaston County district. Current policies that regulate the placement of inexperienced teachers in low SES schools could be revisited depending on the results of this study. Based on the conclusions of this research, recruiting efforts and resources could be utilized using patterns that represent the greatest potential for school success.

Exploring existing research and charting new territory in regards to these leadership issues provides not only a foundation of long-held assumptions and research-supported relationships, but also various indications of the need for further research as assumptions are questioned and quantitative results are analyzed. Review of these very topics is not a foreign idea, as the early 1966

work of Coleman and his colleagues as well as the reanalysis of his work by Jencks, Smith, Ackland, Bane, Cohen, and Ginter demonstrated (Coleman et al., 1966; Jencks, Smith, Ackland, Bane, Cohen, Ginter, & et al., 1972). Coleman was unable to establish strong relationships between teacher characteristics, such as educational background, and their students' achievement, and was also unable to discern differences in the strengths of these relationships based on the poverty or affluence level of the school itself (Coleman et al., 1966). Yet Coleman's work was just the beginning.

During the four decades that have passed since the Coleman report, hundreds of studies have been conducted on the impact of teacher effects (Wilson, Floden, & Ferrini-Mundy, 2001). Many of these studies produced inconclusive results or determined the lack of any relationships between teacher effects and student achievement. There were, however, many examples of teacher effect research that concluded that certain teacher effects are indeed positively related to student achievement (Ferguson & Ladd, 1996; Greenwald, Hedges, & Laine, 1996; Konstantopoulos, 2006; Odden, Borman, & Fermanich, 2004; Wayne & Youngs, 2003). In adding to this building body of work, the implications from this research could be far-reaching and hold the potential for enormous impact on the educational arena nationwide and, ultimately, on each of the nation's more than 50 million students.

### *Operational Definitions*

*Achievement gap* - The gap in achievement or growth towards achievement as demonstrated among different subgroups of students. One example is the frequent occurrence of achievement levels that are higher in affluent schools and lower in schools where poverty is common (Gardner, 2007).

*Advanced degree* - This term refers to any degree beyond a bachelor's degree, including a master's degree (in education or a content area), an educational specialist degree, or a doctorate degree (Gaston County Schools Human Resource Department, 2008).

*Developmental scale score (DSS)* - This term refers to the scale score measure assigned to each student score on standardized achievement tests (North Carolina Department of Public Instruction, 2007b).

*End-of-Grade tests (EOG)* - This term refers to the standardized achievement tests administered in the state of North Carolina to all third through eighth graders (North Carolina Department of Public Instruction, 2007b).

*High quality teacher* - High quality teachers are "ones who consistently obtain higher than expected gains in student performance" (Hanushek, 2003, p. 90).

*Low quality teacher* - Low quality teachers are "ones who consistently obtain lower than expected gains" in student performance (Hanushek, 2003, p. 90).

*National Board Certification* - Refers to certification from the National Board for Professional Teaching Standards (NBPTS), a “teacher-led national standards board whose goal is to advance the teaching profession” (Kelley & Kimball, 2001, p. 548). This certification is the end result of a teacher’s successful completion of a process that includes a prepared portfolio as well as an assessment of mastery. This certification is believed by many to go beyond the minimum requirements of state licensure in recognizing accomplished professional practice (King, 1994). This may also be referred to as NB certification.

*SES* - SES represents socioeconomic status, either of individual students or of a school’s student population. The traditional measures of SES are family economic resources (Konstantopoulos, 2006).

*Student achievement* - This term refers to the quantitative results from standardized achievement tests. These achievement results may be analyzed for individual students and for collective student groups, and are considered as key elements of state and federal accountability systems (NCLB, 2001; Linn, 2003)

*Teacher effect* - Observable independent and additive variables (Kupermintz, 2003) that are estimated as “between-teacher variance components of achievement status and residualized achievement gains” (Nye et al., 2004, p. 234). This is also referred to in some studies as “teacher inputs” or “teacher characteristics”.

*Teaching experience* - Refers to the number of years a teacher has taught prior to and including the 2007-2008 school year. This level includes years of service that are consecutive or interrupted. This level also includes years of service outside of the public school sector, such as years of teaching in a private school (Gaston County Schools Human Resource Department, 2008).

#### *Null Hypotheses*

1. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's level of experience.
2. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's level of education.
3. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's certification through the National Board of Professional Teaching Standards.
4. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent upon the level of teacher experience and a school's socioeconomic level.
5. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent upon the level of teacher education and a school's socioeconomic level.

6. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent upon the level of teacher certification through the National Board of Professional Teaching Standards and a school's socioeconomic level.

#### *Limitations of the Study*

Several factors beyond the researcher's control were acknowledged as producing possible limitations to the results and conclusions.

#### *Validity of Standardized Tests*

It has long been debated whether standardized tests should be considered so significantly in the assessment of teacher effectiveness in regard to student learning. With the arrival of *No Child Left Behind*, the debate became even more fervent, as states, districts, and schools were required to pay more attention than ever before to standardized test results. Standardized tests, such as the End-of-Grade tests highlighted in this study, do indeed measure outcomes that have been deemed as important by policy makers and state leaders. This study relied heavily on this form of data to establish the existence of relationships between teacher preparation characteristics and student achievement, but did so with the acknowledgement that standardized achievement tests measure only a small part of student learning. As Boyd et al. (2006) described, in focusing on standardized measures of achievement, educators may miss important aspects of learning and other valued outcomes.

### *Mid-Year Teaching Change*

There are some instances during a typical school year, and especially in larger districts, in which mid-year attrition brings about the need for a teacher change. For example, if teacher X, who has twenty years of experience, started the school year and taught until March, only to move out of town and be replaced by teacher Y (who is a teacher with two years of experience), the standardized test scores for that class of students will have teacher Y's name at the top, even though teacher Y had very little time with the students, comparatively speaking. While this does not happen every day, even one time is more than any district or school would desire. To protect the study from this skewed data, the researcher only included data from teachers who had taught in their specific school at least 140 days prior to student testing.

### *Student Assignment*

In conducting this study it was acknowledged that there is no realistic way to assure that the classes assigned to each of the hundreds of teachers involved in this study were equal. There can be no doubt that variances within each class and between classes did occur, including but not limited to variances in: cognitive abilities, motivation, socio-economic status, English proficiency, parent education level, attendance, previous retentions, physical limitations, and parental support. The advantage to using a large population, as was done in this study, is in the lessened impact of variances within a particular group. For this study, the mean c-score for each class represented the actual growth of the students compared to

the predicted growth for students. In addition, the school district being studied here, Gaston County Schools, had a district-mandated class assignment policy in the elementary grades. Each school was required to assign classes heterogeneously, or as representative as possible of the entire school population. Only student data representing students in membership at least 140 days prior to testing were included. That having been stated, there was no manner in which a perfectly distributed and equal student assignment in each of these thirty-one schools and hundreds of classrooms could be assured by the researcher in this study.

#### *Secondary Source Data*

An additional general limitation was due to the use of secondary source data for this research. While the documents used to gather information on teacher demographics and student achievement growth were valid and reliable, they were sources that were not produced specifically for research purposes.

#### *Generalization from Population*

While the size of the Gaston County School district was large enough to provide a substantial population for this study, generalizations to other districts cannot be made with full confidence because each school district has unique factors as determined by region, membership, size, and resources.

#### *Summary*

Throughout much of the 20<sup>th</sup>-century, the United States was regarded as global educational leaders (Fowler, 2009; West & Peterson, 2003). Public and

political skepticism grew, however, with the release of the federally sponsored *Nation at Risk* report (1983), which ushered in two and half decades of educational reform efforts (Boyd & Kerchner, 1988). In political and social realms, the focus of education shifted to issues related to excellence and accountability, as demonstrated through increased student achievement, and culminating in the *No Child Left Behind* Act of 2001 (Fowler, 2009; Hanushek & Raymond, 2002; Moe, 2003; Urdan & Paris, 1994).

Through this shift, the public schools have been both motivated and expected to improve. Success in this age of excellence and accountability is most dependent on the quality of teaching in the classroom (Dufour et al., 2005; Good, 1983; Kaplan & Owings, 2001; Marzano et al., 2003; Nye et al., 2004; Rowan et al., 2002; Sanders & Horn, 1994; Schmoker, 2005; Sykes, 1999; Wright et al., 1997). Specifically, the work of Sanders and Rivers (1996) as well as Mendro (1998) demonstrated the impact of individual teacher quality to student learning. In recognition of this reality, school districts have developed policies aimed at recruiting and retaining teachers who possess qualities most likely to positively impact student achievement (Gallagher, 2004; Gimbert et al., 2007; Konstantopoulos, 2006; Wenglinsky, 2000; Wright et al.). Relating this teacher impact to “at-risk” populations of students is relevant for school districts as well, as student achievement levels in lower socioeconomic schools continue to decrease (Kodrzycki, 2002).

### *Organization of the Dissertation*

Chapter 1 is an introduction, defining the problem and establishing the purpose and significance of the study. Chapter 2 will provide a review of the research related to the key topics of this study. A synthesis of this body of work provided a foundation of knowledge as this study set forth in analyzing the influence of teacher effects and school socioeconomic level on student achievement. Chapter 3 discusses the methodology used in this study, while chapter 4 presents an analysis of the data. Chapter 5 presents conclusions and recommendations for further study.

## CHAPTER 2: REVIEW OF LITERATURE

### *Scope of the Review*

This chapter provides a review of literature on research pertaining to teacher effects, student achievement, the impact of socioeconomic factors on the teaching and learning in schools, and the implications for educational leaders in considering research related to these three variables. This collective source of literature was carefully synthesized in order to review and respond to the seven distinct categories analyzed in this chapter: (1) *teacher experience*, (2) *teacher degree level*, (3) *National Board certification*, (4) *other teacher effects*, (5) *school SES effects*, (6) *No Child Left Behind*, and (7) *implications for educational leaders*. The synthesis of research as well as the empirically based data was relevant as the interrelatedness between teacher effects and student achievement was examined against the backdrop of 21<sup>st</sup> century reform and accountability. It should be noted that many of the studies highlighted in this review were carried out as “production function” studies, which are designed to determine the relation of specific measured teacher characteristics with student achievement. This type of study, however, is not without its challenges. When looking at possible correlations between the achievement of students and characteristics of the teacher, how can one be sure that the effect was of the teacher and not of some other influence, such as student background, individual ability, or family support (Nye et al., 2004)? As Wright et al. (1997) described: “Partial confounding of educational (teacher) effects with factors exogenous to

schooling influences and the nonrandom assignment of students to teachers are two of the reasons most often assumed to be insurmountable obstacles to this type of inquiry.” Due to these and other issues, many reviewers of “production function” or teacher effect studies find it difficult to interpret the results to the extent that it describes a cause and effect relationship (Olson, 2003). Therefore, this literature review acknowledges these challenges even as these empirical and observational sources were blended to provide a foundation upon which the research designed for this study could be anchored. In studying the successes and limitations of past research, this current study was designed in a manner that avoids potential pitfalls and produces the most valid and reliable of results and conclusions.

### *History and Design of Teacher Effects Research*

Before delving into the three specific teacher effects analyzed for this study, it is relevant to briefly discuss the nature and history behind teacher effect research over the past half century, much of which is known in the research community as production function studies. Production function refers to equations that are used to show the relationship between inputs and outputs (Wilson et al., 2001), and in the case of education, the relationship between particular teacher characteristics and the academic achievement of students (Konstantopoulos, 2006). While production function studies in the economics and business realm are quite precise and controlled, educational researchers have discovered quite a few challenges in applying this type of research to education

(Odden et al., 2004). As Hanushek (1986) described in his *Economics of Schooling*:

The realities of education...differ considerably from such pedagogical assumptions. Indeed, the production function is unknown...and must be estimated using imperfect data; some important inputs cannot be changed by the decision maker; and any estimates of the production function will be subject to considerable uncertainty (p. 1,149).

The primary challenge with education production function studies as well as teacher effects research is the difficulty in measuring teacher effects separately. Distinguishing between teacher inputs and student behaviors in describing relationships between teacher effectiveness and student learning is a major challenge (Heck, 2007). Due to these recognized imperfections with many teacher effect studies, many researchers have concluded that a number of these educational studies do not hold up to methodological scrutiny (Greenwald et al., 1996; Heck; Wenglinsky, 1998). Therefore, it is widely recognized that more research is needed to identify exactly what teacher effects most positively and significantly correlate with student achievement.

Such was the case with the first major production function education analysis, the *Equality of Educational Opportunity* report. This report is most commonly referred to as the "Coleman Report", in recognition of its primary author, Coleman. This report was a mandate that was included in the Civil Rights

Act of 1964 and was originally designed to study the distribution of education resources across the nation in terms of equity for various races and ethnic groups. In gathering this resource data, however, an extensive statistical base regarding specific school factors (including teacher factors) was created (Hanushek, 2003). One of the key findings from this report was that when the socioeconomic background of the student was held constant, the differences among schools could only be linked to a small fraction of the differences in student achievement (Coleman et al., 1966). Coleman et al. concluded that families and peers have the most significant impact on student learning, therefore relegating schools and the differences among school effects as a factor of less or even no importance (Coleman et al., 1966; Hanushek, 2003). If true, this conclusion would indicate that a particular school or a particular teacher just simply did not matter (Hanushek, 1986).

After its original acceptance and a subsequent intensive debate, the educational community soon came to directly question the methods and conclusions drawn in the Coleman report as well as question the impact of teachers and schools on the performance of students (Hanushek, 1986, 2003). One such study included a complete reanalysis of the Coleman data conducted by Jencks et al., known as the *Inequality* report. While Jencks would eventually determine that the results in this reanalysis were inconclusive, much of the work to follow set clearer directions regarding the impact of teacher effects.

The Coleman report inspired and prompted over 400 studies and four decades of subsequent research into what school and teacher effects may possibly impact student achievement (Wenglinsky, 2000). One example of this was the research of Konstantopoulos (2006) who conducted his analysis on school and teacher effects using three national data bases of high school senior achievement scores: NLS:72, HSB:82, and NELS:92. From this research came a conclusion that appears to be widely accepted, that a substantial proportion of the variation in student achievement lies within schools and not between schools. In math achievement, 34% of the variation in achievement was between teachers, with 18% of the variation between schools. In science, similar results were found with 23% of the variance in achievement attributed to teacher differences and 18% attributed to school differences. In this particular study, teacher heterogeneity in student achievement was larger than school heterogeneity, which indicates that teacher effects have a larger impact on student achievement than even school effects (Konstantopoulos, 2006).

These brief examples of the Coleman, Jencks, and Konstantopoulos studies highlight the complexities and disagreements associated with teacher effect research. Over the course of numerous studies, the findings are still ambiguous at times, with some researchers finding little or no evidence of a relationship between teacher effects and student achievement (Coleman et al., 1966; Hanushek, 1986; Jencks et al., 1972), and others reporting a substantial correlation between the two (Greenwald et al., 1996; Hanushek, Kain, & Rivkin,

1998; Konstantopoulos, 2006; Wright et al., 1997). Wenglinsky contends that of these hundreds of teacher effect studies, 30% indicate a beneficial link between teaching experience and student outcomes, 20% show a beneficial link between teacher salaries and student outcomes, and 10% show a beneficial effect of teacher education level on student outcomes (Wenglinsky, 2000). Thus, for every study that shows a positive correlation between a particular teacher effect and student learning, there are potentially several studies that do not (Ferguson & Ladd, 1996; Wenglinsky, 2000).

While the Coleman report utilized data collected specifically for Coleman's study, most of the newer teacher effect studies do not replicate this approach. Much of the research following Coleman's has been what Hanushek (2003) describes as "opportunistic", using available data to gain insight and understanding of certain school functions and factors. While these early studies from Coleman and Jencks asked primarily whether teachers and schools make a difference, the trend of more current research was to ask what distinguished successful schools and teachers who consistently produce high achievement from those schools and teachers who consistently do not (Shulman, 1983). Some of this more current work has been approached through the study of the effect of varying resources on student achievement (Hanushek, 2003), while others have been conducted against the backdrop of NCLB requirements and high quality teachers (Heck, 2007). Despite the initial motivation or intended purpose of each study featured in this literature review, the fact remains that

there are many contrasts as well as many similarities among designs, findings, and implications.

### *The Effect of Teaching Experience*

While hundreds of studies have been conducted on teacher effects and student achievement, it could be assumed that most of these studies relate to observable teacher attributes, and that out of these one of the most widely studied effects would include teacher experience level, primarily because this data is readily available from district data (Heck, 2007). Therefore, a plethora of research exists that analyzes the impact of teaching experience on student learning. Before reviewing the empirical studies available on this relationship, it is relevant to first discuss the characteristics, assumptions, and challenges associated with the most experienced and least experienced of our teaching workforce.

### *The Influence of Teaching Experience*

Education may be one of just a few professions in which the job description for a 30-year veteran and a novice are virtually identical (Johnson & Kardos, 2005), but such is the case in our K-12 public schools. If the job description is the same, the way in which these different professionals carry out the job and are regarded by their peers certainly is not. Individual teachers bring various strengths and talents to their particular roles, and often these skills are honed and perfected over years of service in the profession. Longevity within the profession is revered in such a way that years of experience are rewarded with

tenure, higher salaries, and often better teaching assignments (Chubb & Moe, 1988) Salary incentives for years of experience indicate a state or district's willingness to quantify through a dollar figure exactly how much the technical skills and talent improvements attained by virtue of experience are worth (Turner et al., 1986).

In considering the value of experience in the teaching profession, it is important to look at the group of professionals who make up this most experienced of our teaching workforce. Johnson and Kardos considered these distinct characteristics in their study of gaps in teaching experience in our nation's schools. From their observations, Johnson and Kardos (2005) were able to offer this description of experienced teachers:

When the cohort of teachers now preparing for retirement entered the profession in the late 1960s and early 1970s, public service was respected and long-term careers were the norm...those who entered teaching at that time were the first cohort to make teaching a lifetime career....Women and people of color found that the teaching field welcomed them, whereas other professional fields, such as banking and law, presented social barriers to entry. As a result, public schools attracted a talented and committed cohort of new teachers at relatively low expense. On the job, these teachers have expressed similar preferences. Most of them have chosen to focus on their careers on becoming better teachers within the

classroom instead of seeking administrative positions beyond it. As a group, they prize the privacy of their classrooms and rely on their colleagues primarily for social support (p. 10).

Veteran teachers are often convinced that they have honed their craft knowledge and teaching skill through a natural development that occurs through their annual experiences in the classroom (Nuthall, 2004). Luft, Bang, and Roehrig (2007), focused specifically on science teachers and the value of experience in fostering a new generation of science teachers. As Luft et al. (2007) discovered, experienced teachers tend to bring a deep understanding of the field of teaching, which comes from years of professional development opportunities and an ongoing dedication to improving their teaching (Luft et al.).

Recognizing that experienced teachers offer schools and students certain valuable qualities that only come with years of service, retaining these veterans has become as much of a challenge as retaining those new to the profession. Alvy (2005) studied this very issue in his analysis of veteran teachers. Alvy found that while our emphasis is often on support programs for our new teachers, veteran teachers are just as much in need of support and encouragement to retain their interest in the profession. As Alvy sees it, the wealth of experience that comes with age should be celebrated, with major efforts aimed at the goal of retaining these cherished teaching veterans. According to Alvy, there are several ways to encourage and support our experienced teachers, including making them mentors for younger teachers, designing differentiated professional growth

activities, and providing a school culture that honors experience and wisdom (Alvy).

Regardless of the strengths of this experienced teaching cohort, the reality is that teachers stop teaching for many reasons. With an increasing student enrollment nationwide, many states now find themselves faced with the possibility that the number of new teachers that will be needed to fill their classrooms each year will be greater than the total number of teachers currently working in the public schools (Algozzine, Gretes, Queen, & Cowan-Hathcock, 2007). The U.S. Department of Education estimates that new teachers will be entering U.S. schools in record numbers in the next decade, due to retirement and class size restrictions (Boreen & Niday, 2000).

In the 1990s, the number of first-time teachers increased sharply, which some took as a possible indication that the reserve pool of teachers was shrinking. About half of these new teachers came directly out of college on the traditional track to teaching. The other half came from delayed entries into teaching and alternative routes to education (Zumwalt & Craig, 2005b). Due to this trend, more teachers now graduate with majors in content areas rather than in education (Zumwalt & Craig, 2005b). These late-entry “new” teachers were also more likely than their traditional counterparts to hold more advanced degrees (Zumwalt & Craig, 2005b).

One perceived strength of this newer generation of teachers lies in the non-traditional means by which they find themselves in the teaching profession.

Johnson and Kardos (2005) explain:

Earning a traditional teaching license is increasingly becoming optional, and today's recruits follow multiple routes to the classroom...Moreover, many new teachers today are career switchers. Our random-sample surveys of teachers in six states show that between 33% and 48% of those entering teaching today come from another line of work rather than straight from college. Therefore, the conventional image of the new teacher as a young, fresh college graduate fails to fit a significant portion of those entering classrooms today (p. 11).

As pointed out in this study, "inexperienced teacher" does not necessarily translate into "inexperienced professional", and "new teacher" does not necessarily translate into "young teacher".

There were some drawbacks, however, to these non-traditional new teachers. According to the 1996 National Commission on Teaching and America's Future (NCTAF) report, not only were more new teachers predicted to be hired during the decade to follow, but it was also predicted that many newly hired teachers were and are unqualified for the job (NCTAF, 1996). This assertion is made based on the number of new teachers who enter classrooms

with provisional, emergency, or temporary licenses, or, in some cases, no license at all (Goldhaber & Brewer, 2000).

Despite the tendency for “high-quality teacher” and “experience” to be used interchangeably, it is not always a foregone conclusion that experienced teachers are superior when compared to their inexperienced colleagues. In their 2007 study, Ayala and Claassen found that some principals actually prefer to hire inexperienced teachers, citing their energy and progressive practices to veteran teachers who were often reluctant to think outside of the box (Ayala & Claassen). Winkler found in her research into teacher contrasts that inexperienced teachers were actually more accepting of standardized testing and the information that could be gleaned from it, while experienced teachers viewed standardized testing in terms of losses (Winkler, 2002).

There are certain unarguable hurdles that face newer teachers, just by the very nature of lack of longevity in the profession. In her observations on inexperienced, non-traditional teachers, Sara Lipka (2007) shared that the observed teachers were “earnest and driven, but ...are also novices [and] they need help” (Lipka, p. 34). Another body of research suggests that new teachers have one basic goal in mind, and that is survival (Mandel, 2006, p. 66). There is a certain amount of expertise that can only be linked to experience. New or inexperienced teachers often lack the opportunities to be involved in professional development opportunities, and when they are, often these activities are irrelevant in meeting their needs (Maciejewski, 2007; Mandel). As noted in the

Mandel and Maciejewski studies, without an opportunity to be involved in meaningful professional development, novice teachers may never progress beyond the “survival” stage of teaching.

Another challenge that faces new teachers is the nature of education, by design, to foster collaborative relationships among colleagues. As Cookson (2007) describes: “For people who have never taught it’s difficult to understand how isolating the teaching profession can be. Teachers are in their classrooms with their students with very few breaks; the chance to interact with other teachers is limited and very often there is no telephone or other way of communicating beyond the classroom” (p. 1). The early years of teaching, and especially the first, are considered as critical periods in learning to teach, but new teachers have traditionally been left on their own (Nemser, 1983). Without established relationships among the school staff, new teachers are at a disadvantage in terms of their ability to share new ideas and learn from their peers (Boreen & Niday, 2000; Keller, 2007; Luft et al., 2007; Sanders, 2007).

Due to these and other challenges, the newest of our workforce posts higher attrition rates than their more experienced counterparts - which in turn indicates a profession that cannot maintain its current pool of educators (Cochran & Reese, 2007). Depending on the research cited, anywhere from 25%-50% of teachers in their first five years of teaching are leaving the profession each year (Boreen & Niday, 2000; Keller, 2007; Maciejewski, 2007). There are some pundits who joke that “education is a profession that eats its young”, and these

attrition figures would certainly seem to support that notion (Delgado, 1999). If new teachers are to not only survive but to equal their more experienced counterparts in teaching quality, much will depend on the support systems in place by individual schools and districts (Nemser, 1983). Research has shown that the most effective means of supporting and retaining this newest cohort of educators in our public schools is through successful induction programs (Boreen & Niday; Maciejewski; Mandel, 2006), which, if designed effectively, include the elements of mentor training and support, opportunities to observe experience teachers, opportunities to network, and professional development that translates theory into classroom practice (Boreen & Niday; Maciejewski; Mandel).

When carried out effectively, induction programs can have a positive impact on teacher retention and even student achievement. The Consortium of Chicago School Research describes one example of this impact that was observed in the Chicago Public Schools. In this study, teachers who were involved in a strong induction program, including strong mentoring, collaboration, principal's support and encouragement, and observations and feedback, were 50% more likely to not only remain in education but to also remain in the same school. Similar results have been noted in Ravenswood City School and Oakland Unified School Districts in California and Durham Public Schools in North Carolina (Maciejewski, 2007). In addition, analysis of student achievement scores in the classrooms of these participating teachers showed that "first and second-year teachers in the induction program were as effective as fourth-year

teachers who had not previously been in the program. Not only do students benefit by having a more effective teacher, but the district receives the equivalent of a fourth-year teacher while paying a beginning teacher's salary" (Maciejewski, p. 51).

While obvious contrasts exist between teachers who have substantial teaching experience and those newer to the profession, educational research and the key issue of improved student achievement leave little room for assumptions. Teacher effect research requires a close analysis of the relationships or lack thereof regarding the impact of teaching experience on student achievement and learning.

#### *The Influence of Teaching Experience on Student Achievement*

More experienced teachers have long been assumed to hold an advantage over their novice colleagues for a variety of reasons. The possibility of actually proving this assertion through empirical data was the premise behind several studies over the past two decades. One such study into the teacher experience effect was that conducted by Ronald Ferguson (1991) using data from 900 school districts in Texas. Although the effect of teacher experience was not isolated in this study, but rather grouped together with degree level and licensing exam score, it is pertinent to this review nonetheless. Ferguson found that this grouping of "teacher expertise" accounted for about 40% of the variance in students' reading and math gains on achievement tests (Ferguson, 1991). This "expertise factor" had more influence on the variance of student

achievement than any other factor studied. Although teacher experience was just one component of this trio of effects, one could reasonably conclude that experience played a significant role in these research results.

Five years later, Greenwald et al. (1996) found through their research that if a student's teacher is a novice in a first career teaching position, the student's gains will likely be less than if the student's teacher possesses six or more years of teaching experience. This data on experience gaps provided strong evidence that teacher experience does indeed impact teacher effectiveness (Fallon, 2006; Greenwald et al.). Soon after the Greenwald study, Wenglinsky was able to support these findings through his analysis of National Assessment of Educational Progress (NAEP) data (Bracey, 1997; Wenglinsky, 1998). The correlation between teaching experience and student achievement had been firmly established.

Another research report of this topic was prepared by Wilson et al. for the U.S. Department of Education and the Office for Educational Research and Improvement. This report, *Teacher Preparation Research: Current Knowledge, Gaps, and Recommendations*, utilized over 300 publicized research reports related to teacher preparation in order to summarize conclusions for the purpose of improved teacher preparation (Wilson et al., 2001). Although most of the research studied for this report dealt with undergraduate teacher preparation programs and majors, there were twelve studies that looked at the issue of teacher experience. Wilson et al. found that the majority of these studies resulted

in positive associations between teacher experience and student achievement, although it was also noted that at least two studies found that the benefits of teacher experience cease after 5 years (Ferguson, 1991; Wilson & Floden, 2003).

Adding to the body of research was a more recent study carried out by Nye et al. (2004). This research team studied student performance gains and concluded that there does exist a relationship between teacher experience and improved gains (Nye et al.; Wiggan, 2007). The team also noted that while the teacher effect in their research did enjoy a significant correlation, there was an even stronger correlation involving the socioeconomic status of the student, echoing findings from almost forty years earlier (Coleman et al., 1966; Nye et al.; Wiggan).

Fetler (1999) noted these same positive correlations in his school-level study of student achievement in California. While cumulative teacher experience did hold a positive correlation to student achievement, Fetler also discovered a negative effect on student achievement that was proportionally related to the number of beginning teachers in the school (Fetler; Wilson et al., 2001). This finding is of special interest to low SES schools as these schools most often have a disproportionate percentage of beginning teachers on staff.

While many other studies exist regarding the positive effect of teacher experience on student achievement, not all of the research into this issue is of this same opinion. The fact that achievement of students during the time span

from 1960 to 2000 flatlined or decreased even as the median years of teacher experience rose from 11 years to 15 years certainly could have prompted some to question the validity of Ferguson's results (Fallon, 2006; Hanushek, 2003)

A study conducted by Gallagher as a sidebar to his analysis of teacher evaluation systems utilized data from Vaughn Elementary School in Los Angeles. Gallagher studied correlations between teacher experience and student achievement and found there to be no significant relationships (Gallagher, 2004). These conclusions would support the earlier work of Jencks et al. (1972), who set out to analyze this question and concluded that the correlation between teacher experience and student achievement is weak at best. Jencks et al. studied the effects of various school and teacher characteristics and found that "experienced teachers are more competent than average in some systems, less competent than average in other systems" (Jencks et al., p. 96). Jencks also explained how the general assumption that experience causes high achievement could have been so readily accepted, as districts, in a teacher retention effort, allow its more experienced teachers to move to its better schools (Jencks et al.). As these more experienced teachers are assigned "better" classes in "better" schools, the higher student achievement could be taken as a result of more effective teachers when in actuality it is a reflection of selective class assignments.

In analyzing over 350 production function studies in 2003, Hanushek concluded that while 29% of these showed a positive and significant correlation

between teacher experience and student achievement, the other 71% showed no significant correlation or, in some cases, a negative correlation. Hanushek also pointed out, as Jencks had, that a possibility of reverse causal relationships existed, with more experienced teachers often getting to choose their students, which in turn results in at least a portion of any positive correlations being called into question (Hanushek, 2003). The Hanushek review clearly illustrates the challenges of production function-type studies. As school and teacher variables remain uncontrolled, certain possible scenarios tend to skew the results and interpretations.

#### *The Effect of Teacher Education Level*

The public concern regarding teacher quality and student achievement includes concern about the quality and impact of the professional preparation in which teachers are engaged (Good et al., 2006). While this concern would include questions related to the effectiveness of teacher education programs, it also pertains to the usefulness and impact of advanced degrees and post graduate work. The level of education for an individual teacher is a pertinent issue, as degrees and work toward degrees influence a teacher's salary as well as professional competence (Sweet & Jacobsen, 1983). While teachers may be exposed to many professional growth activities as part of in-service training, there are some that would suggest that the education of teachers themselves is best accomplished at the college or university level (Fallon, 2006). The format or location of this graduate work towards a master's degree (or beyond) is not the

focus of this study. Rather, the purpose here is to determine how these differences in level of education can impact teachers' abilities to improve student achievement.

Despite Murray's contention that the value of an advanced degree in teacher education is held in anything but high regard (Murray, 2000), the quest for advanced teaching degrees appears to have caught fire. In the forty year span from 1960 to 2000, the percentage of teachers with master's degrees had more than doubled, from 24% to 56% (Fallon, 2006; Hanushek, 2003). This significant rise has now made possession of a master's degree the norm for teachers rather than the exception. This assertion would be especially accurate for the Northeast region of the United States and for the high school level, both of which boast higher rates of teachers with master's degrees than their counterparts (Wenglinsky, 2000).

This trend would appear to be a positive one if taken in light of the teacher quality research conducted by Coleman et al. in 1966. Although overall Coleman concluded a negligible impact of teacher effects on student achievement, he did find a correlation between pupil achievement and certain indices of teacher quality, with a teacher's level of educational attainment being one such index (Coleman et al.). Coleman also concluded that this correlation appears to strengthen as the student progresses through the higher grades (Coleman et al.; Fallon, 2006).

The existence of certain salary incentives for the attainment of an advanced degree would also appear to suggest that policy makers and educational leaders believe this professional graduate work to make a difference. This belief is evident as districts and states demonstrate a willingness to quantify, through a dollar figure, exactly how much the technical skills and talent improvements attained by virtue of the advanced degree are worth (Turner et al., 1986).

These financial rewards and the ever growing population of teachers pursuing advanced degrees between 1960 and 2000 would certainly appear on the surface to be positive trends. These efforts, however, become more difficult to applaud when compared to the trends in student achievement over the same time span. Despite the increased level of education and the incentives that accompany such, student achievement from 1960 to 2000, as measured by the National Assessment of Educational Progress, has failed to significantly increase in reading or math and has, in fact, decreased in science (Fallon, 2006; Hanushek, 2003). The impact of an advanced degree on a teacher's ability to produce high student achievement is therefore a topic of great interest and one heavily researched throughout the past three decades.

*Educational Pursuit: Affecting What Teachers Know and Do*

The importance of the knowledgeable and skilled teacher is clearly articulated in the National Commission on Teaching and America's Future (1996) report *What Matters Most: Teaching for America's Future*. This lengthy report

summarizes its findings through this challenge: “We propose an audacious goal...By the year 2006, America will provide every student with what should be his or her educational birthright: access to competent, caring and qualified teaching” (National Commission on Teaching and America’s Future, 1996). Following two years of discussions regarding several hundred studies of teaching, this National Commission on Teaching and America’s Future concluded that the reform of the public schools would depend on the improvement of teaching (Darling-Hammond, 1998; National Commission on Teaching and America’s Future). While identifying three different avenues through which this improvement should occur, the first was one that a growing body of research appears to support: What teachers know and do is one of the most important influences on what students learn (Darling-Hammond, 1998).

It has been accepted by many educators, including Darling-Hammond and Sykes, editors of the handbook *Teaching as the Learning Profession*, that professional teachers must be involved in career-long professional education experiences, which culminate in the well-educated, scholarly, and accomplished teacher (Darling-Hammond, 1999; Sykes, 1999). Such would be the impetus behind the pursuit of an advanced degree in education, such as a master’s, an educational specialist, or an education doctorate degree, by current classroom teachers.

It should also be recognized that teachers who take the time and initiative to pursue advanced degrees may already be at an advantage over their

colleagues in terms of productivity. By pursuing such a process these teachers are demonstrating a desire to improve their own capabilities. This intrinsic motivation on the part of the teacher means that his learning is part of his own individual vision, and that he will most likely make an effort to keep learning alive throughout his career as a teacher (Senge et al., 1994). This self-pursued learning then has a positive impact on the school as a whole, as “an organization develops along with its people” (Senge et al., p. 193).

In attaining an advanced degree, a teacher is exposed to an education that enables her to synthesize technical knowledge, skills and judgment while considering a wide array of social, economic and political factors (Delaney, 1997; Sparks, 2005). Experiences that have the most impact on the improvement of teaching are those that literally change the brains of teachers. Educators have these experiences when they read, write, observe, use various thinking strategies, listen, speak, and practice new behaviors in ways that deepen understanding and produce new habits of mind and behavior. Teachers are then able to combine this new knowledge into ways that alter classroom practice (Sparks).

In terms of the impact of this advanced degree work on teacher perceptions, one specific study demonstrates positive correlations. A study conducted by Parsad, Lewis, and Farris, sought to establish the difference that an advanced degree potentially makes in a teacher’s perception of her own preparedness. After surveying over 5,000 K-12 teachers, this research team

concluded that of the 60% of this group who reported feeling very well prepared to meet the overall demands of teaching, almost 50% held master's degrees (Parsad, Lewis, & Farris, 2001). The challenge for educational researchers, therefore, is to establish whether perception truly is reality and whether the increased knowledge base and altered teaching practices that accompany advanced degrees bring about improvements in student achievement.

#### *The Influence of Teacher Education Level on Student Achievement*

At first glance, one might assume that a plethora of conclusive research exists describing the extent to which differing levels and types of teacher education influences teachers and ultimately impacts student learning. In reviewing the research on the effectiveness of teacher education programs and varying levels, however, little has been conclusively determined (Boyd et al., 2006; Wayne & Youngs, 2003). This may be due to several reasons, one of which is a significant challenge that impedes any analysis of teacher preparation, *selection bias*. In approaching this analysis, one must consider that teachers who choose to pursue graduate degrees may have significantly different background characteristics from those who choose not to pursue this advanced work (Boyd et al., 2006). While this issue is one to be answered separately from this study, selection bias is no doubt a factor to be considered as the literature on this subject is reviewed.

In response to their aforementioned *Teacher Preparation Research* (Wilson, Floden, & Ferrini-Mundy, 2001), Wilson and Floden (2003) produced a

follow-up report intended for the purpose of answering specific questions that had been raised by the 2001 report. This addendum included a key question: What characteristics of new teachers contribute the most to teaching effectiveness? Instead of focusing only on new teachers, Wilson and Floden answered with a sweeping analysis of the characteristics of *all* teachers that contribute most to teaching effectiveness. In addressing the impact of a teacher's level of education on student achievement, the response given was that these results are not conclusive or consistent and that there exists neither a positive or negative relationship between the two (Wilson & Floden).

In generating the original report, Wilson et al. (2001) highlighted several significant studies that dealt with the topic of teacher level of education, one in particular being the 1994 work of Monk. Monk's research used 51 randomly selected school sites and over 2,500 students as well as student achievement data from the NAEP to compare the impact of teacher degree level to student performance. Monk's conclusion regarding teacher level of education was that not only did a teacher's degree level have no effect on student achievement, there was also some indication that it may have had a negative relationship to student achievement (Monk, 1994; Wilson et al.). These conclusions were supported a year later through Hanushek's data analysis, as only 14% of the prior production function studies reviewed demonstrated a positive correlation between teacher's education level and the achievement of students (Hanushek, 2003).

Another meta-analysis into this topic was conducted by the American Educational Research Association (AERA) Panel on Research and Teacher Education (Cochran-Smith & Zeichner, 2005). This panel critiqued more than 500 peer-reviewed studies of the impact of certain teacher preparation programs on teacher performance and student learning. In reporting the results of this analysis, Cochran-Smith and Zeichner came to the conclusion that although some studies did conclude that teacher preparation and certification had a positive impact on educational outcomes, the research base related to teacher education was neither deep nor reliable (Cochran-Smith & Fries, 2005; Cochran-Smith & Zeichner; Schalock, Schalock, & Ayres, 2006).

In response to the AERA report, Schalock, Schalock, and Ayres conducted their own eight-year investigation into the connection between teacher preparation and student learning with their *Teacher Effectiveness Study*. The major conclusions from this study included the determination that no positive relationships exist between measures of student learning and teacher preparation efforts (Schalock et al., 2006).

The extensive research base regarding the lack of correlation between teacher education level and student learning is impressive and convincing. The Education Commission of the States analyzed close to 100 studies on teacher education, yet was unable to draw any significant conclusions (Good et al., 2006). Fallon (2006) reviewed literally hundreds of journal articles on this topic, and found in doing so that over half was based on anecdotal case studies and

many of the remaining utilized principal ratings, not standardized student achievement results, to determine quantitative effectiveness (Fallon). This conclusion would appear to support Hanushek's (1986) earlier work, from which he asserted "the almost universal finding that graduate education of teachers bears no systematic relationship to achievement" (p. 1,165). Wenglinsky analyzed NAEP data as well as the U.S. Department of Education's Common Core of Data and Teacher Cost Index and concluded that a teacher's highest degree had no effect on student achievement (Bracey, 1997; Wenglinsky, 2000). Hawk, Coble and Swanson (1985) also concluded through their analysis that a teacher's effectiveness had little to do with their coursework or degrees.

Contrasting research, however, does exist, and is equally compelling and thought-provoking. A rather extensive teacher effect study from the state of Colorado analyzed the teacher effect of advanced degree through the lens of the impact of salary incentives. Accessing the data base from the Colorado Department of Education on 181 different districts in Colorado, Turner et al. (1986) set out to examine correlations between certain teacher effects that were linked to salary incentives and student achievement. This research team discovered that as the percent of elementary teachers with master's degrees increased from 0% to beyond 65%, student achievement in the elementary schools increased by about 23% (Turner et al.). This research also found that the impact of a master's degree on student achievement permeates school SES level. A low SES school will have even lower achievement scores if it is unable to

recruit teachers with advanced degrees, and a high SES school will increase its (perhaps already high) student achievement if it adds more teachers with master's degrees to its staff (Turner et al.).

Goldhaber and Brewer's (2000) research also demonstrated a correlation related to teacher degree level, albeit in more particular terms. Although an advanced degree alone does not necessarily impact student achievement, an advanced degree in a particular field has a tremendous impact. In examining twelfth grade mathematics scores, there was no increase found when students had a teacher who possessed a master's degree in education, however, there was a significant increase discovered in student math scores when the teacher held a master's degree in mathematics (Goldhaber & Brewer).

One study in particular stands apart from the rest when reviewing the possibility of a positive correlation between teacher education level and student learning. Even while summarizing that no relationship exists, Wilson et al. (2001), in their *Teacher Preparation Research* report, felt compelled to acknowledge the 1991 and 1996 work of Ferguson. Embarking on an analysis of 900 school districts in the state of Texas, Ferguson (1991) found that a teacher's expertise, including the possession of a master's degree and a teacher's experience level, accounted for about 40% of the variance noted in student achievement scores in reading and math (Ferguson & Ladd, 1996). Ferguson later pursued a similar study, this time with a partner. Ferguson and Ladd analyzed a rich data set from Alabama, the 1991 fourth grade cohort consisting of over 29,000 students in 690

schools. The results were consistent with Ferguson's earlier work in concluding that teacher qualifications associated specifically with master's degrees did positively impact student achievement gains, with the most significant impact in math (Ferguson & Ladd). This particular research is widely recognized as some of the most convincing regarding a positive relationship between master's degrees and higher student achievement (Clune, 1996; Wayne & Youngs, 2003).

Considering this teacher effect research as a whole, very little is still known about the relationship between teacher level of education and how well students learn (Boyd et al., 2006; Good et al., 2006). Despite these past ambiguities, however, there continues to be an interest in establishing research that would associate teacher effects such as teacher education level with student achievement (Fallon, 2006; Schalock et al., 2006).

### *The Effect of National Board Certification*

#### *National Board Certification: The History and Process*

The National Board for Professional Teaching Standards (NBPTS) is a teacher-led national standards board that began as an independent, non-profit organization in 1987, conceptualized and implemented following the recommendations of the 1986 Carnegie Forum Task Force report *A Nation Prepared: Teachers for the 21<sup>st</sup> Century* (Shive, 1988). This report encouraged the teaching profession to act as other professions in establishing standards that would go beyond the minimum requirements of state licensure and hold the professional teacher accountable for accomplished teaching practice (Kelley &

Kimball, 2001; Serafini, 2002; Shive). Thus, the NBPTS was created in order to serve two purposes: the creation of an assessment and certification system to offer teachers an advanced certification representative of accomplished teaching and the establishment of a standards-setting board (Serafini).

Today, National Board for Professional Teaching Standards (NBPTS) certification is an elaborate assessment, grounded upon performance-based standards. These standards were created by committees consisting of K-12 teachers, professors, parents, and business leaders, and were designed for the purpose of defining “accomplished teaching” (Burroughs, 2001). This certification also enjoys endorsement at the highest level, as the *No Child Left Behind Act* designates support of the NBPTS program in targeting highly qualified teachers and teacher quality (Goldhaber, Perry, & Anthony, 2004). Consequently, one of the NBPTS stated missions is to “establish high and rigorous standards for what accomplished teachers should know and be able to do” (NBPTS, 1999). Indeed, it is the very defining of professional standards and its ability to recognize “master” teachers that that has garnered NBPTS widespread support (Kerchner et al., 1997).

Representing one of the most significant teaching reform efforts in the area of teacher quality in the last two decades (Goldhaber et al., 2004), NBPTS has posted some impressive numbers since certifying its first round of teachers in 1995. Fewer than 100 teachers nationwide were certified during that first year, but since then over 32,000 teachers, at a nationwide cost of over \$300 million,

have become NBPTS certified. All fifty states and over 500 local school districts have created incentives and recognitions for NBPTS certified teachers, with many states and districts also subsidizing the initial \$2,300 assessment fee for individual teachers (Goldhaber et al.).

The NBPTS certification process requires a teacher to describe and define one's teaching in a prepared portfolio as well as in a series of tests taken at an independent computer center. Certification is available in a variety of areas, such as early childhood or middle childhood. Within each area, the contents of the portfolio as well as the responses to test questions are made through what is referred to as entries. The portfolio consists of six entries, while the test consists of four entries, for a total of ten entries. Each entry is scored separately by two readers, with the scores averaged for each entry, then weighted according to their importance within the particular certification area. The weighted scores are then added, and if the total meets the minimum total needed for that particular certification area, the applicant is NBPTS certified. The process itself was designed to be rigorous, as evidenced by the general belief (NBPTS does not release official figures) that only 50% of all applicants are certified each year (Burroughs, 2001).

As increased numbers of teachers have pursued NBPTS certification, more interest has been given to who these teachers are and what motivates their pursuit. Kelley and Kimball (2001) studied a cohort group of NBPTS candidates from five various school districts as these teachers pursued this certification in

1999. What was discovered was, while the promise of a financial award was a huge motivating factor, there were other cited reasons why these teachers pursued this particular certification. Many found that while they may have had the desire to pursue a master's degree, the NBPTS process enabled them an intellectually stimulating alternative to course work on a college campus, with the possibility of the same benefits in the long run. In addition, some teachers viewed the Board certification process as a high-quality professional development experience and simply had the intrinsic motivation to advance their own professional abilities and knowledge (Kelley & Kimbal).

#### *The Influence of National Board Certification on Student Achievement*

Considering the national investment in this certification process, both in terms of teacher commitment as well as considerable financial investment, it is surprising to find that very few large-scale quantitative studies have targeted this process and the subsequent results (Burroughs, 2001; Goldhaber et al., 2004). Murray (2000) attributed this empirical deficiency to the timing of development and research:

The distinction between licenses and certificates is only recently made, the later being given, presumably, to master teachers, or at least very good teachers, in recognition of a kind of superior teaching competence and the teacher's articulate justification for it.

At the present time, owing to their recent development, we do not

have evidence of the validity of the assessments of these advanced standards (p. 44).

As states continue to explore and offer various incentives to teachers who attain this national certification, it is interesting to note that scant research has gone into establishing that this certification “pays off” in terms of increased student achievement. States that have implemented financial rewards have certainly seen an increase in the number of teachers certified (with North Carolina leading the way), but little is known about the effects of these incentives or the impact of the certification itself (Kelley & Kimball, 2001; Podgursky, 2001).

While these state incentives vary, it cannot be overlooked that NBPTS certification can be quite lucrative. Alabama, for example, offers a \$5,000 annual increase for the ten-year life of the certificate to those teachers who are successful in their NBPTS certification process. California offers a onetime \$10,000 bonus to NBPTS certified teachers, and then an additional \$20,000 to these same teachers who are willing to teach 4 years in low-performing schools. Florida offers a 10% salary increase for the life of the certificate, plus 10% more for those who are willing to mentor new teachers (Kelley & Kimball, 2001). Once the National Board reaches its goal of 105,000 NBPTS certified teachers, the states and districts nationwide will be spending an annual budget that tops \$1 billion in additional compensation (Podgursky, 2001). Obviously, states are quite confident that NBPTS delivers what its mission envisions: teaching excellence.

Proponents of NBPTS certification see it as an opportunity to truly reform the teaching profession through many positive effects, both direct and indirect, that result from participation in this process (Serafini, 2002). The NBPTS certification process and its assessment system have been heralded as a model for professional development (French, 1997). Others have found that this certification not only rewards the most accomplished of teachers, but also attracts potential teachers to the profession (Shapiro, 1993). Mitchell's (1998) research indicated that the NBPTS program requires applicants to think and talk about their practice in ways that feel foreign to many yet bring about tremendous growth. In addition, supporters of NBPTS certification see it as an avenue to the increased professional standing of the teaching profession while instilling a positive image of public education and teachers in the minds of the general public (Buday & Kelly, 1996; Serafini; Shive, 1988).

While there are studies on the effects of professional certification, such as National Boards, that show these to positively impact educational outcomes such as student achievement, the results in several of these studies were mixed enough to indicate the need for further research (Cochran-Smith & Fries, 2005; Schalock et al., 2006). Complicating this research further is the fact that these NBPTS certified teachers are often viewed by their principals and colleagues as excellent teachers, even *before* having gone through the Board certification process (Kelley & Kimball, 2001). Lacking a direct link between investment and results, it is no wonder than some observers question the investment of funds

into the educational system (Vandenberghe, 1999). More specifically, as Kelly and Kimball ask, “Should states and districts continue to invest in encouraging teachers to seek and obtain National Board Certification” (p. 548)?

One research study that went to the heart of this very question was conducted by Bond, Smith, Baker and Hattie (2000) out of the University of North Carolina in Greensboro. This study was designed to study the differences between teachers who had obtained NBPTS certification and those who had not, utilizing a data source consisting of sixty-five teachers, 31 of whom had obtained NBPTS certification, and 34 of whom were unsuccessful with the NBPTS process. The study made use of a review of literature that identified fifteen dimensions that indicated attributes of excellent teachers and student learning. Evidence was gathered from a variety of sources, including lesson plans, observational visits, and interviews of both teachers and students. Evidence regarding student work was obtained from two sources: (1) student products in response to teacher assignments, and (2) student writing samples in response to prompts. Evidence of student learning for this study did not include student test scores.

The results from this study indicated that NBPTS certified teachers consistently obtained higher mean scores on all of the dimensions of teaching excellence than their non-NBPTS certified counterparts. These results led to specific conclusions from the research team:

The National Board Certified teachers in this sample possess, to a considerably greater degree than non-Certified teachers, those attributes of expert teaching that have emerged from the ever-expanding body of research on teaching and learning. They possess pedagogical content knowledge that is more flexibly and innovatively employed in instruction; they are more able to improvise and to alter instruction in response to contextual features of the classroom situation; they understand at a deeper level the reasons for individual student success and failure on any given academic task; their understanding of students is such that they are more able to provide developmentally appropriate learning tasks that engage, challenge, and even intrigue students, but neither bore nor overwhelm them; they are more able to anticipate and plan for difficulties students are likely to encounter with new concepts; they can more easily improvise when things do not run smoothly; they are more able to generate accurate hypotheses about the causes of student success and failure; and they bring a distinct passion to their work (Bond et al., 2000).

Several limitations were evident in the Bond et al. study, several of which were highlighted by the research team itself. While the lack of standardized test results as a data source for student learning is significant, the research team was most concerned with the size and nature of the sample utilized. Because the

sixty-five teachers involved in this study had to first agree to do so, this was not a random sample of Board Certified or non-Board Certified teachers. As stated by the research team, “it follows that generalization to the larger populations of which these teachers are members should be approached with caution” (Bond et al., 2000).

In contrast to Bond’s research are those skeptics who recognize supposed flaws and failings of the National Board process and certification, such as the University of Cincinnati’s Burroughs. In 2001, Burroughs conducted a comparison study into whether NBPTS certification was an indication more of a teacher’s writing ability than of the teacher’s teaching itself. Burroughs analyzed the experiences of two elementary teachers who both pursued NBPTS certification during its inaugural year of 1996. After working with these two participants in a support group, conducting interviews with both about their experiences with NBPTS, and reading drafts of their NBPTS portfolios, Burroughs concluded that success in NBPTS certification is strongly related to candidates’ writing samples about their teaching, rather than an evaluation of the teaching itself (Burroughs). In his study, Burroughs found that teachers often find themselves incapable of “capturing the complexities” of their practice in written form. As Vanderberghe shared from his research, “The work teachers do is like that of other professionals: it is intellectual [and] cannot be standardized or reduced to routines” (p. 135). Burroughs sees this “articulation of standards” as a significant challenge to the legitimacy of NBPTS certification.

Burroughs (2001) also points out that, in addition to writing ability, ethnicity and race may also impact the eventual success in the pursuit of NBPTS certification. Although his survey sample was small, his research is supported by other studies. Moore (1999) surveyed more than 300 NBPTS candidates in Ohio and found that three factors proved significant in correlating with success on NBPTS certification: type of school (suburban), ethnicity (Caucasian), and writing ability (self-reported confidence). Other research suggests that teaching and discourse styles that are culturally specific may indeed affect how African-American candidates are scored by NBPTS assessors (Burroughs; Irvine & Fraser, 1998). These research results would appear to be in direct contrast to the National Board's assertion that certification is offered "to all qualified teachers irrespective of the teaching environments in which they work" (NBPTS, 1999).

The research of Bond et al. was also strongly questioned and scrutinized by Podursky in his Hoover Institution report *Defrocking the National Board* (Podgursky, 2001). While the National Board was praising Bond et al.'s research as a ground breaking study for which "no comparison can be found," Podursky ascertains that the study only shows that teachers who are National Board certified are more likely to display the types of behaviors favored by the National Board (Podgursky). While the Bond study may have taken three years and over half a million dollars in funding, it may have fallen short, due to methodology concerns, in answering the vital question of whether this certification actually translates into higher student achievement. As Podgursky explains:

No study, however, has ever shown that National Board-certified teachers are any better than other teachers at raising student achievement. Nothing has changed with the release of this report. The National Board's researchers rejected the use of student test scores as a measure of teacher performance...if the underlying measure of student achievement in these [review of literature] studies was standardized tests, as was surely the case in many of them, why are such tests acceptable as measures of teacher quality in studies that are meta-analyzed and used indirectly, but unacceptable when they are used directly to assess teacher quality in a structured research design (p. 2)?

In addition to concerns regarding equity issues, there is research that suggests that NBPTS certification may create divisions of a different nature. Some educators have challenged the NBPTS process with the assertion that it creates a competitive atmosphere rather than a collegial one (Serafini, 2002). Others suggest that in creating distinctions between teachers, a teaching hierarchy will soon follow, which is counterproductive to the "learning community" vision of the NBPTS program (Hamsa, 1998; King, 1994).

Of particular interest to this study is research conducted by Goldhaber, Perry, and Anthony (2004) in the state of North Carolina. While North Carolina will also be the setting of this report's analysis, Goldhaber et al. chose North Carolina due to its generous NBPTS certification incentives: reimbursement of

the \$2,300 NBPTS assessment fee and a 12% annual salary increase for each year of the 10-year NBPTS certificate. Basing estimations on the number of teachers certified in the year 2000 *alone*, North Carolina will have invested nearly \$50 million over 10 years (Goldhaber et al.).

North Carolina, like many states, has made a tremendous investment in the NBPTS program. Whether through media channels or peer-sharing, the advantages of NBPTS certification appears to have spread rather quickly through this state. In just three years between 1997 and 2000, the overall number of NBPTS applications rose from 0.2% of all NC teachers to 3% of NC teachers. During that same time period, the percentage of applicants who were actually attaining the certification itself rose from 41% to 52%.

After gathering data on this specific group of North Carolina teachers, Goldhaber's team was able to draw a few conclusions. Teachers who are younger, female, and African-American are more likely to apply for this certification than their counterparts. Teachers who score higher on standardized tests are more likely to apply than those who do not. Goldhaber et al. (2004) also found that African-American and male teachers are less likely to be certified than their counterparts, and that teachers who score higher on standardized tests are far more likely to gain certification than those who do not (Goldhaber et al.). These conclusions supported earlier findings regarding the impact of ethnicity on NBPTS certification success (Goldhaber et al.).

Imbedded into the formal mission of NBPTS is the following: “to advance related education reforms for the purpose of improving student learning in American schools” (NBPTS, 1999). In the vision of NBPTS is a statement regarding teachers who should be “committed to students and their learning” (NBPTS). While this formal commitment to students and their learning is integrated into the very foundation of NBPTS, very little research is able to correlate NBPTS certification, either directly or indirectly, to improved student achievement (Burroughs, 2001; Serafini, 2002). Considering that the certification has been described as “the highest honor the teaching profession has to bestow” (Podgursky, 2001), one would conclude that such a correlation must surely exist. If not, the implications for policy, budget, and professional training are significant and far-reaching. Therefore, the challenge remains: as NBPTS sets out to define and shape what teaching excellence looks and sounds like, more research is needed in order to establish if this certification actually translates into excellence as reflected in student learning.

#### *Related Research to Teacher Effects*

While this study was specifically focused on three preparation-based teacher effects, there are other teacher characteristics that have been shown to directly impact student achievement. The early work of Coleman et al. (1966) and the later production-function research carried out by Hanushek (1986) found that a positive correlation exists between teacher verbal ability and student achievement (Zumwalt & Craig, 2005b). This connection was supported by

Darling-Hammond's review of a 50-state survey, from which she concluded that verbal ability is a teacher-related factor that can be associated with increased student achievement (Darling-Hammond, 2000). Two years later, this finding was supported by the U.S. Department of Education (2002) in its report *Meeting the Highly Qualified Teachers Challenge*, in which the conclusion was drawn that verbal ability and subject matter knowledge are the two most important components of teacher effectiveness (as cited in Darling-Hammond & Youngs, 2002).

Teacher expectation is another teacher effect that has been shown to correlate with student achievement. A teacher's expectancy of student success has been shown to be related to the student's actual success (Rowan, Chiang, & Miller, 1997), especially in cases in which low teacher expectations resulted in low student achievement (Ehrenberg, Goldhaber, & Brewer, 1995; Ferguson, 1991, 2003; Wiggan, 2007). Good's early 1970 research into this subject found not only the significant impact of teacher expectations on student achievement, but also discovered that approximately 30% of the teachers in the same grade level of the same school have dramatically different expectations of their students, variances that can be traced back to personalities and beliefs about instructional behavior (Good, 1983).

Certification completion and certification route are other factors that have been shown to impact student achievement. Any type of certification is shown to be better than none (Darling-Hammond, 1990), as students who have certified

teachers consistently post higher student achievement results than those students who have non-certified teachers (Darling-Hammond, 2000; Goldhaber & Brewer, 2000; Hawk et al., 1985). Beginning in the 1980s, however, no longer was certification simply a contrast between those who were and those who weren't. During this time period, steadily increasing alternative certification options were becoming available, making entry into the teaching profession possible for non-traditional education students, and raising more than a few questions regarding the alternative certification route's validity and products (Darling-Hammond, 1990; Schoon & Sendoval, 2000; Zumwalt, 1996)

A 2005 study conducted by Boyd, Lankford, Loeb, and Wyckoff analyzed the possibility that the certification route of a teacher may be a teaching effect that impacts student achievement. This research was carried out through the Teacher Pathways Project in New York City, a project specifically designed to study teacher education program effects on practice. Boyd et al. concluded that traditionally certified teachers do indeed post higher student achievement gains than alternative certified teachers. However, this gap in student achievement is often erased within the alternatively certified teachers' first three years of teaching (Boyd et al., 2005).

Related research into this topic has produced mixed results. Good et al. set out to determine how two different types of teacher education preparation – traditional bachelor's degree and nontraditional master's degree – compared to each other when analyzing the student achievement in these various teachers'

classrooms, with the results inconclusive (Good et al., 2006). An earlier study analyzed the same questions and determined that the type of teacher preparation program made little difference with student achievement (Goldhaber & Brewer, 2000).

Contrasting research was carried out by Gimbert et al. (2007) in relation to math achievement of students with alternately and traditionally certified teachers. This research actually showed that students in classrooms of alternately trained teachers had a slightly higher overall mean score than those in the classrooms of traditionally trained teachers (Gimbert et al.). This assertion is supported by the 2002 *Meeting the Highly Qualified Teachers Challenge* report which concluded that alternative certification programs actually have academically stronger recruits, thus resulting in highly effective teachers (Darling-Hammond & Youngs, 2002). These relationships are especially interesting when it is considered that proportionally, more alternately certified teachers are employed in lower-performing schools with low SES students (Olson, 2003).

A teacher's command of his content area field has also been shown to positively impact student achievement (Darling-Hammond, 1990; Darling-Hammond, 2000; Darling-Hammond & Youngs, 2002). Rowan et al. studied the relationship between student achievement and teachers' knowledge base using data from the National Education Longitudinal Study of 1988 (NELS:88). The findings suggested a strong correlation between teachers' knowledge of subject matter and student achievement in mathematics (Rowan et al., 1997). In

addition, students whose teachers actually majored or minored in the subject they teach outscored their peers significantly on the National Assessment of Educational Progress (Wayne & Youngs, 2003; Wenglinsky, 2000). These conclusions also have implications for professional learning, for these findings would suggest that as teachers take advantage of learning how to better present subject matter and construct successful lessons, so their students' achievement improves (Darling-Hammond, 1998).

In contrast to the emphasis on content knowledge, Nuthall (2004) discovered through his research that a teacher's command of methodology is the professional knowledge base that will most significantly improve the quality of teaching in our schools. Goldhaber and Brewer (2000) carried out extensive research from which they concluded that while there is a correlation between high math achievement and students whose teachers hold math major degrees, there is no such relationship between teacher subject matter major and student achievement in science.

An additional correlation has been shown to exist between a teacher's evaluation score and the achievement of the students in her classroom. Gallagher set out to examine this relationship in his 2004 study supported in part by a grant from the U.S. Department of Education. In this research, Gallagher examined the relationship between teacher evaluation scores (TES) on a performance-based assessment system and value-added measures of student achievement. The teacher and student scores analyzed were accessed from

Vaughn Elementary, a Title I charter school in the Los Angeles School District. Gallagher concluded that, overall, the Vaughn teacher evaluation scores had a statistically significant relationship to student achievement, with the strongest relationship seen in literacy achievement (Gallagher, 2004).

The influence of a teacher's race, gender, and ethnicity (RGE) has been a point of interest for many bodies of research, including the AERA Panel report that set out to compare and contrast the available studies in this area. In summary, the conclusions from the research are inconclusive as a whole, but do provide one very interesting isolated finding in several major studies. Ehrenberg et al. (1995), as well as Hanushek (1992) and others found that African-American students experience a positive achievement effect from having an African-American teacher (Ehrenberg et al., 1995; Evans, 1992; Farkas, Grobe, Sheehan, & Shuan, 1990; Hanushek, 1992; Zumwalt & Craig, 2005a). As most teachers in U.S. schools are Caucasian, this particular research is compelling and should be of interest as educators and policy makers continue to address ethnic achievement gaps nationwide.

### *The Effect of Socioeconomic Variables*

#### *The Student Gap*

In researching the socioeconomic status (SES) of students as a factor in student achievement, studies have approached SES as different entities. Traditional approaches included viewing SES in terms of family economic resources or parental educational level. Additional factors were also included at

times, such as parent's occupation, family size, quality of housing, and household possessions (Konstantopoulos, 2006). Regardless of the definition components, students who are from low socioeconomic backgrounds are more likely to attend a lower quality school, and within that lower quality school, are more likely to receive a lower quality education than that of a higher socioeconomic student within the same school (Wenglinsky, 1998). Before exploring the school and teacher qualities that play into this equation, it is pertinent to first look at the socio-based characteristics that can contribute to learning gaps for these low socioeconomic students.

These students often struggle with self-esteem, have families who hold negative perceptions of the schooling experience, and lack experiences that emphasize the relationship between hard work and success (Gardner, 2007). Some of these characteristics can be traced to birth, as children who grow up in poverty often receive inadequate nourishment at a time when their bodies and brains are developing. In addition, their mothers may have themselves been undernourished and deprived of adequate prenatal care during their pregnancies (Gardner). In its 1994 report, The Ohio Children's Defense Fund described how this lack of prenatal care for mothers in poverty can lead to more likelihood that poor mothers will have babies who are born too small, a factor that can impair cognitive functioning later in life (as cited in Gardner). The OCDF also reports that poor children are twice as likely to have physical or mental disabilities, again,

factors that can impact a student's academic achievement during the K-12 years (Bracey, 1997).

Thus, a student's socioeconomic background in and of itself can significantly impact the entire learning process (Kodrzycki, 2002). Educational attainment has shown a propensity to be heavily influenced by family income, with those students in the top income quartile ten times more likely to earn a college degree than those students in the bottom quartile (American Youth Policy Forum, 2001).

In one of the first studies carried out to study this relationship, Coleman et al. (1966) discovered a distinct correlation between a child's educational attainment and his socioeconomic origin (Coleman et al., 1966; Fallon, 2006; Vandenberghe, 1999). Marzano found in his research of the effects of various aspects of socioeconomic status on student achievement that parent income was the second most predominant student-level factor in measure of impact on student achievement (right behind home atmosphere) and that this variable alone can account for close to 10% of the variance in student achievement scores (Marzano, 2003). This conclusion is also supported by other research, including that conducted by the Public Policy Institute in California, which concluded that the socioeconomic level of a student appears to play a dominant role in the achievement of that student (Betts et al., 2001).

Harvard University's research team, led by Jencks, concluded from their reanalysis of Coleman's work that: "The character of a school's output depends

largely on a single input, namely the characteristics of the entering children” (Fallon, 2006; Jencks et al., 1972). Jencks also considered whether, since student achievement is measured through standardized tests, and many of these tests requires a basic familiarity with middle class life and culture, children from poverty were at a natural disadvantage due to the culturally biased design of tests. This hypothesis was quickly disputed, however, as Jencks discovered psychological research that showed the same achievement gaps between the affluent and impoverished students, even with ‘culture fair’ test questions (Jencks et al.).

While many believe there to be a relationship between teaching and student achievement, others contend that this relationship may not exist if other factors, particularly non-school factors, play greater roles in the student’s achievement than the teacher’s work (Ferguson, 1991; Murray, 2000; Thompson, 2007). There can remain little doubt that the socio-economic origin and background of a student is quite decisive in presenting challenges to the learning process (Coleman et al., 1966; Fallon, 2006; Vandenberghe, 1999).

### *The Teacher Gap*

“If you want to understand the root of the achievement gap, it’s the teacher gap that exists between the affluent schools and the less affluent schools. It’s scandalous” (as cited in Olson, 2003). This description from Haselkorn of the University of Cambridge succinctly summarizes the empirical as well as the observational research regarding the differences in teachers and teaching among

our nation's schools. In scrutinizing achievement gaps between our affluent and impoverished student subgroups, the focus is often on student background and family influence. While that information is key (as described in Coleman et al.'s 1966 research), the impact of teacher inequality cannot be overlooked.

In the 2003 *Quality Counts* report, the fact that students in high SES schools were more likely to have access to qualified teachers was highlighted with several examples: (1) In California, 23% of the teachers in the state's lowest-achieving schools lacked full credentials (compared with 6% in the highest-achieving schools); (2) In Missouri, the lowest-performing students have a disproportionate share of teachers who scored among the lowest on the ACT test; and (3) In New York, low SES schools were more likely to have teachers who lack prior teaching experience than their high SES counterparts (Olson, 2003). Additionally, for this report, *Quality Counts* accessed the federal database entitled *Schools and Staffing Survey* (SASS) and discovered that students in low SES schools are more likely to be taught by an inexperienced (less than three years of experience) teacher, are more likely to be taught by a brand new teacher, and are more likely to be taught by teachers who are not licensed in the subjects they teach (Olson). It was also recognized in this analysis that there is an overlap effect with many of these teacher qualities, as many of these low-quality attributes are evident multiple times with multiple teachers within a low SES school (Olson).

Gaps regarding types of teacher certification have also been revealed in contrasting teachers from varying schools. A 2001 study conducted in the state of California analyzed teacher distribution patterns from a random selection of elementary schools, all of which were divided into five socioeconomic status groups, based on the proportion of students receiving free or reduced lunch benefits. The resulting data showed that the median percentage of teachers not fully certified was 22% in the bottom socioeconomic quintile and 2% in the top quintile (Betts et al., 2001). This discrepancy in teacher distribution is perhaps a representation of more alternative-route teachers in low SES schools. While some have questioned whether these alternate certification routes hold the rigor of their traditional counterparts (Darling-Hammond, 1990), others have lauded alternate certification as a method of securing more minority teachers in our nation's classroom (School & Sandoval, 2000). In addition to differences in certification, 24% of the teachers in the bottom group had two or fewer years of experience, compared to 17% in the top quintile who posted this level of inexperience (Betts et al.).

A plethora of research exists that supports these findings and the underlying assertion that low SES students and schools have less access than their high SES counterparts to high quality teaching. The research of Ayala and Claassen (2007), conducted in the Tarrant County School District in Texas, uncovered certain realities about the difference in experienced and inexperienced teachers and poor and affluent schools within this district. Ayala

and Claassen found that the poorest students often get the least experienced teachers, and, as these researchers concluded, this results in a negative impact on student achievement.

In the AERA Panel report (Cochran-Smith & Zeichner, 2005), it was established from a compiling of several studies that more than 20% of teachers in schools with a high rate of low-income students had fewer than three years of experience (Zumwalt & Craig, 2005a). Honawar found large differences between the qualifications of teachers in the low SES schools and teachers serving in schools with few low-income students (Honawar, 2006; Wiggan, 2007). Boyd et al. (2006) also found a “qualification” gap between schools with high populations of students from poverty and those without. Schoon and Sandoval (2000) concluded that low SES schools must often seek out teachers with alternative certification in order to fill the needs within their schools, as there appears to be reluctance on the part of traditionally trained and fully licensed teachers to teach in high-poverty areas (Schoon & Sandoval; Zumwalt, 1996).

One quarter of the new teachers entering U.S. classrooms end up teaching in schools where more than half of the students are eligible for free or reduced lunch (Zumwalt & Craig, 2005b). Ayala and Claassen (2007) even go so far as to claim this unequal distribution as illegal, as it is a civil rights issue to deny all students access to teachers with experience. Ayala and Claassen also found that these pockets of inexperience were not just for one or two years, but

rather an ongoing cycle of new teachers and turnover for the poorest schools in the county.

These gaps in teacher certification and experience undoubtedly affect the difference in academic standards, as described in the 1993 *Third Bracey Report*. In the research included in this report, researchers examined the performance of children in high- and low-SES schools.

High poverty [low SES] schools were defined as those with 76% or more of the student body eligible for free or reduced-price lunches; low-poverty schools [high SES] had 20% or less of the student body eligible for federally subsidized lunches. The researchers first divided the students into categories A, B, C, or D – depending on what grade they commonly took home on their report cards. Then they looked at performance on achievement tests. Students in low-poverty [high SES] schools who got A's on their report cards scored as one would expect: 87<sup>th</sup> percentile in math, 81<sup>st</sup> in reading. Students in high-poverty [low SES] schools who got A's scored higher than their classmates who got lower grades, but they attained only the 36<sup>th</sup> percentile in reading and the 35<sup>th</sup> in math (Bracey, 1997, p. 163).

The body of research on teacher distribution patterns has shown that poor students do not always get comparable access to the most qualified of the teaching workforce. In California, the bottom-scoring quintile of schools also

houses four to six times as many students who are eligible for free and reduced-price lunch, and also, not surprisingly, have larger shares of novice teachers, teachers with at most a bachelor's degree, and teachers who lack full credentials (Betts & Danenberg, 2003). In the New York City Schools between 1996 and 1998, the lowest-achieving schools housed a teaching workforce, 28% of whom scored in the lowest quartile on their certification exam (Boyd et al., 2005). In addition, the percentage of teachers with master's degrees is inversely related to the percentage of students in a school who are eligible for free and reduced lunch (Zumwalt & Craig, 2005b). Especially for large cities with more significant populations of high-poverty schools, the need to improve teacher quality in these hard-to-staff schools is currently acute and will, no doubt, continue to escalate as a challenge (Boyd et al., 2006; Gimbert et al., 2007 ).

### *The School Gap*

The impact of a school's affluence level, as it reflects the socio-economic status of its collective student population, is well-documented as a major factor in the eventual achievement realized by its students. One way in which schools are currently "labeled" in terms of student socioeconomic level is the designation of Title I. 'Title I' is actually a term that traces its origin to a law signed on April 11, 1965 outside a one-room schoolhouse in Texas. This was the date and setting as President Johnson signed the *Elementary and Secondary Education Act* (ESEA) into law. This law was an integral part of Johnson's 'War on Poverty' as it authorized federal funding to support school districts for educational programs

designed to meet the needs of low income students who, traditionally, had been educationally deprived (Guthrie & Koppich, 1988).

At the inception of this law and still holding true today, many viewed ESEA as a major step towards bringing children of poverty into the American mainstream and onto a level playing field with their school peers. 'Title I' is actually one component of ESEA, yet it garners plenty of publicity as it receives five-sixths of the billions of federal monies allocated to carry out this law (Guthrie & Koppich, 1988).

During the forty-plus years since ESEA was enacted a widening gap between low SES schools and high SES schools occurred. During the 1980s, the most accomplished of fourth-grade readers, as represented through NAEP scores, improved dramatically, while the lower quarter of fourth grade readers, who happened to be poor students from poor schools, lost ground in their achievement (Hochschild, 2003). Economists and other social scientists who had long viewed public education as the solution to the social challenge of socioeconomic inequality were dismayed and disappointed (Levin & Kelly, 1994; Vandenberghe, 1999).

A significant shift in educational and domestic policy, driven by trends at home and abroad, made 'excellence' the priority over 'equity' in our American schools (Iannaccone, 1988). This perception was one premise behind the federal *No Child Left Behind Act*, which sought to ensure, among many other things, that these very schools that reflect a lower level of economic affluence would achieve

at a rate consistent with their more affluent counterparts. One major thrust of this act is the recognition that quality teaching is key to student success, and that schools with high levels of poverty are in need of quality teachers as much, if not more so, than their more affluent counterparts.

With its “highly qualified” requirements and its call for improved student achievement, *No Child Left Behind* has yet, however, to correct the inequities in teacher distribution that exist within our schools. Howard (2003), in his research on the implications of the national teacher shortage, noted this disparity. Researchers Sunderman and Kim (2005) also addressed these inequities in their study on teacher quality and equality:

The question of how to achieve the goal of a high quality teacher in every classroom is complicated because of the challenges of attracting and retaining teachers to schools serving large numbers of...low-income students, the schools most likely to have the least qualified teachers (p. 13).

Today, Title I continues in providing funding for low SES schools, including the approximately 45% of North Carolina’s public schools currently designated as Title I schools (NCDPI, 2007a). By reducing gaps in spending between schools, it is assumed that the differences in educational quality and student achievement will also be eradicated (Wenglinsky, 1998). Research would suggest otherwise. Characteristics such as low teacher expectations (Good, 1983), lack of resources (Betts et al., 2001; Gardner, 2007), and high teacher turnover (Ayala & Classan,

2007; Zumwalt & Craig, 2005b) make low SES schools anything but equal when comparing our nation's schools.

In analyzing the transient trends for many disadvantaged schools, it is often the case that the most prepared teachers will leave these schools as soon as the opportunity presents itself (Ayala & Claassen, 2007; Boyd et al., 2005; Gehrke, 2005; Howard, 2003, Wiggan, 2007). In her study of the Chicago Public Schools, Keller (2007) reported that teachers who possess strong academic backgrounds are more likely than their colleagues to leave disadvantaged schools (Keller, 2007). Keller predicts that the attrition rates for the disadvantaged schools will continue to increase. Often this exodus occurs with such rapidity that disadvantaged schools have no opportunity to create an established workforce (Hanushek, 2003; Olson, 2003). As Keller observed, while new teachers may be leaving some specific schools at alarming rates, it should also be noted that more often than quitting the profession, they are simply switching schools (Keller). In fact, the schools with the poorest test scores on state standardized tests lost almost 80% of their new teachers after just five years of teaching. In schools where this poor test performance was accompanied by high poverty populations, the rate of attrition was even higher (Keller).

Research by Lankford, Loeb, and Wykoff (2002) using New York state data as well as Betts et al. (2001) using California data established that while first year teachers may take their first teaching positions in lower performing schools, they move quickly after gaining experience to schools with higher-performing

students. Peske and Haycock found similar results during their 2006 study of the Cleveland and Milwaukee school systems. In these very large, urban districts, analysis of data uncovered large differences between the qualifications of teachers in the highest-poverty schools and teachers serving in schools with few low-income students (Peske & Handcock, 2006). In the midst of a school reform movement that emphasizes accountability through competition, teachers in the highest poverty schools often believe themselves to be at an unfair advantage. As Fowler (1988) describes in analyzing teacher merit pay programs in Tennessee:

According to the reformers' conception of excellence, competition should motivate teachers to achieve. However, competition is motivating only when the competitors have roughly equal advantages – a principle which is well recognized in athletics. In a state marked by gross inequities in school funding, teachers are hardly motivated to achieve when they learn that the highest paid systems have many Level III teachers, or that a wealthy suburban school has high test scores. On the contrary, they are motivated to compare working conditions. Again, their morale drops (Fowler, 1988, p. 196).

### *The Triple Convergence on Student Achievement*

When analyzing what public education means to American students from low socioeconomic backgrounds, the research overwhelmingly indicates gaps in

student readiness characteristics, availability of quality teachers and instruction, and equitable school facilities and resources. With this preponderance of inequalities, the next research challenge is to determine the degree to which these varying factors are integrated in impacting student learning, including the ability of certain factors to negate other factors.

Since Coleman et al. (1966), Jencks et al. (1972), and others have determined that student achievement is determined primarily by pupil, not teacher, characteristics, it may seem logical to conclude that when it comes to student achievement, teaching does not really matter (Fallon, 2006). To draw such a conclusion would be to ignore what more recent research has uncovered...that teacher quality is deeply intertwined with socioeconomically-based success. As pointed out earlier, under the current system, more affluent districts and schools are able to recruit and employ more high-quality teachers, while the poorest districts and the lowest-performing schools employ, at disproportionate rates, the least experienced of the teaching workforce (Blair, Hoff, Keller, & Manzo, 2002; Darling-Hammond, 2000; Darling-Hammond & Youngs, 2002; Wiggan, 2007). The efforts of multiple researchers, however, clearly indicate that regardless of the socioeconomic background of the student or the percentage of a school-based population that consists of students of poverty, the efforts of individual teachers can make an enormous difference in student achievement (Boyd et. al, 2006; Marzano et al., 2003; Sanders & Horn, 1994).

While Coleman et al. (1966) may have discovered an undeniable link between student socioeconomic background and academic achievement, Hanushek actually downplayed student level factors and instead concluded that “‘some’ schools and teachers are systematically more productive than others” (as cited in Vandenberghe, 1999, p, 133). Other researchers over the last decades have concurred with the assessment that individual teaching differences can influence student achievement over and beyond school and student factors (Good et al, 2006; Nye et al., 2004; Rowan et al., 2002). The research of this particular study will, therefore, be focused on the determination of which individual teacher efforts are making this difference and whether these efforts do indeed transcend the poverty or affluence levels of the schools in which they teach.

The 2004 research of Nye et al. is worthy of an in depth review at this juncture due to its close alignment with one particular purpose of this study. Nye et al. readily admitted in embarking on their study that the “empirical evidence regarding teacher effectiveness is weak” (p. 237). This team was focused on discovering not only the teacher effects that most dramatically impact student achievement, but also how the variances with such effects differ when the school SES level is taken into consideration. This team used data from a four-year experiment in which random teachers and classrooms were analyzed regarding student achievement levels as well as gains. One conclusion was that teacher effects have a larger impact on math achievement than on reading. Specifically,

teacher experience was found to positively impact both math and reading achievement, more significantly in grades 2 (reading) and 3 (math) than in others. Another conclusion, and one highly pertinent to this study, is that a much larger teacher effect variance was found to exist in the low SES schools as opposed to the variance in the high SES schools. The range of effect that a particular teacher has on the student achievement in a low SES classroom was always much larger than the range of effect realized by the same teacher effects in the high SES schools. Taken as whole, the Nye et al. research delivers a compelling conclusion...the teacher that a student happens to be assigned within a school matters more than which school the student happens to attend or what the student's socioeconomic background happens to be.

Heck (2007) conducted a similar study that looked at teacher and school effects in light of differences in regard to socioeconomic factors. These correlations were examined from longitudinal data collected from more than 14,000 students included in a random sample of 197 elementary schools. Both reading and math achievement were analyzed, with several key conclusions reached. While a correlation was shown between teacher quality and student achievement, the strength of this correlation was shown to depend on the demographic composition of the school. In addition, higher teacher quality was related to decreasing socioeconomic learning gaps (Heck).

The very legislation designed to improve the quality of education for lower socioeconomic students may have instead made this reality more difficult to

realize. Under *No Child Left Behind* and state-implemented accountability acts, sanctions are reserved for those schools at the bottom end of state rankings. As the Public Policy Institute describes, the schools most likely to be sanctioned are schools with lower socioeconomic populations. An unintended side effect of the accountability reforms is the tendency for principals and teachers to be dissuaded from working in schools serving disadvantaged populations (Betts et al., 2001; Gimbert et al., 2007).

In the most impoverished areas, three out of every four core academic classes are taught by an unqualified teacher (Gimbert et al., 2007). This is quite a barrier when taken in light of the overwhelming research regarding the influence of quality teachers on student learning (Boyd et al., 2006; Heck, 2007; Marzano et al., 2003; Nye et al., 2003; Sanders & Horn, 1994). Coleman's observations from his 1966 research into school and teacher characteristics provides an appropriate analogy: "just as a loaf of bread means more to a starving man than to a sated one, so....one very able teacher may mean far more to a deprived child than to one who already has several" (Coleman et al., 1966, p. 8).

The research is compelling...a single teacher, even within a low SES school, has the ability to produce high student achievement, even with a student from a low SES background. The research of Wright et al. (1997) would also support that "effective teachers appear to be effective with students of all

achievement levels, regardless of the level of heterogeneity in their classrooms” (p. 63).

The current reality is that one in every six American children lives in poverty, and in schools where a majority of children fall within poverty levels, roughly two-thirds will fail to reach even basic levels of achievement (Gehrke, 2005). Many have pondered whether it is the socio-economic factors involved that act as the sole determinants, or whether more of the reason has to do with teacher quality inequities (Olson, 2003). It is well documented that low SES schools house higher numbers of students at risk for academic failure (Quartz, 2003; Tredway, 1999), but still the question remains: are certain teacher characteristics more inclined to impact student achievement in these low SES settings than others? As it is determined which characteristics of a teacher’s preparation and experiences are most likely to grant teachers the ability to carry out this feat, we will move ever closer to addressing the impact of socioeconomic factors on student learning.

### *No Child Left Behind*

#### *Redefining Accountability*

“As of this hour, America’s schools will be on a new path of reform, and a new path of results.”- With these words President Bush signed into law the *No Child Left Behind* (NCLB) Act of 2001, a law that was and has since been viewed by many as the most significant federal education legislation in over 35 years and the first law ever of its kind (Rudalevige, 2003; West & Peterson, 2003). In

contrast to previous reform legislations, the NCLB Act, which was actually a reauthorization of the 1965 ESEA, acted as the nation's first "national accountability system". As such, NCLB redirected educational policy and thinking in a new direction (Hess, 2003; Moe, 2003; West & Peterson), and subsequently distinguished itself from earlier laws in that its chief focus was not on effort, but rather on accountability and results (Dee, 2003; Hanushek & Raymond, 2002).

Accountability in education has been described as a "tripod" consisting of the three "legs" of *standards*, *testing*, and *consequences* (Rudalevige, 2003). When educators are asked what accountability means to them, most often the words *responsibility* and *shared* are mentioned (Linn, 2003). Thus, this sweeping NCLB accountability law made terms such as these the new household language of education (West & Peterson, 2003). This path-breaking legislation accelerated the public's familiarity with educational standards and also accelerated the public's assumption that schools, teachers, and students are rightfully judged by student achievement and test scores (Good et al., 2006; West & Peterson).

While the law itself is quite complex, covering more than 680 finely printed pages, the primary focus of NCLB is quite simply centered on standards and testing. The law states that its intended purpose is to ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging state academic achievement standards and state academic assessments (Haas, Wilson, Cobb, & Rallis, 2005; NCLB, 2002).

Perhaps one of the most controversial and debated components of NCLB is the requirement that states bring 100% of its tested students to the proficient level on state tests by the year 2013-2014. For their part, individual schools, school districts, and states are required to demonstrate progress on their efforts to steadily increase student performance goals, both for students as a whole and for certain student subgroups, in order to eventually meet the 100% mark (Linn, 2003). Performance levels increase at least every three years and in equal increments until the final year of 2013-2014, when all levels must reach 100%. These annual state targets are labeled as *Adequate Yearly Progress (AYP)* goals. If a school fails to meet AYP for two consecutive years, a series of sanctions begins to be enacted, which can include intra-district school choice, supplemental tutoring for students, and, eventually, restructuring by state government. In order to meet AYP a school must demonstrate proficiency at set levels by students as a whole and by students in subgroups such as economically disadvantaged, students with disabilities, and students from specific racial or ethnic groups. In addition, if a school fails to test at least 95% of its students, the school fails to make AYP.

Among those who debate the NCLB concept of 100% proficiency levels are educational researchers Hass et al. (2005). As this team describes, there is good reason to question the reasonableness of expecting schools, especially schools serving large populations of students from disadvantaged backgrounds, to attain ever-increasing AYP goals and ultimately 100% proficiency:

Experience has shown that a 100% proficiency rate is virtually impossible. For example, on the Programme for International Student Assessment (PISA), no country has achieved a 100% pass rate at any reasonable level of achievement...In the 2003 results from the PISA test, not one country – even the highest performing countries of Finland, Korea, and Canada – had all of its students pass the *lowest* standard in either math or reading (PISA) (Hass et al., 2005, p. 181).

Another skeptic of the 100% proficiency standard is Linn, who, in his presidential address to the American Educational Research Association in 2003, applauded the notion behind accountability while questioning the logic behind NCLB. While NCLB (2001) “stays the course on standards-based reform and encourages states to adopt ambitious subject-matter standards” (p. 4), it also contains questionable features, the most prominent of which is the unreasonable expectations. Linn calculated in his own research that, at the current rate of improvement, American schools will need more than 100 years to reach 100% proficiency in all NCLB subgroups and content areas (Linn, 2003). Linn also points out an “existence proof” problem when analyzing the goals of NCLB. He supports Haas et al. (2005) in convincingly questioning how NCLB can set a goal for all schools (100%) that is so ambitious that no school has yet achieved it (Linn).

In responding to these questions of fairness and validity, Noddings recognized in his 2004 research that as long as the goals of the *No Child Left Behind Act* are questioned as reasonable and just, there is no justification for imposing sanctions on either individual students or schools that are unable to meet them (Noddings, 2004). Noddings also contends that with its emphasis on testing in order to reach these established AYP goals, NCLB is actually undermining the teaching of critical thinking, and, in turn, the public school's ability to truly educate (Noddings). This opinion corresponds with the often discussed assumption that the preponderance of standardized testing now required of schools actually squelches the ability of teachers to differentiate instruction for an increasingly diversified student population (English, 2008). Good et al. (2006) added another dimension to this criticism, describing a particular NCLB flaw in the following excerpt:

Schools and teachers are about more than student achievement on narrow measures. Students must learn to think logically, communicate persuasively, achieve many non-subject matter outcomes, and stay in school. Student achievement clearly is an essential outcome of schooling and as educators, we have an obligation to optimize it. To equate effective teaching only with student achievement, however, is shortsighted if not tragically self-defeating (Good et al., p. 413).

Beyond the quantitative, mathematical challenges that the NCLB 100% goal produces, one must also consider that even within business production models, perfection is a difficult ideal to attain. Juran's (1988) economic models for business describe how goals for improvement should be "based on analysis of what is achievable at their level" (p. 10.51), and that businesses that are heavily dependent upon human beings for their production are at a natural disadvantage (Juran). Education *is* a people-intensive enterprise, and thus rife with human fallibility. On any given day, with any given standardized test, any number of human factors (such as hunger, fatigue, or illness) can result in a less than proficient score. In 2014, a single student failure is sufficient for the entire school to fail as a whole (Haas et al., 2005).

While public schools bear obvious contrasts to their business counterparts, it is evident that NCLB is a law that exhibits strong parallels to business (Haas et al., 2005). Just as business must ask the central question: "How can we create a process that will ensure that the highest number of products meet quality standards?", so too must schools, under the framework of NCLB, self-examine its own processes. Following NCLB logic, the question for public schools would become: "How can we create an educational system that regularly produces the highest number of proficient test scores by students on a standardized test" (Haas et al.)? The quickest route to answering this question may be in identifying those factors that produce teachers who are able to teach students in a manner which results in standardized testing proficiency.

NCLB assumes, through its reliance on student achievement as the sole determinant of teacher effectiveness, that if a school can ensure effective teaching, student achievement results will follow. In analyzing the effectiveness of NCLB in producing the results it was created to produce, Hanushek and Raymond (2004) looked at data from the NAEP in order to establish what impact, if any, NCLB has had on the nation's public schools. The National Assessment of Educational Progress (NAEP) enjoys vast participation on the part of states, thus providing a rich data source for this research team to use in assessing not only this federal accountability program (NCLB) but also various individual state accountability programs. The conclusions drawn from this research were that accountability systems, both the *No Child Left Behind Act* as well as individual state programs, do have a positive impact on student achievement, albeit a more profound impact on some subgroups more than others (Hanushek & Raymond, 2004). This conclusion raised additional questions regarding how NCLB is improving education and what it lacks in terms of its ultimate goal:

The finding of differential effects raises a clear policy dilemma. A prime reason for the U.S. federal government to require each state to develop a test based accountability system involved raising the achievement of all students. These results suggest a beneficial effect on overall achievement but simultaneously that some gaps across subgroups could widen. We conclude from this that additional policies are needed to deal with the multiple objectives.

Again, as is frequently the case, a single policy cannot effectively work for two different objectives – raising overall student performance and providing more equal outcomes across groups (Hanushek & Raymond, 2004, pp. 414-415).

In addition to the challenges inherent in raising student performance and equalizing outcomes for all groups, NCLB also presents challenges to educators who must prioritize immediate and long-term goals. In responding to the pressures of raising the percent proficient, many schools now focus instruction primarily for those students closest to meeting the proficiency standards. As described by Sanders: “In the short run by restricting the focus to students perceived to be near proficient, while overlooking those who are very low or high achieving, this strategy may result in increasing the percent proficient in the short term, but in the longer run may be a detriment to meeting AYP in future grades” (Sanders, 2003, p. 1). Sanders concluded that this subtle suppression of student growth can have long-reaching repercussions. “Our research has documented the necessity of appropriate progress each year if students are to leave their K-12 experience sufficiently prepared for employment or college success” (Sanders, 2003, p. 1).

#### *No Child Left Behind and Teacher Quality*

A significant policy decision included in the 2001 *No Child Left Behind Act* is the target of a “highly qualified teacher” in every classroom by 2006 (Schalock et al.). The quality of teachers and their teaching has long been a topic for

discussion, tracing back to the 1966 research of Coleman. Many who read Coleman's final 737 research report focused solely on the conclusions drawn regarding the strong correlations between student socioeconomic levels and student achievement. However, it was an entirely different phenomenon that was uncovered in this research that was perhaps, at first, overlooked (Fallon, 2006). Coleman and his colleagues reported that the variation among student achievement within schools was different and greater (almost four times greater) than the variation among student achievement between schools. These surprising variations clearly indicated that some pupils in poor low-performing schools were actually doing very well and some students in affluent high-performing schools were struggling with academic achievement (Coleman et al., 1966). In addressing teacher quality specifically, Coleman et al. reported the following: "The quality of teachers shows a relationship to pupil achievement. Furthermore, it is progressively greater at higher grades, indicating a cumulative impact of the qualities of teachers in a school on the pupil's achievements" (Coleman et al., p. 22). Hanushek describes high quality teachers as those who consistently obtain higher than expected student achievement, while low quality teachers are those who consistently obtain lower than expected student achievement (Hanushek, 2003). Based on this research as well as others (Mendro, 1998; Sanders & Rivers, 1996), *No Child Left Behind* makes the goal of "highly qualified" teachers in every American classroom a major cornerstone of this legislation.

There is no doubt that the successes and flaws of *No Child Left Behind* will continue to be debated for years to come, but for now there is widespread agreement that this legislation stands as the most important piece of education legislation in thirty-five years (Rudalevige, 2003; West & Peterson, 2003). One legacy of *No Child Left Behind* will be its success in shifting public and policy focus from equity to excellence, which, as described by Green, is a more encompassing goal:

Policies in pursuit of educational excellence are more likely to produce gains in equity than policies in pursuit of equality are likely to produce gains in excellence....if we could achieve uniform excellence of education, then whatever social inequalities remain could not be unfair, or if unfair, then the lack of equity could not be attributable to inequity in education...that is the essential reason why the pursuit of educational excellence for all is a more serious and more important aim of public policy than the pursuit of bare equality (Green, 1983, p. 335).

The transformation of the American educational process into a transparent enterprise will perhaps remain the most significant legacy of *No Child Left Behind*. At its core, NCLB demands accountability on two fronts: in the requirements that must be met in order to receive federal money and in providing information to parents that can result in increased parental demands of schools (Rudalevige, 2003). As student performance becomes more available for scrutiny

by all stakeholders, this in and of itself places new pressure on schools to perform and renewed pressure on the education profession to identify and replicate teacher effects that are proven to be the most effective (West & Peterson, 2003).

*Teacher Effect Research: The Role of the Educational Leader*

Educational leaders are responsible for ensuring not only highly qualified teachers in the classroom, but also highly effective teaching for every student (Kaplan & Owings, 2001). The conclusions from much of the aforementioned research would suggest that the most important factor affecting the achievement of students is the teacher. The conclusions from this research hold significant implications for those who recruit, hire, supervise, and support teachers. It is through the teaching workforce that leaders have the best opportunity to affect and improve learning for students. One example of this potential is in the work of Wright et al. (1997):

...the results of this study well document that the most important factor affecting student learning is the teacher. In addition, the results show wide variation in effectiveness among teachers. The immediate and clear implication of this finding is that seemingly more can be done to improve education by improving the effectiveness of teachers than by any other single factor (p. 63).

The research featured in this review reflects the ongoing debate on whether teachers make a difference, and, if so, which particular teacher effects

make the most difference. Perhaps no group of educators is more directly impacted by the implications of this debate than educational leaders, and, more specifically, school-based principals. Much of the research on educational leadership suggests that the role played by the principal in improving student learning is sometimes underestimated (Andrews & Soder, 1987) while also highly significant (Andrews & Soder; Leithwood, Louis, Anderson & Wahlstrom, 2004; Nettles & Herrington, 2007). The influence of the principal in affecting classroom instruction and student learning may vary among resource provider, data analyzer, communicator and instructional resource, but in any case is one that is critical in ensuring academic achievement (Andrews & Soder; Glasman, 1984). Effective schools research supports this link in suggesting that certain instructional leadership behaviors are related to higher levels of student achievement (Andrews & Soder; Gentilucci & Muto, 2007; O'Donnell & White, 2005). Although it is recognized that student achievement and improvement are directly executed by teachers, the "indirect" leadership practices of the principal, such as the hiring and placement of teachers, has also been shown to positively influence instructional effectiveness (Gentilucci & Muto; Glasman).

The two broad areas that define teacher quality: teacher preparation and teacher practice, are both included under the authority of the principal. It is the principal's responsibility to determine whether the preparation and qualifications of a certain teacher candidate match the needs of the school, including certain inputs the teacher brings to the school, such as teaching experience, education

level, and professional certifications (Kaplan & Owings, 2001). It is also the principal's responsibility to monitor and provide feedback pertaining to teaching practices used in the classrooms. As noted by Kaplan and Owings: "research has many implications for principals", as improvement in student achievement depends on the improvement of teacher quality.

In her 1998 publication, *Good Teaching Matters*, The Education Trust's Haycock reminds readers that while much of the research may suggest that teachers and the effects of teachers make a difference with the learning of students, the potential influence of different teachers may not always be valued. In defining this deficiency, Haycock describes the need for leaders to "reliably identify which of our teachers really are terrific at moving students from wherever they are academically to higher levels of achievement, and which teachers still need help to attain that level of effectiveness" (Haycock, 2004, p. 1). In clearly identifying relationships among certain teacher effects and the achievement of students, principals and those in educational leadership roles will be better equipped to aggressively recruit the most effective teachers, to appropriately compensate teachers in accordance with their value, and to more effectively support their further development (Haycock).

### *Summary*

Beginning with the early research of Coleman et al. (1966), a variety of studies have been conducted in order to determine the influence of particular teacher effects on student achievement (Fallon, 2006; Ferguson & Ladd, 1996;

Greenwald et al., 1996; Hawk et al., 1985; Monk, 1994; Wenglinsky, 1998). While teacher experience and teacher education level have demonstrated positive correlations to student achievement (Fallon, 2006; Ferguson, 1991; Fetler, 1999; Goldhaber & Brewer, 2000; Greenwald et al.; Nye et al., 2004; Turner et al., 1986; Wenglinsky), there also exists research on these effects which stand as inconclusive (Boyd et al., 2006; Cochran-Smith & Fries, 2005; Gallagher, 2004; Good et al., 2006; Hanushek, 2003; Jencks et al., 1972; Wilson et al., 2001). The influence of National Board certification on student achievement is yet to be determined, as limited prior research exists on this relationship (Burroughs, 2001; Goldhaber et al., 2004; Kelley & Kimball, 2001; Murray, 2000; Podgursky, 2001).

The influence of certain teacher effects on student achievement is relevant for all students and schools, and in particular schools that house a low socioeconomic student population. Research indicates that students in low SES schools are more likely to be taught by an inexperienced or less qualified teacher (Betts et al., 2001; Olson, 2003; Zumwalt & Craig, 2005a). In addition, low SES schools experience higher teacher attrition rates than their more affluent counterparts (Ayala & Claasen, 2007; Boyd et al., 2005; Gehrke, 2005; Howard, 2003; Wiggan, 2007).

The expectation of the public school system to demonstrate excellence through student achievement is a direct result of federal and state accountability systems, including the *No Child Left Behind Act* of 2001 (Rudalevige, 2003; West

& Peterson, 2003). While some question the fairness or effectiveness of the law's expectations (Haas et al., 2005; Linn, 2003; Noddings, 2004), it is also recognized that school accountability, as defined through NCLB, has changed the landscape of teaching and learning (Hess, 2003; Moe, 2003; West & Peterson). Quality teaching, as evidenced through improved student achievement, is now the focus of educators and leaders alike (West & Peterson). Therefore, identifying those teacher characteristics related to increased student achievement is one key to success in this age of excellence.

In the following chapter, a detailed description of this study's purpose as well as the data and analyses utilized will be discussed. In carrying out this methodology, this research joins the variety of studies outlined in this literature review in forming the body of teacher effects literature.

## CHAPTER 3: METHODOLOGY

### *Introduction*

Based on the literature presented, there were two primary purposes for this research. The first purpose was to determine the degree of difference in elementary student mathematics achievement growth means based on each of three specific teacher preparation-based effects. The three specific teacher preparation-based effects researched were: (1) years of teaching experience; (2) teacher education level; and (3) National Board certification status. The second purpose was to explore the degree to which differences among each of these three variables and the elementary mathematics achievement growth means were affected by school socioeconomic status. The conceptual framework for this study is illustrated in Figure 1 (page 11).

The need for this research is timely and significant. With the number of low SES schools increasing across this nation, we now have more teachers than ever housed within these schools. In addition, the *No Child Left Behind Act* requires sanctions for low-performing schools, which are more often low SES schools. Factors that may affect the success of all students as well as the success of low SES schools is significant information for educators to utilize. Inferences drawn from this research could potentially be used in assessing the effectiveness of teacher support programs, the wisdom of placing less experienced teachers at low SES schools, the priority that pay incentives for advanced degrees and NBPTS certification should take in public school budgets,

and the need for specific placement and recruitment of experienced teachers, teachers with advanced degrees, and teachers with NBPTS certification.

With newer as well as more veteran teachers reportedly leaving the profession to avoid what National Education Association president Chase described as the “instructional straightjacket” imposed by testing (Gorman, 2001), and with more funds than ever before dedicated to rewarding the accomplished through advanced degrees and National Board certification, the topic of variables related to success on student standardized tests is significant. The implications from this research hold the potential for enormous impact on the educational arena.

#### *Research Questions*

1. What is the impact of teacher’s level of experience on mean achievement growth in mathematics for students in grades 3-5?
2. What is the impact of teacher’s level of education on mean achievement growth in mathematics for students in grades 3-5?
3. What is the impact of teacher’s National Board of Professional Teaching Standards certification on mean achievement growth in mathematics for students in grades 3-5?
4. What is the impact of teacher’s level of experience and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?

5. What is the impact of teacher's level of education and school socioeconomic level on mean achievement growth in mathematics for grades 3-5?
6. What is the impact of teacher's National Board of Professional Teaching Standards certification and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?

*Null Hypotheses*

1. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's level of experience.
2. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's level of education.
3. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's certification through the National Board of Professional Teaching Standards.
4. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent upon the level of teacher experience and a school's socioeconomic level.

5. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent upon the level of teacher education and a school's socioeconomic level.
6. There is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent upon the level of teacher certification through the National Board of Professional Teaching Standards and a school's socioeconomic level.

### *Design of the Study*

#### *Site*

The data used for this research was generated from the Gaston County school district in North Carolina for the 2007-2008 school year. The Gaston County school district was selected for this study based on several factors. During the 2007-2008 school year, Gaston County was the seventh largest school district in North Carolina, with 53 schools and a total student enrollment of 33,000 students. The size of this district provided a large data base and provided justification for the generalizing of results to the statewide population. In addition, the ethnic distribution of students in Gaston County was fairly representative of the state as a whole. In the state of North Carolina, African-American students made up 31.2% of the student population, Hispanic students made up 10%, and Caucasian students made up 55%. In comparison, 20.3% of Gaston County's students were African-American, 7.5% of students were Hispanic, and 68.2% were Caucasian. During the 2007-2008 school year, the graduation rate of

Gaston County was 72.3%, consistent with the state rate of 69.7%. Twenty-three percent of teachers in Gaston County held advanced degrees, as compared to 25.4% in the state of North Carolina. Finally, with 52.18% of its student population qualifying for free and reduced lunch benefits, Gaston County was representative of the economic challenges facing students across the state. These demographic and quantitative comparisons illustrate the applicability of using Gaston County Schools as the site for this research.

### *Participants*

Gaston County housed thirty-one elementary schools, therefore, the availability of a rich body of data was present. During the 2007-2008 school year, Gaston County employed 2,121 teachers, with the average years of teaching experience at 13 and 23% of these teachers holding advanced degrees. More specific to this study, there were 333 elementary teachers who held advanced degrees, 22% of the elementary teacher workforce. In addition, Gaston County had 185 National Board certified employees during this time, with the elementary schools averaging 3 National Board certified teachers per school (Gaston County Schools Human Resource Department, 2008).

*Teachers.* All of Gaston County's 3<sup>rd</sup>-5<sup>th</sup> grade teachers were considered for inclusion in this research, with two data filters used to determine the final 310 teachers whose scores were analyzed for this study. Only teachers employed in the Gaston County school system for the majority of the 2007-2008 school year, as measured by a hire date prior to October 15<sup>th</sup> and an employment continuation

through the remainder of the school year, were included. This date range was selected because: (1) it is the approximate date range used to determine that a student has been in membership at least 140 days prior to standardized testing, as required through the accountability standards of the *ABCs of Accountability* and *No Child Left Behind*; and (2) a teacher who was not in employment at the end of the year would not be identified through testing reports. In addition, any teacher not documented as the “teacher of record” for math instruction was excluded from the study. Several of Gaston County’s elementary schools use a “team teaching” approach in grades 3-5, with some teachers teaching math exclusively and others teaching reading exclusively. The Gaston County teacher mean achievement data did not assign math mean scores to teachers who were not designated as math teachers. All data used in the study is reflective of teachers who were actually assigned the responsibility of teaching math.

*Students.* All of the 2007-2008 Gaston County Schools’ elementary students in grades three (n=2,560 students), four (n=2,551 students), and five (n=2,391 students), whose math achievement growth scores were housed in the district data base, were sorted into their heterogeneously assigned mathematics class groups. Class student math achievement growth means were determined and assigned to the mathematics “teacher of record” who taught the heterogeneously grouped class of students. This process was repeated for each of the student scores considered and for each of the 310 teachers included in the study. While all students were considered, not all were included in this research.

Only those scores representing students in membership in a particular school for 140 days prior to standardized testing were included (n=6,093), consistent with the accountability standards of North Carolina's accountability model for public schools and federal *No Child Left Behind* interpretations from the state. In addition, students taking an alternate form of assessment were not included in this study.

#### *Data Collection Procedures*

In studying the effects of teacher experience, teacher education, and National Board certification on student achievement, this analysis acknowledged a large number of student- and school-related variables. Many of these variables were not under the control of the study and are described thoroughly in the section *Limitations and Threats to Validity*.

The independent variables used as measures of teacher effects included years of experience, level of education, and National Board certification. Regarding school variables, the independent variables included the school's status as a Title I school (50% or higher free and reduced lunch student population) or a non-Title I school. This Title I designation was used to indicate whether a school was low SES, with the percentages set by the Gaston County School district in designating elementary schools as Title I schools during the 2007-2008 school year.

The singular dependent variable in this study was the achievement growth posted by students as represented by a class mean for each teacher. This

variable was measured by the students' 2008 North Carolina End-of-Grade test results in math. This test is designed and validated by the North Carolina Department of Instruction and is mandated for all students in grades three through eight. For this study, only grades three, four, and five were analyzed. Following is a description of each of the data sources that were utilized for this study, including collection procedures and possible challenges associated with each.

#### *Student Standardized Test Results*

The first data source used was the Gaston County 2008 End-of-Grade math test results for third, fourth, and fifth grades. Standardized test scores were the logical choice for this research, as it was a study into relationships between teacher quality, as related to certain teacher effects, and student achievement. As Fallon (2006) conducted his own research he found that the studies he analyzed that dealt with teacher quality or pupil outcomes all used standardized tests as a measure of pupil achievement (Fallon). Likewise, the research team of Ferguson and Ladd (1996) asserted that "standardized tests remain the best available measures of output that are valid for comparisons over time and across schools" (p. 267).

While the North Carolina ABCs of Accountability program was implemented in 1996-1997, this state accountability program is still very much in a state of transition. Changes in curricula and scales prompted the North Carolina Department of Public Instruction to also alter the formula for determining

student growth, beginning in 2006-2007. This new growth formula was a shift in direction as a student's growth was now based on past as well as current student performance. The North Carolina growth formula uses a standardized scale score (known to NC educators as the "c-score") to measure relative student performance instead of the original developmental scale score (DSS). This c-score is very similar to a z-score in that it standardizes how far and in what direction the student's score is different from the score that was expected. Developmental scales scores are converted into c-scores for the purpose of comparing students across the state of North Carolina to each other and to their own expected growth. As the North Carolina Department of Public Instruction explains: "Under this growth formula, [a student's DSS] is standardized and a student's performance is considered as a point on the c-scale (or change scale) relative to standard performance for that grade level in a standard setting year" (North Carolina Department of Public Instruction, 2007b).

Under this growth formula, growth is indicated through *academic change*. Academic change is expressed as the difference between a student's actual c-scale score for the current year and the student's predicted c-scale score, as determined using the average of the previous two years' assessments and a correction for regression toward the mean. A positive academic change indicates a gain in academic achievement, while a negative academic change indicates a loss in achievement.

The formula used by the NC DPI to determine academic change is as follows:

*AC = CS – (0.92 X ATPA), where AC is academic change, CS is current score, and ATPA is the average of the two previous assessments.*

Heck (2007) used longitudinal data, such as the academic change score, from particular student cohorts for his research into teacher effects and achievement. He defended this methodological decision with the following:

Growth trajectories provide a more thorough and accurate estimation of student learning than does the simple comparison of achievement levels at one point in time, learning gains between two measurements, or an achievement score adjusted for a previous score because growth models incorporate more information about students' previous learning than the other approaches. In growth models, both the level of outcomes attained and the shape of the change over time can be examined simultaneously (Heck, p. 409).

The elementary grades have been selected for this study for a specific reason. As Bingham, Heywood, and White shared in determining the research plan for their 1991 study related to student performance, "it is only in elementary schools where one teacher is basically responsible for the academic achievement of his or her students" (p. 196). Although there are instances in which additional support staff may assist students who are experiencing

difficulties (i.e. individualized reading assistance), in the Gaston County district, elementary classrooms follow the self-contained, heterogeneous instructional model. Additionally, elementary schools, of all schools in the district, are less influenced by district effects. As English (2008) pointed out in his analysis of curriculum audits, elementary schools can operate independently of any system of schools, while secondary schools cannot. The elementary grades were ideal for generating data to analyze the true impacts of teacher effects on student achievement.

#### *Teacher Experience Level*

The second data source analyzed in this study was information on the teacher experience level of each Gaston County teacher in grades 3-5, in values of cumulative years of classroom teaching. While the teacher effects study conducted by Nye et al. (2004) categorized teachers into two experience categories: (1) those with less than three years of experience, and (2) everyone else, this study took a different approach. Teacher experience was grouped into three categories: new teachers (in years 0-3 of their teaching careers); established teachers (in years 4-9 of their teaching careers); and career teachers (in year 10 or more of their careers). The *new* category and the years assigned were chosen to align with the three years a new teacher spends as an “Initially Licensed Teacher” in the state of North Carolina. The *established* category and the years assigned were chosen because, at this point, a teacher has made it past what many would consider the “attrition-friendly” zone and is settled into the

profession. The *career* category and the years assigned were chosen because, in the state of North Carolina, the tenth year marks the point at which these teachers are rewarded with an annual longevity bonus. This experience level data was gathered from the Gaston County Human Resource department using figures from the 2007-2008 school year.

#### *Teacher Education Level*

The third data source analyzed for this research was the level of educational degree obtained by the teacher. This information was grouped into two different categories: teachers who held a bachelor's degree only and teachers who held an advanced degree (including master's, educational specialist, and doctorate). This design was a replica of the design utilized by Nye et al. (2004) in their research on teacher education effects. This education level information was obtained from the Gaston County Human Resource department data and included figures from the 2007-2008 school year.

#### *National Board Certification*

The fourth data source analyzed in this research was the attainment of National Board Certification. This information was grouped into two different categories: teachers who had obtained National Board certification and teachers who had not. This information was obtained from the Gaston County Human Resource department using figures from the 2007-2008 school year.

### *School Title I Status*

The final data source analyzed in this research was the socioeconomic category of each Gaston County school from which these test scores were derived. Two categories were used to group this information: Title I/low SES schools (those schools with 50% or more students qualifying for free and reduced lunch) and non-Title I/high SES schools. Each teacher and set of mean math achievement growth (c-scores) were designated in terms of whether the teacher was assigned to a Title I/low SES school or a non-Title I/high SES school. The Title I/low SES schools' level of 50% free and reduced lunch student population was determined in order to align with the 2007-2008 Gaston County Schools' policy, which set a 50% free or reduced lunch threshold for schools to receive Title I funding. Thus, Title I is an indication of a socioeconomically disadvantaged student population. During the 2007-2008 school year, eighteen of Gaston County's thirty-one elementary schools were designated as Title I, with seventeen of these Title I schools housing third, fourth, and fifth grade students.

This design was consistent with that of many studies that account for socioeconomic status, including that of Wayne and Youngs (2003). These researchers described the justification behind this approach:

Accounting for both prior achievement and socioeconomic status makes a study's findings more compelling because the question 'Do students learn more from teachers with these characteristics?' pertains to a causal relationship. There are many studies that

examine end-of-year student test scores and teacher qualifications. But in order to attribute any observed student achievement differences to teacher characteristics, one must rule out alternative explanations (Wayne & Youngs, p. 92).

### *Threats to Validity*

Several factors beyond the researcher's control are acknowledged as having possible impact on the validity of the results and conclusions.

#### *Validity of Standardized Tests as a Measure of Student Achievement*

It has long been debated whether standardized tests should be considered so significantly in the assessment of teacher effectiveness in regards to student learning. With the arrival of *No Child Left Behind*, the debate became even more fervent, as states, districts, and schools were required to pay more attention than ever before to standardized test results (West & Peterson, 2003). Standardized tests, such as the End-of-Grade Tests utilized in this study, do indeed measure outcomes that have been deemed as important by policy makers and state leaders. This study relied heavily on this form of data to establish the existence of possible relationships between teacher preparation effects and student achievement, but did so with the acknowledgement that standardized achievement tests measure only one part of student learning. As Boyd et al. (2006) described: "by focusing on these measures, we are missing many important aspects of learning, as well as other valued outcomes of schooling; this is an inherent limitation to these kinds of data."

### *Mid-Year Teaching Change*

There are some instances during a typical school year, and especially in larger districts, in which mid-year attrition brings about the need for a teacher change. For example, if teacher X, who has twenty years of experience, started the school year and taught until March, only to move out of town and be replaced by teacher Y (who is a teacher with two years of experience), the standardized test scores for that class of students will have teacher Y's name at the top, even though teacher Y had very little time with the students, comparatively speaking. While this does not happen every day, even one time is more than any district or school would desire. To protect the study from this skewed data, the researcher only included data from teachers who had taught in their specific schools at least 140 days prior to student testing.

### *Student Assignment*

In conducting this study it was acknowledged that there is no realistic way to assure that the classes assigned to each of the hundreds of teachers involved in this study were equal. There can be no doubt that variances within each class and between classes did occur, including but not limited to variances in: cognitive abilities, motivation, socio-economic status, English proficiency, parent education level, attendance, previous retentions, physical limitations, and parental support. The advantage to using a large population, as was done in this study, is in the lessened impact of variances within a particular group. For this study, the mean c-score for each class represented the actual growth of the students compared to

the predicted growth for students. In addition, the school district being studied here, Gaston County Schools had a district-mandated class assignment policy in the elementary grades. Each school was required to assign classes heterogeneously, or as representative as possible of the entire school population. Also, only student data representing students in membership at least 140 days prior to testing were included. That having been stated, there was no manner in which a perfectly distributed and equal student assignment in each of these thirty-one schools and hundreds of classrooms could be assured by the researcher in this study.

#### *Secondary Source Data*

An additional general limitation was due to the use of secondary source data for this research. While the documents used to gather information on teacher demographics and student achievement growth were valid and reliable, they were sources that were not produced specifically for research purposes.

#### *Generalization from Population*

While the size of the Gaston County School district was large enough to provide a substantial population for this study, generalizations to other districts cannot be made with full confidence because each school district has unique factors as determined by region, membership, size, and resources.

### *Data Analysis*

Several analyses were utilized in this study in order to establish the acceptability of the null hypotheses stated above. Included here is a description of each of the analyses used and a summary of each test's purpose.

#### *Analysis of Variance*

Separate one-way ANOVAs were conducted to determine whether means on the dependent variable of elementary math achievement growth were significantly different among the levels of teacher experience, teacher education, and National Board certification.

#### *Factorial ANOVA*

Two-way ANOVAs were conducted to evaluate the effects of school Title I status on elementary math achievement growth means among levels of teacher experience, teacher education, and National Board certification. This included a 3 X 2 analysis for teacher experience, a 2 X 2 analysis for teacher education, and a 2 X 2 analysis for National Board certification, each of which determined the effects on elementary math achievement growth means.

#### *Post Hoc*

Where significant effects were demonstrated in either of the ANOVAs used to evaluate differences in math mean achievement growth among the levels of teacher experience, Post-Hoc comparisons were conducted. Only the teacher experience ANOVAs held the potential for Post-Hoc comparisons, as these involved more than two levels.

### *Summary*

In this age of excellence in educational achievement, as defined by both federal and state accountability, it is timely and relevant to closely examine the potential influence of particular teacher effects in the improvement of student achievement. In addition, as economic crises threaten the financial stability of families and homes, increased proportions of the public school population will join the ranks of the impoverished, with potentially increased numbers of low SES schools to follow suit. Identifying teacher effects that permeate these socioeconomic factors in positively influencing student math achievement is of critical importance as district and school-based leaders strive to stay ahead of federal AYP requirements.

With the stage set for this very pursuit of excellence, this study sought to address two overriding issues. The first was to expand upon earlier research in analyzing the impact of teacher education and preparation effects on student mathematics achievement. While prior research has shown compelling results, the research as a whole is not conclusive or entirely in agreement. For this study the specific focus was to determine whether any or all of the three teacher effects of teaching experience, teacher education, and teacher certification, demonstrated variances in elementary mathematics achievement growth in the Gaston County, North Carolina, school district. The second overriding issue of this study was to examine whether any of the established differences in mathematics achievement growth related to teacher effects were varied when

comparing teachers in higher socioeconomic school cultures to teachers in lower socioeconomic school cultures.

The following chapter will provide the analyses of the data used for this study. The results from these analyses hold the potential for a variety of outcomes. Regardless of the outputs, the implications are compelling for those who lead the learning and teaching process.

## CHAPTER 4: DATA ANALYSIS AND RESULTS

### *Introduction*

This study explored six research questions focused upon the impact of teacher effects on student achievement. The teacher effects were teacher experience, teacher education, and National Board certification. The review of literature in chapter 2 of this study indicated that much is yet to be learned about the specific impact of certain teacher effects on student learning. While two of the effects, teacher experience and teacher education level, have been widely studied to determine their impact on student learning, the third effect, that of National Board certification, has not been researched extensively. The conceptual framework for this study (see Figure 1) originates in the prior research of Nye et al. (2004) as well as Ferguson (1991). Ferguson (1991) worked extensively in analyzing the impact of teacher preparation-based effects on student achievement, and the work of Nye et al. examined the impact of teacher effects when analyzed in light of school socioeconomic factors. This study adds to the existing research by addressing the issues of teacher effect impact while also examining the influence of school socioeconomic level on teacher effect and student achievement relationships.

This study focused on student math achievement and utilized the academic change results of North Carolina's End-of-Grade tests as its data source. These tests were first implemented as part of North Carolina's ABCs of Public Education accountability system during the 1996-1997 school year in

order to measure student proficiency as well as student change in performance (NCDPI, 2007b). These tests measure math achievement through two separate sessions – a calculator active session and a calculator-inactive session, which are combined to provide one math achievement score. Test questions are aligned to the North Carolina Standard Course of Study curriculum for each grade.

This study utilized data from the Gaston County School District in North Carolina in order to explore the previously described topics regarding teacher effects and school socioeconomic level. In this chapter, the procedures for data collection and an analysis of the data for the research questions that guided this study are presented. Specifically, this study addressed the following research questions:

1. What is the impact of teacher's level of experience on mean achievement growth in mathematics for students in grades 3-5?
2. What is the impact of teacher's level of education on mean achievement growth in mathematics for students in grades 3-5?
3. What is the impact of teacher's National Board of Professional Teaching Standards certification on mean achievement growth in mathematics for students in grades 3-5?
4. What is the impact of teacher's level of experience and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?

5. What is the impact of teacher's level of education and school socioeconomic level on mean achievement growth in mathematics for grades 3-5?
6. What is the impact of teacher's National Board of Professional Teaching Standards certification and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?

*Description of the Participants*

All participants in this study (n= 310) were selected from third, fourth, and fifth grade teachers in the Gaston County School district in North Carolina. There are thirty-one elementary schools in Gaston County. Three elementary schools were excluded from the participants because these schools only teach K-2 students and North Carolina does not utilize standardized testing at these grade levels. Therefore, twenty-eight elementary schools and their math teachers participated in this study. During the 2007-2008 school year, Gaston County Schools employed 2,121 K-12 teachers, with the average years of teaching experience at 13. During the 2007-2008 school year, 23% of Gaston County's K-12 teachers held advanced degrees and 185 Gaston County K-12 teachers were National Board certified.

The participants in this study consisted of 310 3-5 grade teachers from the Gaston County School district, all of whom taught math in the 3-5 grades during the 2007-2008 school year. These participants included 23 National Board

certified teachers and 61 teachers who held advanced degrees (Gaston County Schools Human Resource Department, 2008).

Table 1 provides a summary of the study participants' demographic information, including teacher effect information analyzed in this study. As noted in Table 1, demographic information included years of teaching experience, education level, and National Board certification status. Demographic information also noted the number of teachers who worked in Title I (n=175, 56% of participants) or non-Title I (n=135, 44% of participants) schools.

While there were 401 total Gaston County teachers in grades 3-5 during the 2007-2008 school year, 91 of these teachers were excluded from participating in this study due to two specific factors. Only teachers employed in the Gaston County school system for the majority of the 2007-2008 school year, as measured by a hire date prior to October 15<sup>th</sup> and an employment continuation through the remainder of the school year, were included in this study. This date range was selected because: (1) it is the approximate date range used to determine that a student has been in membership at least 140 days prior to standardized testing, as required through the accountability standards of *No Child Left Behind*; and (2) a teacher who was not in employment at the end of the year would not be identified through standardized testing reports. 55 of Gaston County's teachers in grades 3-5 did not meet this employment requirement and were excluded from the study.

Table 1

*Description of Study Participants*

	n	%	Title I	%	No Title I	%
Teaching Experience						
New (0-3 yrs)	71	23	51	16	20	6
Established (4-9 yrs)	89	29	49	16	40	13
Career (10+ yrs)	150	48	75	24	75	24
Education						
Bachelors	249	80	147	45	109	35
Advanced	61	20	35	11	26	8
National Board						
National Board	23	7	5	2	18	6
No National Board	287	93	170	55	117	38
Socioeconomic Levels						
Title I teachers	175	56				
Non Title I teachers	135	44				

In addition, any teacher not documented as the “teacher of record” for math instruction was excluded from the study. Several of Gaston County’s elementary schools use a “team teaching” approach in grades 3-5, with some teachers teaching math exclusively and others teaching reading exclusively. The Gaston County teacher mean achievement data did not assign math mean scores to teachers who were not designated as math teachers, and this resulted in 36 teachers who were excluded from the study based on this “teacher of record” requirement. All data used in the study is reflective of teachers who were actually assigned the responsibility of teaching math to students.

#### *Description of Student Achievement Data*

Each student’s academic change, or growth, in math was generated by the state of North Carolina using the academic change formula described in chapter 3 of this study. Academic change is expressed as the difference between a student’s actual c-scale score for the current year and the student’s predicted c-scale score, as determined using the average of the previous two years’ assessments and a correction for regression toward the mean. A positive academic change indicates a gain in academic progress, while a negative academic change indicates a loss in progress. The math academic change, or growth, was analyzed for each student as part of North Carolina’s ABC Accountability model and was made available to the researcher with permission of the district’s superintendent (see Appendix B).

All of the 2007-2008 Gaston County Schools' elementary students in grades three (n=2,560 students), four (n=2,551 students), and five (n=2,391 students), whose math achievement growth scores were housed in the district data base, were sorted into their heterogeneously assigned mathematics class groups. Class student math achievement growth means were determined and assigned to the mathematics "teacher of record" who taught the heterogeneously grouped class of students. This process was repeated for each of the student scores considered and for each of the 310 teachers included in the study.

While there were 7502 total 3-5 individual student End-of-Grade math achievement results for the 2007-2008 school year, 609 of these scores were excluded from consideration in this study due to lack of adequate membership. Only those scores representing students in membership in a particular school for 140 days prior to standardized testing were included (n=6,093), consistent with the accountability standards of North Carolina's accountability model for public schools and federal *No Child Left Behind* interpretations from the state. In addition, students taking an alternate form of assessment were not included in this study.

### *Analysis of Data*

#### *Analysis of Research Question #1: The Impact of Teacher Level of Experience on Student Achievement*

Levels of teaching experience were analyzed to determine whether this variable had an effect on student math achievement. Math achievement was

measured by the students' 2008 North Carolina End-of-Grade test results in math for grades 3-5. Information on the teacher experience level of each Gaston County teacher in grades 3-5, in values of cumulative years of classroom teaching, was obtained from the Gaston County Human Resources Department. Teacher experience was identified through three categories: new teachers (in years 0-3 of their teaching careers); established teachers (in years 4-9 of their teaching careers); and career teachers (in year 10 or more of their careers). A one-way analysis of variance was utilized to determine whether there were significant differences in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's level of experience. The null hypothesis for this analysis was that there was no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's level of experience.

A univariate analysis of variance assesses the mean differences between independent variable groups on a dependent variable (Green & Salkind, 2008). For this study, one independent factor, teacher experience level, and the dependent variable, student mathematics mean achievement growth, were analyzed. The dependent variable, student mathematics mean achievement growth, was the mean *academic change* score for the teacher's class of students, which represents the difference between the predicted growth in math achievement and the actual growth in math achievement. The academic change score was provided by a state-generated comparison of a student's historical

scores and actual scores from the End-of-Grade standardized tests. The math academic change, or growth, is analyzed for each student as part of North Carolina's ABC Accountability Model and is available to principals and district leaders through the North Carolina ABC Tools program.

*Descriptive statistics.* The means and standard deviations of students' mean math achievement scores by teacher experience level are shown in Table 2. Standard deviations for each experience group are similar and within a normal range. As seen in Table 2, the independent factor divided participants into three groups of teaching experience: *new*, *established*, and *career*. The *new* group included teachers with 0-3 years of teaching experience (n=71, 23% of participants), the *established* group included teachers with 4-9 years of experience (n=89, 29% of participants), and the *career* group represented teachers with 10 or more years of experience (n=150, 48% of participants).

Figure 2 provides a histogram representing additional descriptive statistics for this analysis. The range of mean math achievement growth was slightly narrower for the *new* group than for the *established and career* groups. Minimal outliers exist at the *established* and *career* level only. These frequency distributions would indicate a relatively normal distribution of scores for the three groups.

*Analysis of test of equality.* Prior to the ANOVA, Levene's test of equality (see Table 3) was used to evaluate the assumption that the population variances

Table 2

*Descriptive Statistics for Student Achievement by Teacher Experience Levels*

Experience	<i>M</i>	<i>SD</i>	<i>N</i>	%
New	.0765	.23180	71	22
Established	.1461	.24457	89	29
Career	.2189	.28558	150	48
Total	.1654	.26804	310	

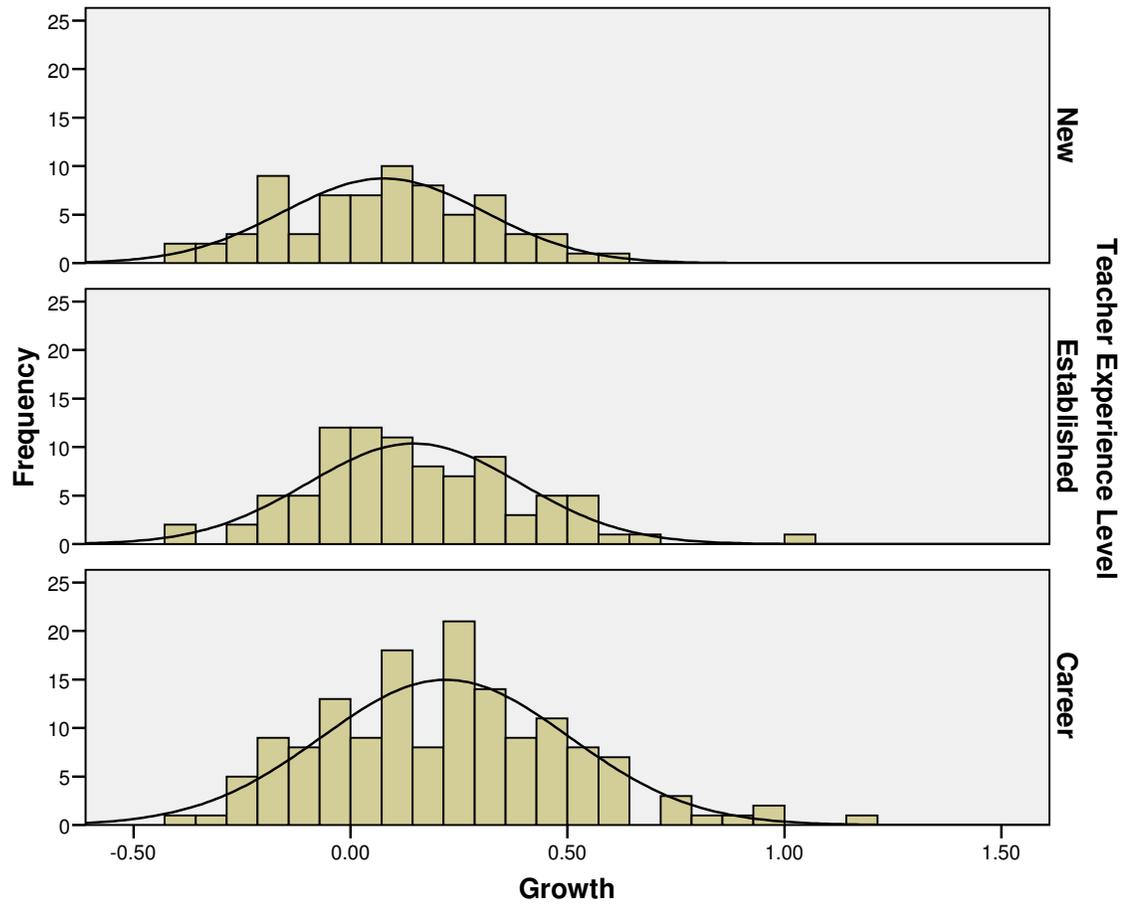


Figure 2. Histogram of dataset for teacher experience analysis of variance.

Table 3

*Levenes's Test of Equality of Error Variances-Teacher Experience*

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<i>F</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
1.931	2	307	.147

---

*Note.* a. Design: Intercept+Experience.

for all three groups are equal. The results of this test,  $p=.147$ , indicate that homogeneity of variance can be assumed.

#### *Analysis of Variance for Teacher Experience*

In determining the impact of teacher's level of experience on mean achievement growth in mathematics for students in grades 3-5, an analysis of variance was conducted. Respondents were divided into three groups according to their years of experience. These three groups were *new* (0-3 years of experience), *established* (4-9 years of experience), and *career* (10+ years of experience). Table 4 illustrates that the test was significant, as  $F(2,307) = 7.42$ ,  $p < .01$ . Because the  $p$  value is less than .05, the null hypothesis that there are no differences among the experience groups is rejected.

Figure 3 provides a plot of estimated marginal means. From the results of the ANOVA and the plot line, mean growth scores increase with increased levels of teacher experience for this population.

*Effect size.* The strength of this relationship is represented by the partial eta squared. At  $\eta^2=.046$ , this result indicates a small effect size (Cohen, 1988; Green & Salkind, 2008) of teacher experience level in impacting student achievement growth in math, with an estimated 5% of the variance in this variable impacted by teacher experience.

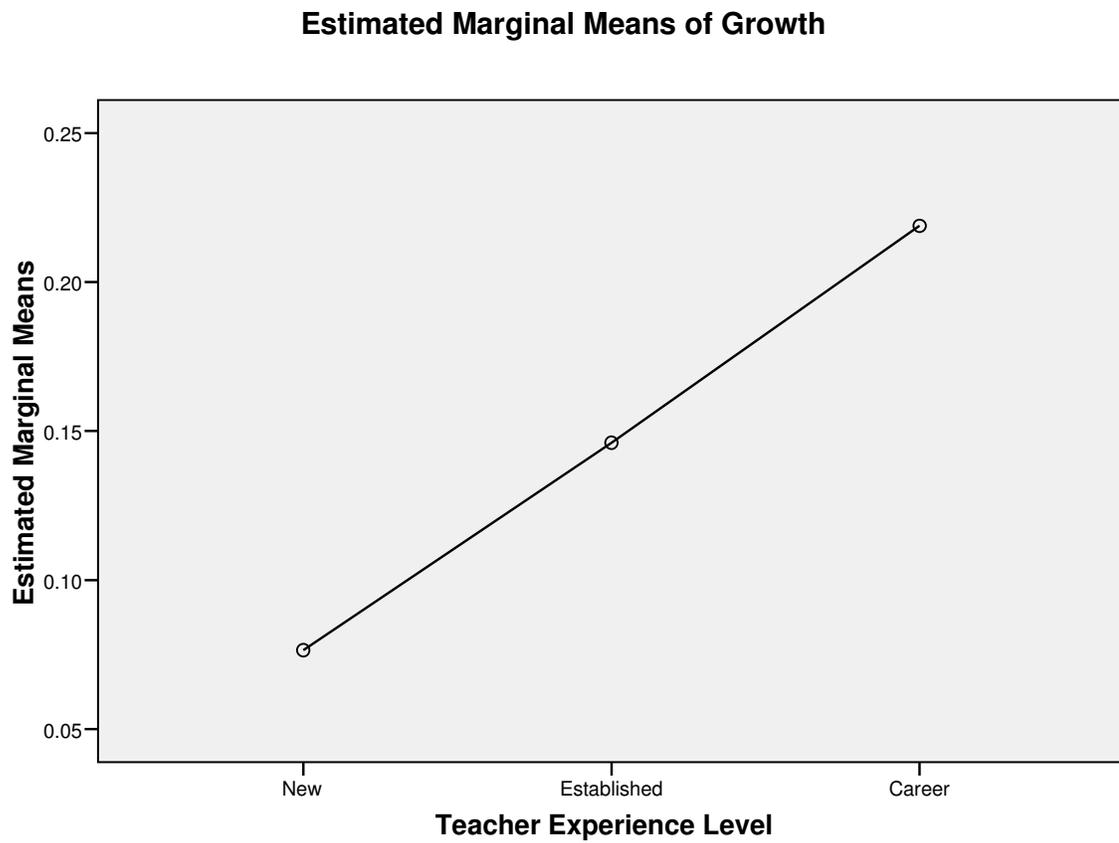
Table 4

*Analysis of Variance for Teacher Experience and Student Achievement*

Source	df	F	$n^2$	$p$
Between Subjects				
Experience	2	7.419**	.046	.001
Error	307	(.069)		

*Note.* Value enclosed in parentheses represents mean square error.

\* $p < .05$ . \*\* $p < .01$ .



*Figure 3.* Means plot of teacher experience analysis of variance.

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*Post Hoc Tests.* Because the overall F-test was significant, follow-up tests were conducted to determine pair wise differences among the teacher experience level means. Of the post hoc procedures available, the Tukey test was selected, as equal variances were assumed for this analysis. The results of the post hoc comparisons are shown in Table 5. Using the Tukey test (see Table 5), the *new* group and the *career* group differ significantly from one another ( $p < .01$ ). The difference in means between these two groups was .14, approximately twice the difference in means between the *new* and *established* groups and the *established* and *career* groups. This post hoc examination suggests that although approximately 5% of the variance in math achievement can be attributed to differences in teacher experience level, it is the differences between the *new* and *career* groups that may primarily constitute this impact.

#### *Analysis of Research Question #2: The Impact of Teacher Level of Education on Student Achievement*

Levels of teacher education were analyzed to determine whether this variable had an effect on student math achievement. Math achievement was measured by the students' 2008 North Carolina End-of-Grade test results in math for grades 3-5. Information on the teacher education, or degree level of each Gaston County teacher in grades 3-5 was obtained from the Gaston County Human Resources Department. Teacher education was identified through two categories: bachelors degree only and advanced degrees. Upon gathering this teacher education information it became apparent that all advanced degrees for

Table 5

*Post Hoc/Tukey Test for Teacher Experience and Student Achievement*

Experience (I)	Experience (J)	<i>M</i> difference (I-J)	Standard Error	<i>p</i>	95% Confidence Interval	
					Lower Bound	Upper Bound
New	Established	-.0696	.04179	.220	-.1680	.0288
	Career	-.1424*	.03783	.001	-.2315	-.0533
Established	New	.0696	.04179	.220	-.0288	.1680
	Career	-.0728	.03514	.097	-.1556	.0100
Career	New	.1424*	.03783	.001	.0553	.2315
	Established	.0728	.03514	.097	-.0100	.1556

*Note.* \*The mean difference is significant at the .05 level.

Gaston County's 3-5 grade teachers were master's degrees. A one-way analysis of variance was utilized to determine whether there were significant differences in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's level of education. The null hypothesis for this analysis was that there is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's level of education.

A univariate analysis of variance assesses mean differences between independent variable groups on a dependent variable (Green & Salkind, 2008). For this study, one independent factor, teacher education level, and the dependent variable, student mathematics mean achievement growth, were analyzed. The dependent variable, student mathematics mean achievement growth, was the mean *academic change* score for the teacher's class of students, which represents the difference between the predicted growth in math achievement and the actual growth in math achievement. The academic change score was provided by a state-generated comparison of a student's historical scores and actual scores on the End-of-Grade standardized tests. The math academic change, or growth, is analyzed for each student as part of North Carolina's ABC Accountability Model and is available to principals and district leaders through the North Carolina ABC Tools program.

*Descriptive statistics.* The means and standard deviations of students' mean math achievement growth scores by teacher education level are presented

in Table 6. Standard deviations for each experience group were similar and within a normal range.

As shown in Table 6, the independent factor, teacher education level, divided participants into two groups, *bachelors* and *advanced*, each of which represented the highest degree earned for each teacher. Education levels used were *bachelors* (n=249, 80% of participants), representing a bachelors degree only; and *advanced* (n=61, 20% of participants), representing an advanced degree, including a master's, an educational specialist, or a doctorate degree.

Figure 4 provides a histogram of the mean mathematics achievement growth by teacher education level. The range of mean math achievement growth was broader for the *bachelors* group than for the *advanced* group. Minimal outliers were identified for the *bachelors* group. The frequency distribution would indicate both groups as having relatively normal distribution of scores.

*Analysis of test of equality.* Prior to the ANOVA, Levene's test of equality (see Table 7) was used to evaluate the assumption that the population variances for the two teacher education groups are equal. The results of this test,  $p=.92$ , indicate that homogeneity of variance can be assumed.

#### *Analysis of Variance for Teacher Education*

In determining the impact of teacher's level of education on mean achievement growth in mathematics for students in grades 3-5, an analysis of variance was conducted. As shown in Table 8, the test is not significant, as  $F(1,308) = 1.26, p = .263$ .

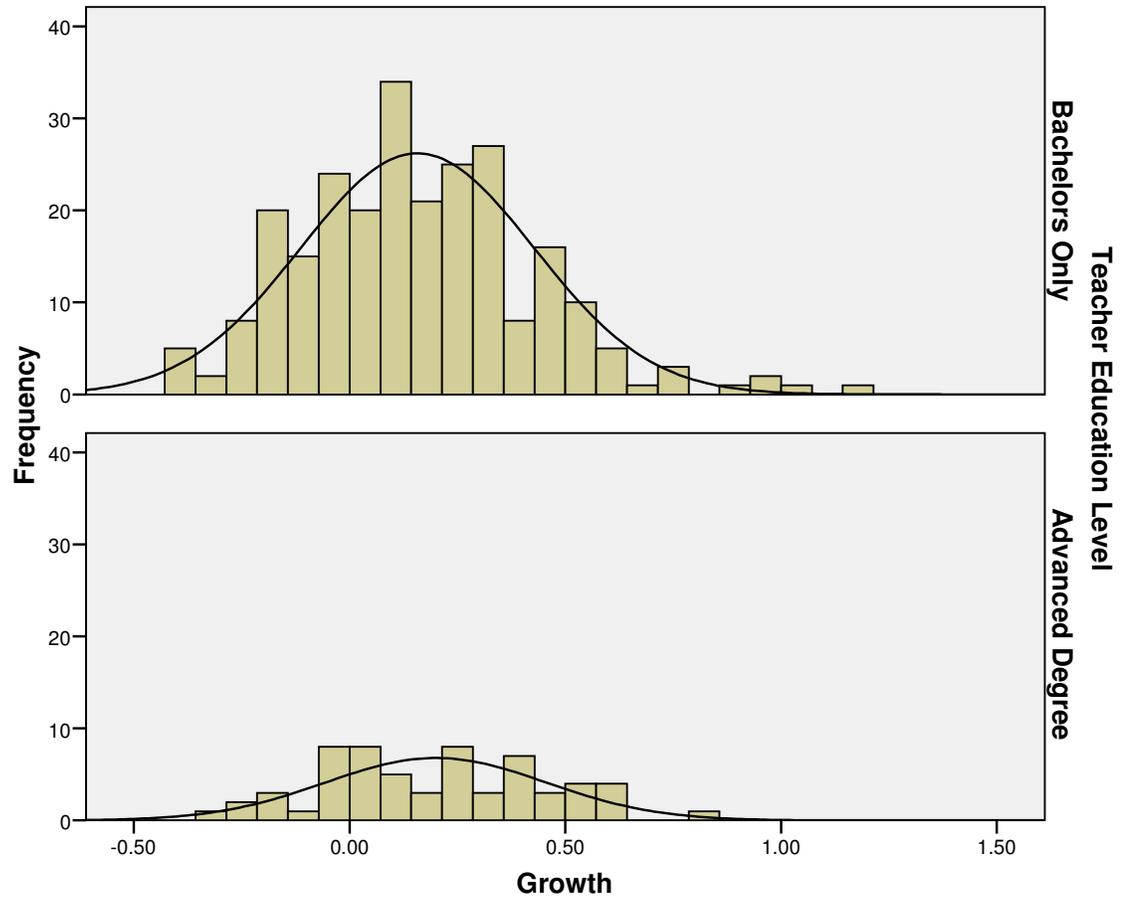
Table 6

*Descriptive Statistics for Student Achievement by Teacher Education*

---

Education	<i>M</i>	<i>SD</i>	<i>N</i>	%
Bachelors	.1569	.27073	249	80
Advanced	.1998	.25604	61	20
Total	.1654	.26804	310	

---



*Figure 4.* Histogram of dataset for teacher education analysis of variance.

Table 7

*Levene's Test of Equality of Error Variances –Teacher Education*

---

<i>F</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
.010	1	308	.919

---

*Note.* Design: Intercept+Education.

Table 8

*Analysis of Variance for Teacher Education and Student Achievement*

Source	df	F	$n^2$	$p$
Education	1	1.258	.004	.263
Error	308	(.072)		

*Note.* Value enclosed in parentheses represents mean square error.

\* $p < .05$ . \*\* $p < .01$ .

Because the  $p$  value is greater than .05, the null hypothesis that there are no significant differences between the education groups is accepted.

*Analysis of Research Question #3: The Impact of National Board Certification on Student Achievement*

Teachers' National Board certifications were analyzed to determine whether this variable had an effect on student math achievement. Math achievement was measured by the students' 2008 North Carolina End-of-Grade test results in math for grades 3-5. Information on the National Board certification status of each Gaston County teacher in grades 3-5 was obtained from the Gaston County Human Resources Department. Teachers were identified as either having National Board of Professional Teaching Standards certification or not. A one-way analysis of variance was utilized to determine whether there were significant differences in the mean achievement growth in mathematics for students in grades 3-5 dependent upon the teacher's National Board certification. The null hypothesis for this analysis was that there was no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's certification through the National Board of Professional Teacher Standards.

A univariate analysis of variance assesses mean differences between independent variable groups on a dependent variable (Green & Salkind, 2008). For this study, one independent factor, teacher National Board certification, and the dependent variable, student mathematics mean achievement growth, were

analyzed. The dependent variable, student mathematics mean achievement growth, was the mean *academic change* score for the teacher's class of students, which represents the difference between the predicted growth in math achievement and the actual growth in math achievement. The academic change score was provided by a state-generated comparison of a student's historical scores and actual scores on the End-of-Grade standardized tests. The math academic change, or growth, is analyzed for each student as part of North Carolina's ABC Accountability Model and is available to principals and district leaders through the North Carolina ABC Tools program.

*Descriptive statistics.* The means and standard deviations for student achievement by certification status are shown in Table 9. Standard deviations for each certification group are similar and within a normal range. As illustrated in Table 9, the independent factor of certification divided participants into two groups: *National Board* and *no National Board*. The *National Board* group (n=23, 7% of participants) represented teachers who had National Board certification, while the *no National Board certification* group (n=287, 93% of participants) represented teachers with no National Board certification prior to the conclusion of the 2007-2008 school year.

Figure 5 provides a histogram representing additional descriptive statistics for this analysis. The range of mean math achievement growth was relatively similar for both groups, despite the frequency differential. Minimal outliers were

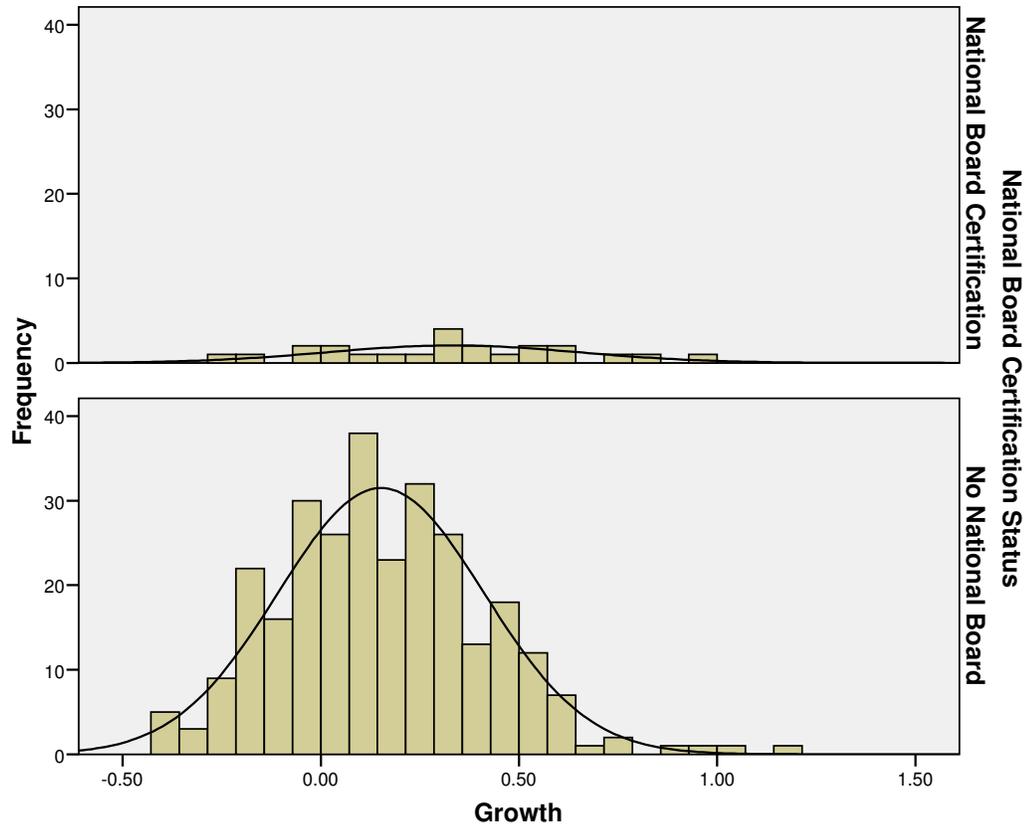
Table 9

*Descriptive Statistics of Student Achievement by Certification Status*

---

Certification	<i>M</i>	<i>SD</i>	<i>N</i>	%
National Board	.3335	.31770	23	7
No NB certification	.1519	.25962	287	93
Total	.1654	.26804	310	

---



*Figure 5.* Histogram of dataset for teacher National Board certification analysis of variance.

---

identified for both groups. The frequency distribution would indicate a normally distributed set of scores for both teacher groups.

*Analysis of test of equality.* The number of participants in the two National Board certification groups differs by more than 200 participants. Therefore, Levene's test of equality (see Table 10) was used prior to the ANOVA to evaluate the assumption that the population variances for both certification groups are equal. The results of this test,  $p=.19$ , indicate that homogeneity of variance can be assumed.

#### *Analysis of Variance for National Board Certification*

In determining the impact of teacher's National Board certification on mean achievement growth in mathematics for students in grades 3-5, an analysis of variance in math achievement as determined by teacher National Board certification was conducted. As Table 11 illustrates, the test is significant, as  $F(1,308) = 10.06$ ,  $p < .01$ . Because the  $p$  value is less than .05, the null hypothesis that there are no significant differences in math achievement among the National Board groups is rejected.

Figure 6 provides a plot of the means for the two groups. From the results of the ANOVA and the plot line, mean growth scores for this population of students are significantly higher for teachers holding a National Board certification.

Table 10

*Levenes's Test of Equality of Error Variances – National Board Certification*

---

<i>F</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
1.729	1	308	.190

---

*Note.* Design: Intercept+National Board.

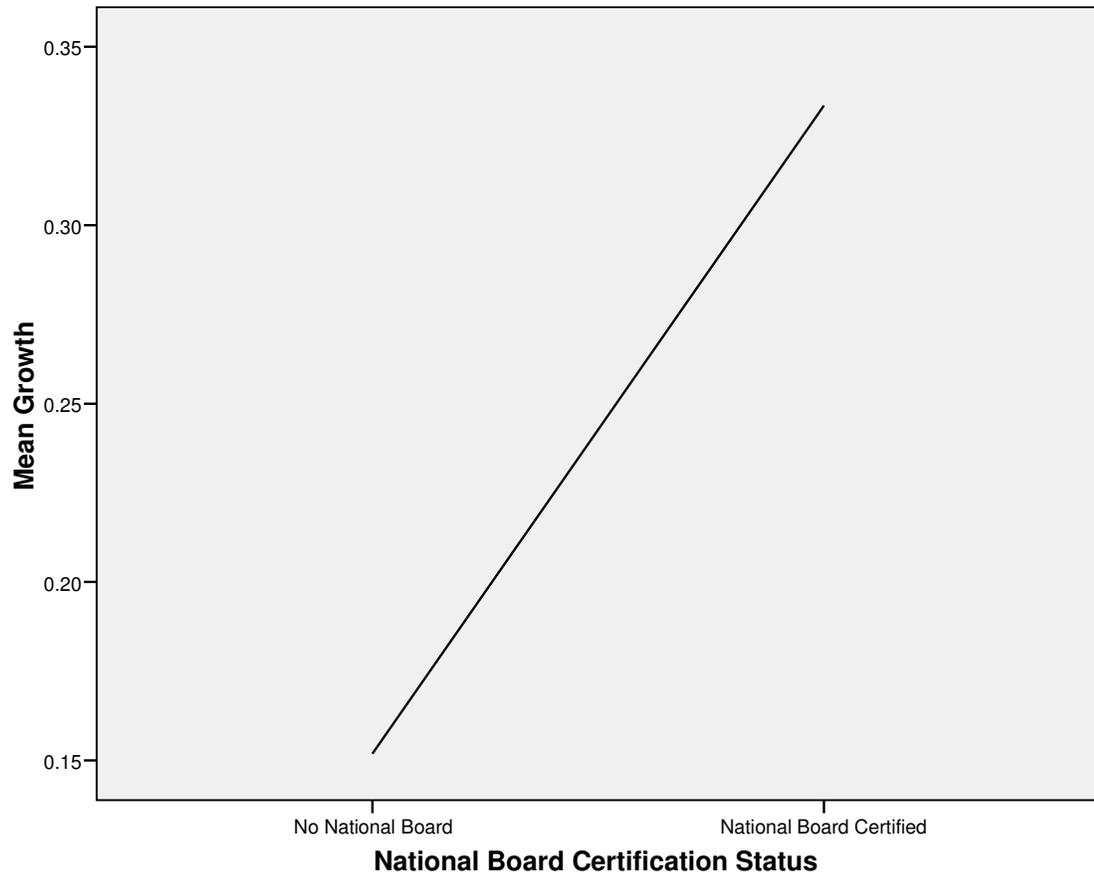
Table 11

*Analysis of Variance for National Board and Student Achievement*

Source	df	F	$\eta^2$	$p$
National Board	1	10.060**	.032	.002
Error	308	(.070)		

*Note.* Value enclosed in parentheses represents mean square error.

\* $p < .05$ . \*\* $p < .01$ .



*Figure 6.* Means plot for National Board Analysis of Variance.

---

The strength of this relationship is represented by the partial eta squared. At  $\eta^2=.032$ , this result indicates a small effect size (Cohen, 1988; Green & Salkind, 2008) regarding the impact of National Board certification on student achievement growth in math, with an estimated 3% of the variance in this variable impacted by National Board certification.

The size difference of the groups analyzed in the National Board certification study is worthy of further exploration. The confidence intervals shared in Table 12 reflect the difference between the sizes of datasets for each of these groups. Because the population for the *National Board* group was much smaller than that of the *no National Board* group, the *National Board* confidence intervals are much wider, representing less power and precision in comparing random samples to these findings. It is also noted, however, that Levene's test verified that, despite these vast differences in size, homogeneity of variance could be assumed between the groups.

*Analysis of Research Question #4: The Impact of Teaching Experience and School Socioeconomic Level on Student Achievement*

A two-way analysis of variance was utilized to determine whether there were significant differences in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's level of experience and the school socioeconomic level. The null hypothesis for this analysis was that there is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent upon the level of teacher experience and a

Table 12

*Confidence Intervals of National Board Certification Groups*

Certification	<i>M</i>	Standard Error	95% Confidence Interval	
			Lower Bound	Upper Bound
National Board	.333	.055	.225	.442
No NB certification	.152	.016	.121	.183

school's SES level. For this study, two independent factors, teacher experience level and school socioeconomic level, were utilized along with the dependent variable of student math mean achievement growth. The dependent variable, student mathematics mean achievement growth, was the mean *academic change* score for the teacher's class of students, which represents the difference between the predicted growth in math achievement and the actual growth in math achievement. The academic change score was provided by a state-generated comparison of a student's historical scores and actual scores on the End-of-Grade standardized tests. The math academic change, or growth, is analyzed for each student as part of North Carolina's ABC Accountability Model and is available to principals and district leaders through the North Carolina ABC Tools program.

*Descriptive statistics.* The means and standard deviations for students' mean mathematics growth scores and by teacher experience level and school SES level are in Table 13. Standard deviations for these groups are similar and within a normal range.

The independent factor of teacher experience level divided participants into three groups, with each of the three groups representing the total number of years of experience for each teacher, including the 2007-2008 school year. Experience levels used were *new* (n=71, 23% of participants), representing 0-3 years of teaching experience; *established* (n=89, 29% of participants), representing 4-9 years of experience; and *career* (n=150, 48% of participants),

Table 13

*Descriptive Statistics of Teacher Experience and SES Level with Student**Achievement*

Experience	SES Level	<i>M</i>	<i>SD</i>	<i>N</i>	%
New	Title I	.0867	.23401	51	16
	Non-Title I	.0505	.22993	20	6
	Total	.0765	.23180	71	23
Established	Title I	.1537	.25582	49	16
	Non-Title I	.1368	.23293	40	13
	Total	.1461	.24457	89	29
Career	Title I	.1761	.30618	75	24
	Non-Title I	.2616	.25839	75	24
	Total	.2189	.28558	150	48
Total	Title I	.1438	.27403	175	56
	Non-Title I	.1933	.25839	135	44
	Total	.1654	.26804	310	

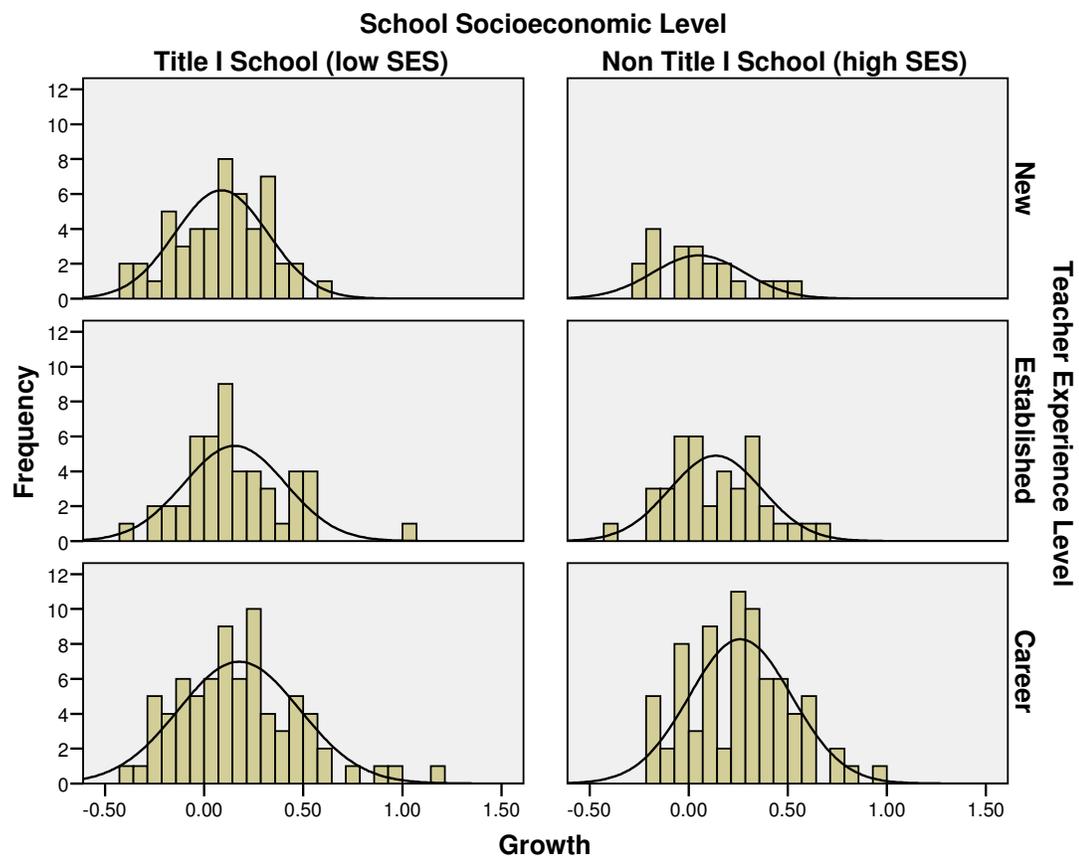
representing 10 or more years of experience. The independent factor of school socioeconomic level divided participants into two groups representing the socioeconomic level of the student population of the school in which each teacher taught. The two socioeconomic groups were *Title I* (n=175, 56% of participants) representing Title I schools (50% or more of the students qualifying for free or reduced lunch benefits), and *non Title I* (n=135, 44% of participants), representing non-Title I schools.

Figure 7 provides a histogram providing additional descriptive statistics for this analysis. The range of mean math achievement growth was generally broader for the *Title I* schools than for the *non Title I*, as well as broader for the *career* teacher group than for the other teacher groups. Minimal outliers were noted in the *Title I* group of teachers. The frequency distributions suggest normal distributions for these variables.

*Analysis of test of equality.* Prior to the ANOVA, Levene's test of equality (see Table 14) was used to evaluate the assumption that the population variances for all of these six groups were equal. The results of this test,  $p=.47$ , indicate that homogeneity of variance can be assumed for this analysis.

#### *Analysis of Variance for Teacher Experience and School Socioeconomic Level*

In determining the impact of teacher's level of experience and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5, an analysis of variance was conducted.



*Figure 7.* Histogram of dataset for teacher experience and school SES analysis of variance.

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Table 14

*Levenes's Test of Equality of Error Variances – Teacher Experience and School Socioeconomic Level*

<i>F</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
.913	5	304	.473

*Note.* Design: Intercept+Experience+SESLevel+Experience\*SESLevel.

As Table 15 illustrates, the interaction between teacher experience and school SES level was not significant as  $F(2, 304)=1.650, p=.194$ . Since the interaction effect was not significant, main effects were analyzed. The test for the main effect of teacher experience was significant, as  $F(2,304) = 7.294, p < .01$ . The estimated marginal means for the teacher experience groups were: *new* (.069), *established* (.145), and *career* (.219). Because the  $p$  value is less than .05, the null hypothesis that there are no differences in math student achievement as related to teacher experience level is rejected. This result is a replication of the outcome of the simple ANOVA discussed previously in this study.

In analyzing the main effect of school SES level, the test was not significant, as  $F(1,304)=.108, p=.743$ . The estimated marginal means for the two school SES level groups were: *Title I* (.139) and *non Title I* (.150). This analysis indicates that differences in math achievement growth dependent upon the socioeconomic level of the school do not differ significantly for this population of students.

Figure 8 provides a plot of the mean math achievement growth by teacher experience level and school SES level. This figure illustrates the positive impact of teacher experience on math achievement growth, regardless of school socioeconomic level.

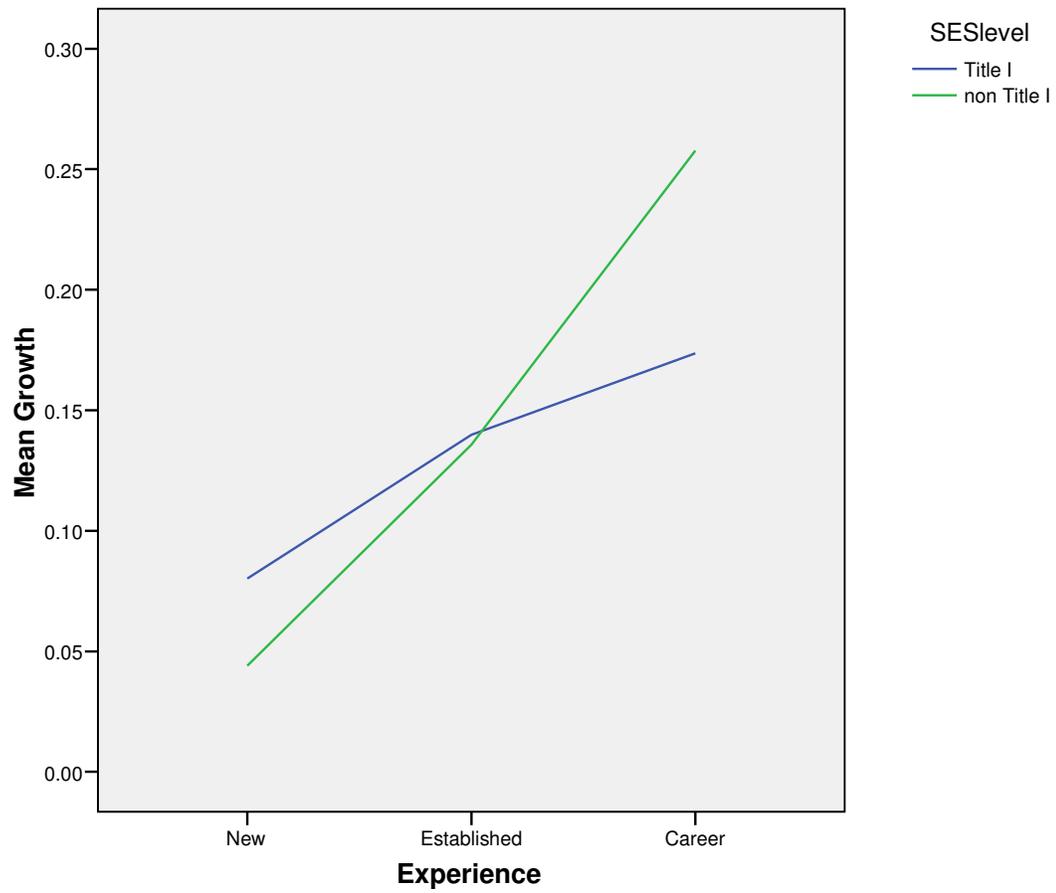
Table 15

*Factorial Analysis of Variance for Teacher Experience and School SES Level*

Source	<i>df</i>	<i>F</i>	$\eta^2$	<i>p</i>
Main Effects				
Experience	2	7.294**	.046	.001
SES Level	1	.108	.000	.743
Interaction				
Experience*SES Level	2	1.650	.011	.194
Error	304	(.069)		

*Note.* Value enclosed in parentheses represents mean square error.

\* $p < .05$ . \*\* $p < .01$ .



*Figure 8.* Means plot for teacher experience and school SES level analysis of variance.

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*Effect size.* As the main effect of teacher experience was shown to have a significant impact on math mean achievement growth, the strength of this relationship is noteworthy. With a partial eta squared of  $\eta^2=.046$ , this result indicates a small effect size (Cohen, 1988; Green & Salkind, 2008) of teacher experience in impacting student achievement growth in math, with an estimated 5% of the variance in this variable impacted by teacher experience.

*Post hoc tests.* Because the main effect of teacher experience level was shown to be significant, follow-up tests were conducted in order to evaluate differences in population means among levels of teacher experience for each level of school SES. A Tukey HSD post hoc test conducted on the main effect of experience (see Table 16) demonstrated a significant difference between the career and new teacher groups, with  $p<.01$ . In comparing these post hoc tests with those conducted on teacher experience with the simple ANOVA, the standard errors, confidence intervals, and significance levels were all either identical or only slightly ( $<.20$ ) different with the effect of school SES level considered.

*Analysis of Research Question #5: The Impact of Teacher Education and School Socioeconomic Level on Student Achievement*

A two-way analysis of variance was utilized to determine whether there were significant differences in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's level of education and the school socioeconomic level. The null hypothesis for this analysis was that there

Table 16

*Post Hoc/Tukey Test for Teacher Experience (school SES) and Student*

*Achievement*

Experience (I)	Experience (J)	M difference (I-J)	Standard Error	P	95% Confidence Interval	
					Lower Bound	Upper Bound
New	Established	-.0680	.04167	.234	-.1661	.0302
	Career	-.1457*	.03773	.000	-.2345	-.0568
Established	New	.0680	.04167	.234	-.0302	.1661
	Career	-.0777	.03504	.070	-.1602	.0048
Career	New	.1457*	.03773	.000	.0568	.2345
	Established	.0777	.03504	.070	-.0048	.1602

*Note.* \*The mean difference is significant at the .05 level.

is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent upon the level of teacher education and a school's SES level. For this study, two independent factors, teacher education level and school socioeconomic level, were utilized along with the dependent variable of student mathematics mean achievement growth. The dependent variable, student mathematics mean achievement growth, was the mean *academic change* score for the teacher's class of students, which represents the difference between the predicted growth in math achievement and the actual growth in math achievement. The academic change score was provided by a state-generated comparison of a student's historical scores and actual scores on the End-of-Grade standardized tests. The math academic change, or growth, is analyzed for each student as part of North Carolina's ABC Accountability Model and is available to principals and district leaders through the North Carolina ABC Tools program.

*Descriptive statistics.* The means and standard deviations for students' mean mathematics achievement scores by teacher education level and school socioeconomic level are shown in Table 17. Standard deviations are similar for the groups and within a normal range.

As shown in the descriptive statistics represented in Table 17, the independent factor of teacher education level divided participants into two groups, *bachelors* and *advanced*, with each of these groups representing the highest degree earned for each teacher. The *bachelors* group (n=249, 80% of

Table 17

*Descriptive Statistics of Teacher Education and School SES Level*

Education	SES Level	<i>M</i>	<i>SD</i>	<i>N</i>	%
Bachelors	Title I	.1334	.27717	140	45
	Non-Title I	.1871	.26037	109	35
	Total	.1569	.27073	249	80
Advanced	Title I	.1851	.26081	35	11
	Non-Title I	.2196	.25321	26	84
	Total	.1998	.25604	61	20
Total	Title I	.1438	.27403	175	56
	Non-Title I	.1933	.25839	135	44
	Total	.1654	.26804	310	

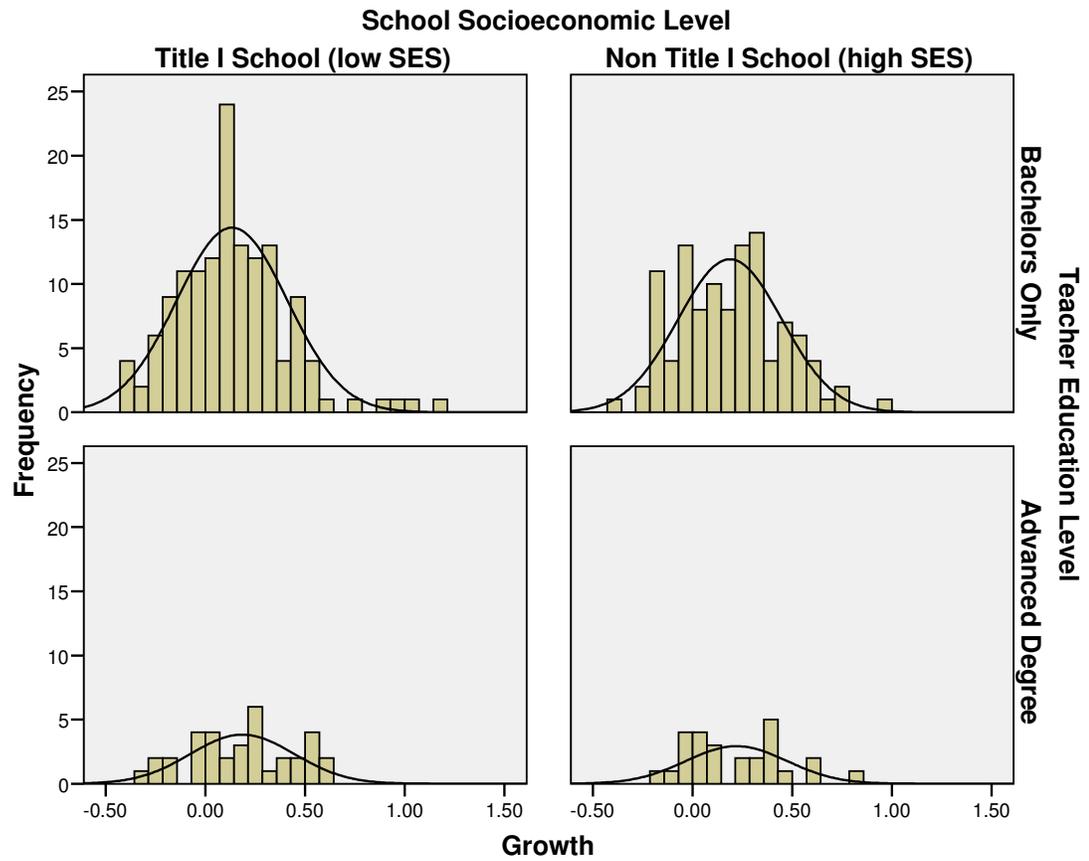
participants), represented teachers who held a bachelors degree only, while the *advanced* (n=61, 20% of participants) represented teachers with an advanced degree, including a master's, an educational specialist, or a doctorate degree. The independent factor of school socioeconomic level divided participants into two groups representing the socioeconomic level of the student population of the school in which each teacher taught. The two socioeconomic groups were *Title I* (n=175, 56% of participants), representing Title I schools (50% or more of the students qualifying for free or reduced lunch benefits), and *non Title I* (n=135, 44% of participants), representing non-Title I schools.

Figure 9 provides a histogram of these groups' scores. The range of mean math achievement growth was broader for the *bachelors* group than for the *advanced* group. Minimal outliers existed for the *Title I, bachelors* group. The frequency distributions suggest normally distributed set of scores.

*Analysis of test of equality.* The number of participants in these factorial groups ranged from 26 to 140. Levene's test of equality (see Table 18) was conducted to evaluate the assumption that the population variances for these four groups were equal. The results of this test,  $p=.99$ , indicate that homogeneity of variance can be assumed for this analysis.

#### *Analysis of Variance for Teacher Education and School Socioeconomic Level*

In determining the impact of teacher's level of education and school socioeconomic level on mean achievement growth in mathematics for students in



*Figure 9.* Histogram of dataset for teacher education and school SES analysis of variance.

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Table 18

*Levenes's Test of Equality of Error Variances – Teacher Education and School Socioeconomic Level*

<i>F</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
.038	3	306	.990

*Note.* Design: Intercept+Education+SESLevel+Education\*SESLevel.

grades 3-5, an analysis of variance in math achievement as determined by teacher education and school socioeconomic level was conducted.

The interaction between teacher education and school SES level,  $F(1,306) = .062, p=.804$ , was not significant in regards to student math achievement (see Table 19). Because the  $p$  value is greater than .05, the null hypothesis that there are no significant differences in math student achievement as related to teacher education level and school SES level is accepted.

Since the interaction effect was not significant, main effects were analyzed. As Table 19 illustrates, the test for the main effect of teacher education was not significant, as  $F(1,306) = 1.189, p=.276$ . There was also no significant main effect obtained for school SES level, as  $F(1,306) = 1.30, p=.255$ .

The lack of interaction between these factors as well as the plot of estimated marginal means are evident in Figure 10.

*Analysis of Research Question #6: The Impact of National Board Certification and School Socioeconomic Level on Student Achievement*

A two-way analysis of variance was utilized to determine whether there were significant differences in the mean achievement growth in mathematics for students in grades 3-5 dependent on the teacher's certification through the National Board of Professional Teaching Standards and the school socioeconomic level. The null hypothesis for this analysis was that there is no significant difference in the mean achievement growth in mathematics for students in grades 3-5 dependent upon National Board certification and a

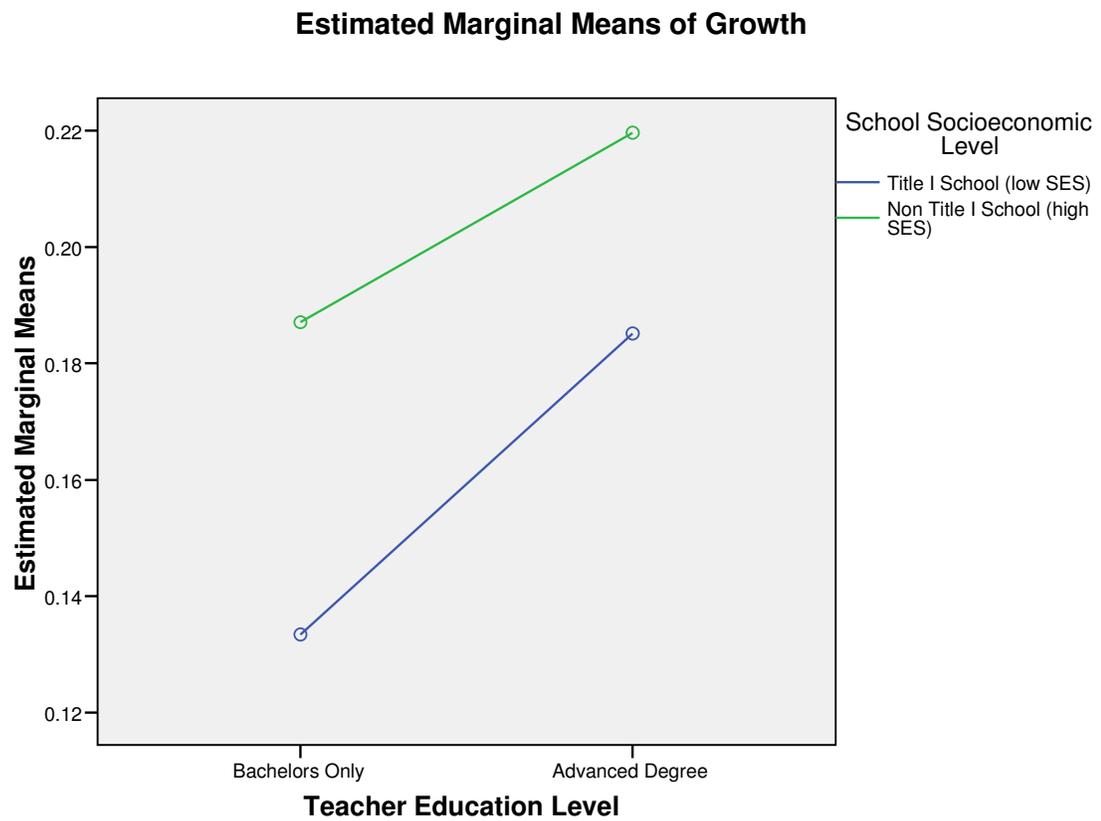
Table 19

*Factorial Analysis of Variance for Teacher Education and School SES Level*

Source	<i>df</i>	<i>F</i>	<i>r</i> <sup>2</sup>	<i>p</i>
Main Effects				
Experience	1	1.189	.004	.276
SES Level	1	1.300	.004	.255
Interaction				
Experience*SES Level	1	.062	.000	.804
Error	306	(.072)		

*Note.* Value enclosed in parentheses represents mean square error.

\**p*<.05. *p*<.01.



*Figure 10.* Means plot for teacher education and school SES level analysis of variance.

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school's SES level. For this study, two independent factors, teacher National Board certification and school socioeconomic level, were utilized along with the dependent variable of student mathematics mean achievement growth. The dependent variable, student mathematics mean achievement growth, was the mean *academic change* score for the teacher's class of students, which represents the difference between the predicted growth in math achievement and the actual growth in math achievement. The academic change score was provided by a state-generated comparison of a student's historical scores and actual scores on the End-of-Grade standardized tests. The math academic change, or growth, is analyzed for each student as part of North Carolina's ABC Accountability Model and is available to principals and district leaders through the North Carolina ABC Tools program.

*Descriptive statistics.* Table 20 provides the means and standard deviations for teacher National Board certification groups and school socioeconomic level groups. Standard deviations for these groups are similar and within a normal range.

As shown in the descriptive statistics displayed in Table 20, the independent factor of National Board certification divided participants into two groups. These two groups represented whether a teacher had obtained National Board certification prior to the conclusion of the 2007-2008 school year. National Board certification groups were designated as *National Board* (n=23, 7% of participants), representing National Board certification, or *no National Board*

Table 20

*Descriptive Statistics of National Board Certification and SES Level*

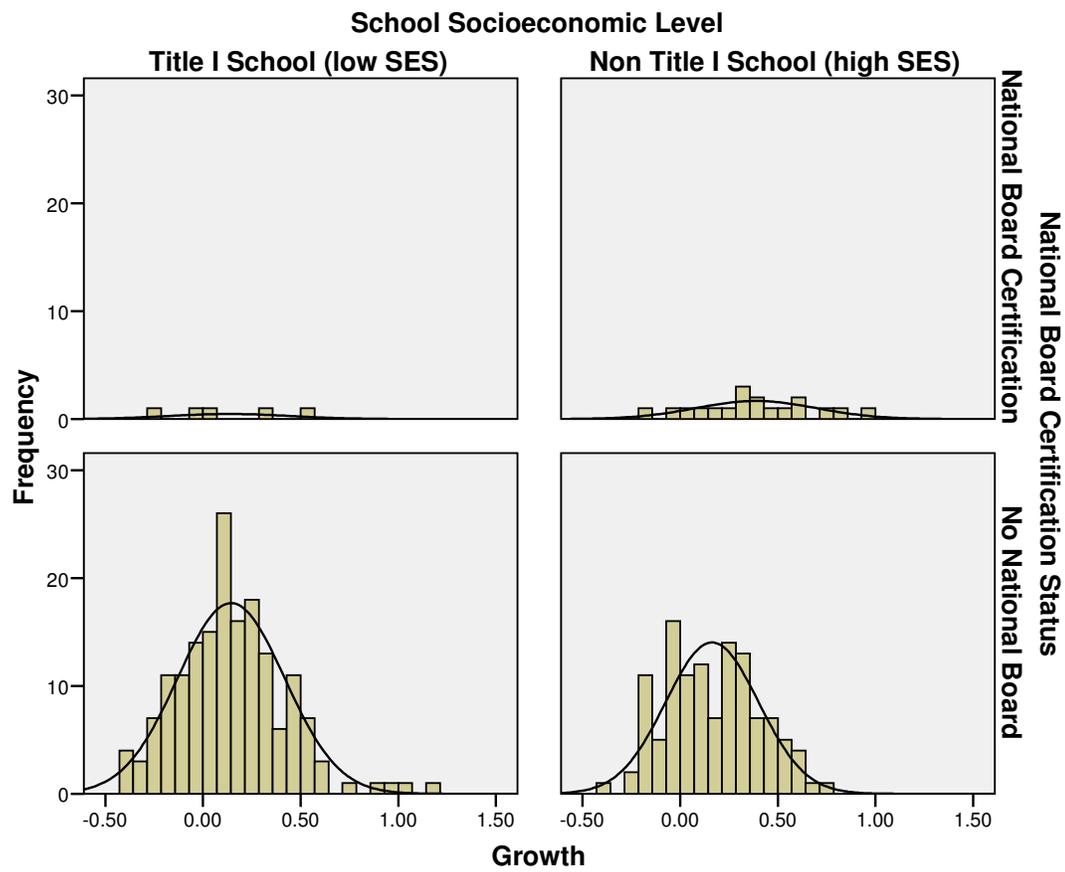
National Board	School SES Level	<i>M</i>	<i>SD</i>	<i>N</i>	%
National Board	Title I	.1360	.30468	5	2
	Non-Title I	.3883	.30679	18	6
	Total	.3335	.31770	23	7
No National Board	Title I	.1440	.27407	170	54
	Non-Title I	.1633	.23775	117	38
	Total	.1519	.25962	287	93
Total	Title I	.1438	.27403	175	56
	Non-Title I	.1933	.25839	135	44
	Total	.1654	.26804	310	

(n=287, 93% of participants), representing no National Board certification. The independent factor of school socioeconomic level divided participants into two groups representing the socioeconomic level of the student population of the school in which each teacher taught. The two socioeconomic groups were *Title I* (n=175, 56% of participants), representing Title I schools (50% or more of the students qualifying for free or reduced lunch benefits), and *non Title I* (n=135, 44% of participants), representing non-Title I schools.

In describing the respondents in terms of National Board certification within school SES setting, it is to be noted (see Table 20) that 5 teachers are included in the *National Board, Title I* group. This quantity is lower than needed for reliable inclusion in the overall conclusions.

Figure 11 provides a histogram representing additional descriptive statistics for this analysis. The range of mean math achievement growth was similar among the three reliable groups of data. Minimal outliers were noted for the *Title I, no National Board* group of teachers. The frequency distributions indicated normally distributed sets of scores.

*Analysis of equality of groups.* As with the previous analyses, Levene's test of equality was used prior to the ANOVA to evaluate the assumption that the population variances for these groups are equal. The results of this test indicate a significance level of .71, therefore, homogeneity of variances may be assumed for this analysis (see Table 21).



*Figure 11.* Histogram of dataset for teacher National Board certification and school SES level analysis of variance.

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Table 21

*Levenes's Test of Equality of Error Variance- National Board Certification and School Socioeconomic Level*

<i>F</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
.456	3	306	.713

*Note.* Design: Intercept+National Board+SESLevel+National Board\*SESLevel.

*Analysis of Variance for National Board Certification and School Socioeconomic Level*

In determining the impact of teachers' National Board certification and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5, an analysis of variance was conducted.

As Table 22 illustrates, the interaction between National Board certification and school SES level was not significant as  $F(1, 306)=2.899$ ,  $p=.090$ . Since the interaction effect was not significant, main effects were analyzed. The test for the main effect of National Board certification was not significant ( $F(1,306) = 2.515$ ,  $p = .114$ ). This result is in contrast to the one-way ANOVA regarding National Board certification conducted earlier in this study. The one-way ANOVA suggested that National Board certification, when analyzed alone, has a significant impact with weak effect on student math achievement.

In analyzing the main effect of school SES level,  $F(1,306)=3.941$ ,  $p=.048$ , the test showed a significant impact from this effect. The estimated marginal means for the two school SES level groups were: *Title I* (.140) and *non Title I* (.276). Because the  $p$  value is less than .05, the null hypothesis that there are no differences in math student achievement as related to school socioeconomic level when considered along with National Board certification is rejected.

A plot of estimated marginal means of math achievement growth by National Board certification and school socioeconomic level is provided in Figure 12.

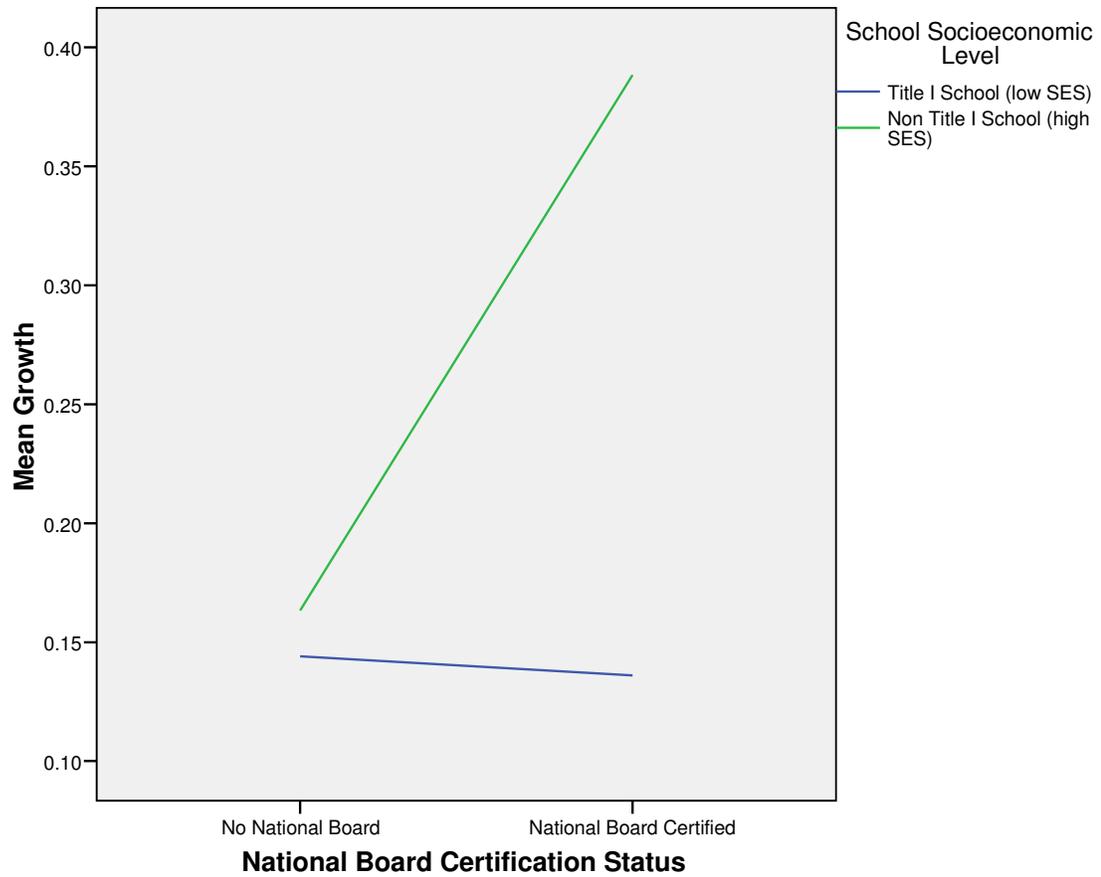
Table 22

*Factorial Analysis of Variance for National Board and School SES Level*

Source	<i>df</i>	<i>F</i>	<i>n</i> <sup>2</sup>	<i>p</i>
Main Effects				
National Board	1	2.515	.008	.114
SES Level	1	3.941*	.013	.048
Interaction				
National Board*SES Level	1	2.899	.009	.090
Error	306	(.069)		

*Note.* Value enclosed in parentheses represents mean square error.

\**p*<.05. \*\**p*<.01.



*Figure 12.* Means plot for National Board certification and school SES level analysis of variance.

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### *School SES Level Main Effect Analysis*

Pair wise comparisons (see Table 23) were computed in order to more thoroughly examine the significant impact of SES level as suggested through the two-way ANOVA including school SES level and National Board certification (see Table 22). Within the school SES level of *non Title I*, there is a significant difference in the mean achievement growth between *National Board* teachers and *no National Board* teachers. The significance of this difference was at the  $p < .01$  level. Within the *Title I* school SES level, there are no significant differences between the two National Board teacher groups, although the small population for the *Title I, National Board* group must be acknowledged (N=5).

As the main effect of school SES level was shown to have a significant impact on math mean achievement growth when considered in light of National Board certification, the strength of this relationship is noteworthy. With a partial eta squared of  $\eta^2 = .013$ , this result indicates a small effect size (Cohen, 1988; Green & Salkind, 2008) of school SES level, crossed with National Board certification, in impacting student achievement growth in math, with an estimated 1% of the variance in this variable impacted by school SES level.

### *Summary*

This study explored the impact of certain preparation-based teacher effects: teacher experience, teacher education, and National Board certification, alone and in consideration of school SES level, on student math achievement growth. The analyses into these impacts were determined through simple and

Table 23

*Pair Wise Comparisons for School SES Level*

SES Level	NB (I)	NB (J)	p	Standard Error	P	95% Confidence Interval	
						Lower Bound	Upper Bound
Title I	Nat Board	No Nat Bd	-.008	.947	.119	-.243	.227
	No Nat Bd	Nat Board	.008	.947	.119	-.227	.243
Non-Title I	Nat Board	No Nat Bd	.225**	.001	.067	.094	.356
	No Nat Bd	Nat Board	-.225**	.001	.067	-.356	-.094

*Note.* \*\*The mean difference is significant at the  $p < .01$  level.

factorial ANOVAs with a population of 310 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> grade teachers. Six research questions were identified, with specific analyses conducted and unique results produced.

The first research question indicated that teachers' years of teaching experience had a significant impact on student math achievement growth, accounting for approximately 5% of the variance in this dependent variable. Additional statistical analyses indicated this impact to be concentrated on the differences between new and career teachers, with no significant difference detected between the new and established teachers and the established and career groups.

The second research question indicated that the teachers' education level had no significant impact on mean math achievement growth. The study determined that while teachers with advanced degrees attain higher mean math achievement growth than teachers with bachelors degrees only, these variances are not significant.

While acknowledging a reduced sample size of National Board certified teachers, the third research question indicated that the teachers' certification through the National Board of Professional Teaching Standards had a significant impact on student math achievement growth. This impact was determined to carry a small effect size, accounting for approximately 3% of the variance in this dependent variable.

At this point in the study, the additional independent variable of school SES level was added, with teacher effects now analyzed in terms of variances among the averages of this second main effect. The fourth research question indicated that the interaction between teacher experience level and school SES level did not have a significant impact on student math achievement. The main effect of teacher experience was shown to have a significant impact with a small effect size. When taken in consideration of school SES level, teacher experience level accounted for approximately 5% of the variance in student math achievement. This factorial analysis also determined the main effect of school SES level to be a non-significant variable in terms of student math achievement.

The fifth research question indicated that the interaction between teacher education level and school SES level produced no significant variances in student math achievement. In addition, analyses of the two main effects also resulted in no significant impact on student math achievement.

The sixth research question indicated that the interaction between National Board certification and school SES level resulted in no significant variance in student math achievement. Analysis of the main effect of National Board certification resulted in no significant impact on student math achievement. The main effect of school SES level was, however, shown to have a significant impact on student math achievement when considered crossed with the effect of National Board certification. When taken in consideration of National Board certification, the impact of school socioeconomic level was determined to carry a

small effect size, accounting for approximately 1% of the variance in student math achievement.

The next chapter provides conclusions based on these data analyses results and will compare results and conclusions with prior research and literature. Chapter 5 will also offer the implications for educational leaders based on the study's results, as well as recommendations for future research on these topics.

## CHAPTER 5: DISCUSSION AND RECOMMENDATIONS

### *Summary*

There were two purposes for this study. The first was to expand upon earlier research in analyzing the impact of teacher preparation-based effects on student mathematics achievement. The teacher preparation-based effects in this study were: teacher experience, teaching education level, and National Board certification. The second purpose of this study was to examine whether any of the established differences in mathematics achievement growth related to teacher effects vary due to the socioeconomic levels of a school as defined by socioeconomic level (Konstantopoulos, 2006). Data analyzed in this study was obtained from the Gaston County School District in North Carolina. Math achievement growth means for  $n=6,093$  students in grades 3, 4, and 5 were disaggregated and analyzed by each of three preparation-based effects of  $n=310$  Gaston County mathematics teachers in grades 3, 4 and 5. In analyzing these data, several major findings were evident.

### *Findings and Discussion*

This study was designed to address several research questions:

1. What is the impact of teacher's level of experience on mean achievement growth in mathematics for students in grades 3-5?
2. What is the impact of teacher's level of education on mean achievement growth in mathematics for students in grades 3-5?

3. What is the impact of teacher's National Board of Professional Teaching Standards certification on mean achievement growth in mathematics for students in grades 3-5?
4. What is the impact of teacher's level of experience and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?
5. What is the impact of teacher's level of education and school socioeconomic level on mean achievement growth in mathematics for grades 3-5?
6. What is the impact of teacher's National Board of Professional Teaching Standards certification and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?

The following sections will discuss findings for each of the research questions in this study.

#### *The Impact of Teacher Experience on Student Achievement*

The first research question in this study addressed the impact of teacher's level of experience on mean achievement growth in mathematics for students in grades 3-5. The analysis of teacher experience and student math achievement yielded several conclusions. This research determined that students' math achievement growth increased as the level of teacher experience increased, reflecting similar findings as that of Fallon (2006), Greenwald et al. (1996), and Wenglinsky (1998) that teaching experience does have a positive impact on

student learning. In addition, as teacher experience levels increased, so did the standard deviations among mathematics achievement means, indicating a wider range of achievement scores and a wider range of teacher performance within the higher teacher experience levels ( $SD=.28558$ ) than those with less experience ( $SD=.23180$ ). The teacher experience effect had a significant impact with small effect on student math achievement growth, accounting for approximately 5% of the variance in this dependent variable in determining a positive impact of teacher experience on student achievement. These findings are similar to the findings of Fetler (1999), Nye et al. (2004), as well as Wilson et al. (2001). Nye et al. concluded that there is a relationship between teacher experience and improved gains, as did Fetler in his focused study on student achievement in California. In their analysis of over 300 studies, Wilson et al. found that the majority of these studies resulted in positive associations between teacher experience and student achievement.

Of the hundreds of teacher effect studies analyzed by Wenglinsky (2000), only 30% were found to indicate a link between teaching experience and student outcomes. This study adds to the literature of teacher experience and student outcomes demonstrating that there is connection between the two. The findings in this study are similar to those from the research of Konstantopoulos (2006), although the effect sizes from this study and that of Konstantopoulos are of different magnitude. In this study, a small effect size determining 5% of the variation in math achievement was suggested, while Konstantopoulos

determined a much larger effect size, with 34% of the variation in math achievement attributed to teacher differences.

This study contributes to Ferguson's 1991 teacher effects study in Texas. In Ferguson's study, the effect of teacher experience was not isolated, but rather grouped together with education level and licensing exam score. From his research, Ferguson concluded that the "teacher expertise" grouping accounted for about 40% of the variance in students' math growth on achievement tests (Ferguson, 1991). In this study, the teacher experience effect can be solely attributed to be a key that impacts student achievement in mathematics, further isolating teacher experience from licensure as presented in Ferguson's research.

Additional statistical analysis conducted in this study indicated that the impact of teaching experience on the variance in math achievement was significant on the differences between new and career teachers, at a  $p < .01$  level, with no significant difference detected between the new and established teachers and the established and career groups. These results are in contrast to Ferguson's conclusions, which suggested that the benefits of teacher experience cease after five years (Ferguson, 1991; Wilson & Floden, 2003). In contrast, this study found that it is after the ten year mark that the significant impact of teacher experience is evident with student achievement.

Hanushek analyzed over 350 production function studies in 2003 and found that 29% of these studies showed a positive and significant correlation between teacher experience and student achievement. Hanushek (2003) also

concluded that of this 29%, a strong possibility of reverse causal relationships existed because more experienced teachers are more likely to select the students in their classrooms. Two factors in this research question Hanushek's theory. First, the students and teachers in this study conducted in the Gaston County, North Carolina school system, were members of heterogeneously-grouped classes in all 3-5 grade classrooms, as mandated by school district policy. Secondly, the achievement scores used for this study were not proficiency scores, but rather academic change scores, derived from a comparison, based on previous performance, of what a student is predicted to achieve compared to actual achievement. In contrast to Hanushek's rebuttal of the impact of teacher experience on student achievement, this research indicated a significant impact with small effect that influences about 5% of the variance seen in a student's math achievement.

#### *The Impact of Teacher Education on Student Achievement*

In addressing the research question: "what is the impact of teacher's level of education on mean achievement growth in mathematics for students in grades 3-5?" this study yielded several findings. First, this research determined that teachers with advanced degrees had students' math achievement growth with higher means than teachers with bachelors degrees. These findings were similar to the findings of Turner et al. (1986) which, through their analysis of Colorado school districts, suggested that as the percent of elementary teachers with master's degrees increased from 0% to beyond 65%, student achievement in the

elementary schools increased by about 23%. Second, this study found that while the means for the advanced degree group were higher, the impact of this variable on variances in student math achievement was not at a significant level. This conclusion is similar to the AERA *Teacher Effectiveness Study* report, in which it was concluded that no positive relationships exist between measures of student learning and teacher preparation efforts (Schalock et al., 2006). Finally, this study found that teacher education level, considered separately as an effect, impacts less than 1% of any variance in a student's math achievement growth, which is consistent with the research of Hawk et al. (1985), who also concluded that a teacher's effectiveness has little to do with the level of educational degree.

In the sweeping meta-analysis known as the *Teacher Preparation Research* report, Wilson et al. (2001) concluded that neither a positive or negative relationship existed between teacher education and student achievement. Hanushek's review of prior studies resulted in his determination that only 14% demonstrated a positive correlation between a teacher's education level and the achievement of students (Hanushek, 2003), and Wenglinsky's similar analysis resulted in only 10% of the studies showing this correlation (Wenglinsky, 2000). Monk's study of NAEP data resulted in a similar conclusion to this research - that a teacher's degree level has no effect on student achievement (Monk, 1994). Similarly, this study found that teacher education levels had no significant impact on student achievement.

*The Impact of National Board Certification on Student Achievement*

In analyzing the effect of National Board certification and in addressing the research question of “what is the impact of teacher’s National Board of Professional Teaching Standards certification on mean achievement growth in mathematics for students in grades 3-5?,” this study found that the mean achievement growth for students with National Board certified teachers was more than twice that of students taught by teachers with no National Board certification. The results of this study indicate that National Board certification has a significant impact on student math achievement growth, with 3% of the variance in a student’s math achievement growth determined by whether the teacher has National Board certification.

The size difference of the groups analyzed in the National Board certification study is worthy of further exploration. Because the population for the *National Board* group was much smaller than that of the *no National Board* group, the *National Board* confidence intervals are much wider, representing less power and precision in comparing random samples to these findings. Although Levene’s test verified that, despite these vast differences in size, homogeneity of variance could be assumed between the groups, findings from this small data set should be discussed with an acknowledgement of such.

The findings of this study are similar to the findings of the AERA research on the positive impact of professional certification on student achievement (Cochran-Smith & Fries, 2005; Schalock et al., 2006) as well as the “fifteen

dimensions” research conducted by Bond et al. (2000), both of which concluded that professional certifications such as National Board can result in increased indicators of teacher excellence as well as increased student learning. The research for this study adds to the findings of Bond et al. by addressing several of the limitations inherent in their 2000 study. In contrast to the primary challenges to Bond’s research, this study utilized student standardized achievement data and also collected data from all the teacher population that met the sample selection criteria through secondary data collection, thus eliminating Bond’s limitations associated with lack of standardized testing data and reliance on volunteer participants.

The findings of this research answer Podursky’s (2001) call, in his *Defrocking the National Board* article, for a more quantitative analysis regarding the impact of National Board certification on student achievement. As Podgursky writes: “No study...has ever shown that National Board-certified teachers are any better than other teachers at raising student achievement” (p. 2). The conclusions drawn from this study demonstrate that, while not a strong effect, this certification does impact student achievement in a significant manner.

Over 32,000 teachers, at a nationwide cost of over \$300 million, have become NBPTS certified. All fifty states and over 500 local school districts have created incentives and recognitions for NBPTS certified teachers, with many states and districts also subsidizing the initial \$2,300 assessment fee for individual teachers (Goldhaber et al., 2004). While past observers have

questioned the investment of funds into the NB process, this study indicates a link between investment and results. The results of this study would suggest that these incentives are directed towards a process that does make a difference in student learning.

*The Impact of Teacher Experience and School Socioeconomic Level  
on Student Achievement*

In analyzing the effects of teacher experience and school socioeconomic level in addressing the research question of “what is the impact of teacher’s level of experience and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?,” several significant findings were determined in regards to the two main effects of teacher experience level and school SES level, and specifically how the previously established significant impact of teacher experience level is strengthened or weakened by the intercept of school SES level. When considering the interaction of these two variables, the results of this study suggest that there is no significant interaction therefore, the impact of teacher experience on student achievement does not depend on the socioeconomic level of the school in which a teacher happens to teach. The results of this study suggested that the main effect of teaching experience has a significant impact regardless of the socioeconomic level of the school in which the teacher is teaching. This study also supported the findings of the simple ANOVA conducted for research question #1, in that the variance related to teaching experience was concentrated on the differences between the new

teachers (0-3 years of experience) and the career teachers (10+ years of experience). The results of this study also suggested that school socioeconomic level analyzed as a main effect had no significant impact on student math achievement growth.

The Gaston County data used in this study indicated that half of the school district's career teachers taught in low SES schools, and half of the career teachers taught in high SES schools. In contrast, 72% of the new teachers (0-3 years of experience) taught in low SES schools. The findings in this study are similar to the findings in the *Quality Counts* report, as descriptive statistics from this Gaston County population suggested that students in low SES schools are more likely to be taught by an inexperienced teacher with less than three years of experience (Olson, 2003). In terms of percentage of new teachers who teach in low SES schools, the findings of this study surpass the estimated 25% mark determined by Zumwalt and Craig (2005a) as well as the estimated 20% mark determined by the AERA panel report (Cochran-Smith & Zeichner, 2005). In Gaston County, this rate was higher, with 29% of the Title I teachers qualifying in the new teacher group. These findings, both in terms of quantity of new teachers in Title I schools and analysis of variance results, would support the research of Ayala and Claasen (2007), who concluded that the poorest students often get the least experienced teachers which results in a negative impact on student achievement.

A comparison to the research of Nye et al. is warranted at this juncture as this 2004 research most closely aligns to the purpose of the research at hand. Nye et al. used data from a four-year experiment in which random teachers and classrooms were analyzed regarding student achievement gains. The team focused on discovering not only the teacher effects that most dramatically impact student achievement, but also how the variances with such effects differ when the school SES level is taken into consideration. Nye et al. concluded that individual teaching differences can influence student achievement over and beyond school and student factors, specifically citing a positive relationship between teacher experience and student learning.

*The Impact of Teacher Education and School Socioeconomic Level  
on Student Achievement*

In addressing the research question of “what is the impact of teacher’s level of education and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?,” it was determined that there is no significant interaction between teacher education and the socioeconomic level of the school in which a teacher teaches in impacting the variance in student math achievement growth. Further factorial analyses, conducted separately on the main effects of teacher education and school socioeconomic level, showed no significant impact of either variable on student math achievement growth.

*The Impact of National Board Certification and School Socioeconomic Level  
on Student Achievement*

In analyzing the effects of National Board certification and school socioeconomic level this study addressed the research question, “what is the impact of National Board certification and school socioeconomic level on mean achievement growth in mathematics for students in grades 3-5?”. The interaction between the two independent variables, National Board certification and school socioeconomic level, was determined to have no significant impact. When analyzing the main effects of National Board certification and school socioeconomic level separately, only the main effect of school socioeconomic level was found to have a significant impact on student math achievement. These findings are similar to the research of Heck (2007), who discovered correlations between teacher effects and student learning but also discovered that the strength of these correlations depended on the demographic composition of the school. This study determined that the strength of the impact of National Board certification was impacted by the school socioeconomic level, with National Board certification demonstrating significant influence on math achievement in the high socioeconomic settings only.

As with the National Board certification simple ANOVA discussed earlier in this study, the size difference of the groups analyzed in the National Board certification analysis is worthy of further discussion. Because the populations for the *National Board/Title I* and the *National Board/non-Title I* groups were much

smaller than the *no National Board certification* population, findings that compare these small data sets and draw conclusions on their impact should be considered with caution.

### *Limitations of the Study*

While hundreds of prior studies have been conducted into the topic of teacher effects and the impact on student achievement, much remains to be learned based on the results of this research. In the discussions and implications in this chapter several limitations have been described as well. To summarize the conclusions of this study, there were several limitations that could be addressed in further research. The limitations were:

- The standardized testing data used for this study included only test scores for students in membership within a particular school for at least 140 days prior to standardized testing. It is recognized that in removing the data from the 609 students who were not in membership at least 140 days prior to testing, the research study results may have been impacted.
- A plethora of research has supported the premise that school leadership has a significant impact on the success of a school, the effectiveness of teachers, and the achievement of students (Gentilucci & Muto, 2007; Glasman, 1984; Kaplan & Owings, 2001). While conducting this study, the researcher acknowledges that the thirty-one schools and the hundreds of elementary teachers involved in this study

are led by different leadership styles and different experience levels of leaders. These factors cannot be controlled in their entirety.

- While this study analyzes the differences between teacher effectiveness and certain teacher effects, as these pertain to school socioeconomic level, it must also be acknowledged that within school types and even within individual schools, not all classrooms are the same. Many times there are differences in the availability of resources such as math manipulative kits, books for independent reading, science experimentation equipment, and available technology.

While this is part of the disparity that is sometimes noted between low SES and high SES schools, this resource gap is not necessarily limited to a between-schools factor. Just as often, disparity in resources may be the difference between individual teachers. Any variance in level of resources, while most certainly present, cannot be controlled in this study.

- The design of this study closely resembles production function studies in which relationships between particular teacher characteristics and the academic achievement of students are analyzed. A challenge with education production function studies is the difficulty in measuring teacher effects separately (Greenwald et al., 1996; Heck, 2007; Wenglinsky, 1998), as many of education's inputs and outputs are what Hanushek refers to as "imperfect data" (Hanushek, 1986, p.

1,149). In using predicted and actual growth in consideration of past individual student performance, the design of this particular study addresses some of these concerns. However, this research acknowledges the historic challenges to studies into the relationships between teacher effects and student learning.

### *Recommendations for Further Research*

There are many recommendations for additional study:

- Further study could focus on the differentiation between career teachers in varying phases of their 10-30 year service range. “Burn-out” is a common educational phrase, indicating that point in a teacher’s career when teaching effectiveness stalls or decreases. A determination of the specific point during this broad range of years when teacher effectiveness is altered would be important information for educational leaders.
- Goldhaber and Brewer’s (2000) prior research demonstrated that an advanced degree in a particular field has an impact on student learning, while a degree in education showed no correlation with achievement (Goldhaber & Brewer). Further study on the differences in student achievement when comparing teachers with content area master’s degrees and education master’s degrees may shed new light on this topic and lead to a greater discussion on the impact of teacher education on student learning.

- Based on the results of this study, the differences between new teachers (those with 0-3 years of teaching experience) and career teachers (those with 10 or more years of teaching experience) were found to be significant in terms of student math achievement. The literature review in chapter 2 of this study indicated that, depending on the research cited, anywhere from 25%-50% of teachers in their first five years of teaching are leaving the profession each year. Attrition rates as well as significant differences in student success imply an alarming gap. Further study should be conducted to determine the specific qualities or characteristics of career teachers that translate into higher student achievement and how these characteristics can more readily be shared with the less experienced teaching workforce. Varying levels of expertise in behavior management, time management, curricular familiarity, or established support relationships could all be potential research topics.
- This quantitative analysis is one of too few quantitative studies into the impact of National Board certification on student achievement. While the conclusions drawn here are compelling, a larger dataset would add validity and accuracy to variances and results. It is suggested that similar research be conducted using state data on the student achievement growth dependent upon National Board certification of the teacher.

- As National Board certification and teacher experience were the two effects in this study that demonstrated significant variances on student achievement, it is recommended that further research be conducted into the overlap between these two variables. Further analyses into the interaction between teacher experience and National Board certification in regards to student achievement are warranted based on the conclusions reached here.
- The exodus of good teachers from poorer schools often occurs with such rapidity that disadvantaged schools have no opportunity to create an established workforce (Hanushek, 2003; Olson, 2003). More research into the impact of this transiency is recommended, specifically, to what degree the number of years of experience in a single school impacts the student achievement of teachers and how this further impacts the school in regards to socioeconomic factors.
- It is recommended that the analyses conducted in this research be replicated for other content areas, such as reading, writing, and science. As accountability programs expand in demands for higher student achievement in various curricular areas, information regarding significant teacher effects in other content areas is pertinent for school leaders.
- The knowledge and use of teacher effect research in the recruitment and placement of teachers holds great significance for educational

leaders in light of increased standardized testing and accountability. Further studies into the degree of consideration of particular teacher effects in hiring and placement decisions made by school and district educational leaders could shed light on the improvement of student learning.

### *Implications for Educational Leaders*

Since public schools are evaluated by student achievement results (Senge et al., 1994), the identification of teacher effects that make a difference in student achievement is relevant to future reform success and education policy. The results of this study have implications for educational leaders at the state, district, and local level.

#### *Principal*

There are several key implications for school-level leaders from the conclusions reached in this study. As principals consider school specific recruitment and hiring needs, this study would suggest that teaching experience and National Board certification are favorable characteristics in terms of student achievement. When considering the grade level placement of teachers, the conclusions from this study would suggest that more experienced teachers and those with National Board certification should be considered for placement in grades levels that are included in standardized testing. In determining decisions on retiree returns, this study would suggest that the recruitment and retention of retirees are supported in improving student math achievement. In considering the

degree to which principals encourage teachers to pursue advanced degrees and National Board certification, the conclusions of this study suggest that the encouragement towards National Board certification is justified in terms of student achievement.

### *Human Resource*

This research also holds key implications for those educational leaders charged with the recruitment, induction, placement, and retention of a district's teaching workforce. Recognizing that experienced teachers offer schools and students certain valuable qualities that only come with years of service, retaining these veterans could become a priority district-based education leaders. While attrition rates for newer teachers get much-deserved attention, retaining the veteran teaching workforce takes on new importance when teaching experience is shown to have a significant impact on the success of students in mathematics. When considering the recruitment of teachers, this study would suggest that the recruitment of experienced teachers may result in improved student math achievement. As Human Resource leaders explore the designation of signing bonuses, this study would suggest that these bonuses may be better spent as incentives for retaining career level teachers as well as incentives for teachers to pursue National Board certification. Regarding district level decisions to place teachers in low or high SES schools, this study provides several implications for those in the Human Resource arena. This study suggested a significant difference between the math achievement of students taught by career teachers

and students taught by new teachers. While school SES level did not alter this impact, the placement of experienced teachers in schools that are most in need of improved student achievement would be supported by this research.

### *Superintendent*

The superintendent, as the executive leader of the school district, is often held exclusively accountable for the success of the district's students. The findings of this study hold specific implications for these key educational leaders. This research suggested that there are significant differences between new and career teachers, and this finding could provide guidance to superintendents in the support and professional learning provided and directed towards certain teacher populations. The differences between career and new teachers would warrant professional learning targeted at replicating those qualities that make experienced teachers more successful with student math achievement. These findings would indicate that the reverence traditionally given to longevity within the profession through tenure and higher salaries are research-supported. As shared by Turner et al. (1986), salary incentives for years of experience indicate a district's willingness to quantify through a dollar figure exactly how much the technical skills and talent improvements attained by virtue of experience are worth. The results of this study imply that the Gaston County district may quantify, through this study's conclusions, the positive impact of teacher experience. As superintendents consider placing restrictions or caps on the number of new or career teachers that are hired or placed at low SES or high

SES schools, this study provides guidance for those decisions. This study suggested that teachers with more experience produce higher student achievement, regardless of school socioeconomic levels. In considering strategic incentives or supplements for career teachers or other groups of teachers, this study holds several implications for superintendents. Incentives for career teachers to teach in the highest need classrooms and schools would be warranted based on the conclusions of this research. Incentives for National Board teachers are also justified as suggested from this study's conclusions, however, incentives for advanced degrees are not substantiated. Finally, this research suggested that any incentives for National Board or advanced degree teachers to teach in low SES schools are not supported, although the small data set for the National Board certification finding indicates the need for cautious consideration.

### *State Leaders*

In determining state mandates and initiatives that have far-reaching impact across hundreds of schools and districts, educational leaders at the state level hold a significant influence over a state's educational success. This study would suggest that as state leaders consider pay structures for levels of degree, experience and certification, rewarding experience as well as National Board certification would be justified. In considering the degree of financial support for the National Board process, the implication for state leaders from the findings in this research would be that financial support for National Board certification is

warranted. As state leaders determine state level programs for recruitment of teachers to low SES schools, this research holds several implications. State level programs that recruit experienced teachers to low SES schools would be justified through the findings of this study. State level programs that recruit National Board certified teachers to low SES schools would not be supported through this study's conclusions, although the small data set utilized for the National Board analysis must be acknowledged and the findings used with caution. State level programs that recruit advanced degree teachers to low SES schools would not be supported by the findings of this research. Salary incentives for the attainment of an advanced degree suggest that state leaders value professional graduate work and its ability to make a difference in teacher performance and student learning (Turner et al., 1986). The growing population of teachers pursuing advanced degrees between 1960 and 2000 suggests that financial rewards successfully encourage more teachers to pursue advanced degrees. The results of this study, however, indicated that advanced degrees do not have a significant impact on student learning in math.

### *Summary and Conclusions*

In a report written in response to Section 402 of the Civil Rights Act of 1964, the U.S. Commissioner of Education, Harold Howe II, posed a striking question:

The ... question is whether the schools offer equal educational opportunities in terms of a number of other criteria which are

regarded as good indicators of educational quality....they include the characteristics of teachers found in the schools – such things as their education, amount of teaching experience, salary level, verbal ability and indications of attitudes (Coleman et al., 1966, p. iii).

Several decades later, however, a significant shift in educational and domestic policy made “excellence” the priority over “equity” in our American schools (Iannaccone, 1988). Increased public scrutiny included demands for improvement and more efficiency in the expenditures and allocations of the public investment in education (Ladd, 1996). Teacher salaries – human capital – continues to be the largest expenditure of the K-12 budget, yet measures have not been in place to determine whether “supply-side” factors, such as teacher experience and teacher development, had the intended impact on student learning (Greenwald et al., 1996; Vandenberghe, 1999; Wayne & Youngs, 2003).

This increased call for accountability was the premise behind the *No Child Left Behind* act, which sought to ensure that schools that reflect a lower level of economic affluence would achieve at a rate consistent with their more affluent counterparts. The stated goal of NCLB is to increase the academic achievement of all students to at least a proficient level, particularly those students in groups that have traditionally been underserved by the public school system (Haas et al., 2005). One major cornerstone of this act is that quality teaching is key to student success, and that schools with high levels of poverty are in need of quality teachers as much, if not more so, than their more affluent counterparts. In order

to assess this, NCLB invokes the increased scope and frequency of standardized testing

Equity and excellence have converged to form the public and political expectation for 21<sup>st</sup> century schools. It is important to understand, according to research, the qualities or preparations that make one teacher high performing regarding standardized student test score results and another teacher not successful. It is true that neither this nor any research study can conclude that any individual teacher effect necessarily translates into individual teacher effectiveness-that is a determination that can only be made through individual teacher statistical proof (Ding & Sherman, 2006). What can be concluded is that since public schools are evaluated by student achievement results (Senge et al., 1994), the identification of the most productive teacher effects in terms of relationships to student achievement is key to any future reform success and educational policy (Boyd et al., 2006; Heck, 2007). The recognition of this reality was the impetus behind the formulation of six research questions for this study based on determining teacher effects such as education, experience, and National Board certification on students' math achievement at the elementary level. In addition, the effects were further analyzed to determine whether there were significant differences in the impact of these effects when compared between schools that teach high socioeconomic populations and schools that teach low socioeconomic populations. The study included a setting of a large school district located in Gaston County, North Carolina, and included data from

all elementary schools within the district. A review of each question and a summary of the findings of this research are now presented.

*What is the Impact of Teacher's Level of Experience on  
Mean Achievement Growth in Mathematics for Students in Grades 3-5?*

The impact of teacher experience on student math achievement was concluded to be significant with a small effect, influencing 5% of the variance in a student's math achievement growth. While teacher experience does result in higher math achievement, the variance in this effect is most significant when comparing teachers with 0-3 years of experience to teachers with 10 years or more of experience.

*What is the Impact of Teacher's Level of Education on  
Mean Achievement Growth in Mathematics for Students in Grades 3-5?*

Based on the results of this research, it was concluded that there is no significant impact of teacher education on student math achievement. While teachers with advanced degrees do demonstrate higher mean math achievement growth, this difference is not significant when compared to the math achievement of teachers with bachelors degrees only.

*What is the Impact of Teacher's National Board of Professional Teaching  
Standards Certification on Mean Achievement Growth  
in Mathematics for Students in Grades 3-5?*

This study concluded that National Board certification has a significant impact on math achievement, with a small effect and 3% of math achievement

influenced by this variable. National Board certified teachers post significantly higher math achievement growth means than their non-National Board certified counterparts. While the impact for this effect was found to be significant, it was acknowledged that the small data set lacked the power and precision needed for more conclusive findings.

*What is the Impact of Teacher's Level of Experience and School Socioeconomic Level on Mean Achievement Growth in Mathematics for Students in Grades 3-5?*

The research included in this study led to the conclusion that as the two independent variables of teacher experience and school socioeconomic level are crossed between one another, there is a significant impact of small strength of the main effect of teacher experience on student achievement, with teacher experience impacting 5% of the variance in student math achievement growth. Results also indicated no significant impact of the main effect of school socioeconomic level on student math achievement. The interaction of these two variables is not significant, therefore, the effects of teacher experience does not depend on the socioeconomic level of the school.

*What is the Impact of Teacher's Level of Education and School Socioeconomic Level on Mean Achievement Growth in Mathematics for Grades 3-5?*

This study concluded that as these two independent variables of teacher education and school socioeconomic level are crossed with each other, with each value of one variable paired with every value of the other variable, there is

no significant impact of either of these main effects on student math achievement. The interaction between these two variables, with main effect results removed, resulted in no significant impact on student achievement.

*What is the Impact of Teacher's National Board of Professional Teaching Standards Certification and School Socioeconomic Level on Mean Achievement Growth in Mathematics for Students in Grades 3-5?*

The conclusion regarding this question is that the interaction of these two independent variables results in no significant impact on math achievement growth. When these two variables are considered as crossed with each other and in terms of main effects, the impact of National Board certification (seen earlier in question #3 as significant) is not significant. The main effect of school socioeconomic level in this analysis was determined to be of significant impact. The small data set used in this particular analysis was acknowledged and the results used with caution.

In summary, this research has led to the conclusion that the primary teacher effects linked most closely to higher student performance were teacher experience and National Board certification, and that both of these effects impact student achievement variance in a significant manner. This study has also led to the conclusion that when school socioeconomic levels are analyzed with each teacher effect variable, the impact of teacher experience remains significant.

Factors that may affect the success and achievement of low SES schools and students as well as all schools and students provide significant information

for educational leaders to utilize in all stages of recruitment, hiring, placement, and support. This study has identified needs for further research as long-held assumptions are questioned and quantitative results are analyzed. In recognizing teacher experience and National Board certification as significant teacher effects with small effect strength, this research has provided the foundation for a compelling educational discussion. In addition, this research has substantiated the belief that substantial proportions of variation in student achievement lies within schools rather than between schools. As future teacher effect research is analyzed and applied, schools may prove better equipped to successfully educate all students and to finally and conclusively address educational inequities in this age of excellence.

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## APPENDIX A: INSITUTIONAL REVIEW BOARD APPROVAL LETTER



University and Medical Center Institutional Review Board  
East Carolina University  
Ed Warren Life Sciences Building • 600 Moye Boulevard • LSB 104 • Greenville, NC 27834  
Office 252-744-2914 • Fax 252-744-2284 • [www.ecu.edu/irb](http://www.ecu.edu/irb)  
Chair and Director of Biomedical IRB: L. Wiley Nifong, MD  
Chair and Director of Behavioral and Social Science IRB: Susan L. McCammon, PhD

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TO: Dixie Abernathy, 401 Armstrong Dr, Belmont, NC 28012  
FROM: UMCIRB *WJ*  
DATE: December 9, 2008  
RE: Human Research Activities Determined to Meet Exempt Criteria  
TITLE: "Affluence and Influence: A Study of Inequities in the Age of Excellence"

UMCIRB #08-0729

This research study has undergone IRB review on 12.5.08. It is the determination of the IRB Chairperson (or designee) that these activities meet the criteria set forth in the federal regulations for exemption from 45 CFR 46 Subpart A. These human research activities meet the criteria for an exempt status because it is a research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. *NOTE: 1) This information must be existing on the date this IRB application is submitted. 2) The data collection tool may not have an identifier or code that links data to the source of the information.*

The Chairperson (or designee) deemed this **unfunded** study **no more than minimal risk**. This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any changes must be submitted to the UMCIRB for review prior to implementation to allow determination that proposed changes do not impact the activities eligibility for exempt status. Should it be found that a proposed change does require more substantive review, you will be notified in writing within five business days.

The following items were reviewed in determination exempt certification:

- Internal Processing Form- Exempt Application (dated 11.20.08)
- Letter of Support (11.1.08)

It was furthermore determined that the reviewer does not have a potential for conflict of interest on this study.

**The UMCIRB applies 45 CFR 46, Subparts A-D, to all research reviewed by the UMCIRB regardless of the funding source. 21 CFR 50 and 21 CFR 56 are applied to all research studies that fall under the purview of Food and Drug Administration regulations. The UMCIRB follows applicable International Conference on Harmonisation Good Clinical Practice guidelines.**

APPENDIX B: REEVES MCGLOHON APPROVAL LETTER



Gaston County Schools  
*shaping our future*

November 1, 2008

L. Reeves McGlohon  
Superintendent

Dear Ms. Abernathy,

Central Administrative Office  
943 Osceola Street  
P.O. Box 1397  
Gastonia, NC 28053  
(704) 866-6100  
FAX (704) 866-6175

I have reviewed your request and I approve of your use of Gaston County School District data for your research title *Affluence and Influence: A Study of Inequities in the Age of Excellence*. Specifically, I grant permission for you to use demographic data regarding teacher experience level, teacher degree level, and National Board certification status as well as student math achievement growth means for 3<sup>rd</sup>-5<sup>th</sup> grade classrooms.

Department of  
Exceptional Children  
730 W. Garrison Boulevard  
Gastonia, NC 28052  
(704) 866-6160  
FAX (704) 866-6191

I look forward to hearing about the results of your study.

Division of  
Resource Management  
1351 Bradford Heights Road  
Gastonia, NC 28054  
(704) 866-6129  
FAX (704) 866-6193

Sincerely,

L. Reeves McGlohon

Superintendent

School Nutrition Programs  
500 Reid Street  
Lowell, NC 28098  
(704) 824-8423  
FAX (704) 824-8442

Staff Development Center  
236 Eighth Avenue  
Cramerton, NC 28032  
(704) 824-2828  
FAX (704) 824-4918

Teacher Resource Center  
366 W. Garrison Boulevard  
Gastonia, NC 28052  
(704) 866-6174  
FAX (704) 866-6194