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The Effect of National Board Certified Teachers on Mathematics Achievement for Students in a Title I School

Watress Lashun Harris

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The effect of national board certified teachers on mathematics achievement for students

in a Title I school

By

Watress Lashun Harris

A Dissertation
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Mississippi State University
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The effect of national board certified teachers on mathematics achievement for students

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By

Watress Lashun Harris

Approved:

_____
D. Kay Brocato
(Major Professor)

_____
Stephanie B. King
(Committee Member)

_____
Debra L. Prince
(Committee Member)

_____
Jianzhong Xu
(Committee Member)

_____
David T. Morse
(Graduate Coordinator)

_____
Richard L. Blackburn
Dean
College of Education

Name: Watress Lashun Harris

Date of Degree: December 14, 2013

Institution: Mississippi State University

Major Field: Elementary, Middle, and Secondary Education Administration

Major Professor: D. Kay Brocato

Title of Study: The effect of national board certified teachers on mathematics
                    achievement for students in a Title I school

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Candidate for Degree of Doctor of Philosophy

The purpose of the study was to determine if there is a difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students taught by national board certified teachers (NBCTs) and those taught by non-NBCTs in a low socioeconomic, high minority, Title I school. For this study, a causal-comparative research design and a statistical analysis procedure of ANCOVA were used to answer two research questions: First, is there a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between fourth grade African American and Caucasian students taught by NBCTs and those taught by non-NBCTs, while controlling socioeconomic status and 3rd grade MCT2 mathematics scale scores? Second, is there a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between fourth grade students by socioeconomic status based on eligibility for free/reduced or full pay lunch taught by NBCTs and those taught by non-NBCTs, while controlling race and 3rd grade MCT2 mathematics scale scores?

The results of the analysis for research question one indicated that there was not a statistically significant difference in mathematics mean score growth on the MCT2 mathematics assessment between students by race taught by NBCTs and those taught by non-NBCT. African American and Caucasian students taught by NBCTs had a comparable mathematics mean scale score growth with African American and Caucasian students taught by non-NBCTs.

The results of the analysis for research question two indicated that there was a statistically significant difference in mathematics mean score growth on the MCT2 mathematics assessment between students by socioeconomic status based on eligibility for full pay lunch taught by NBCTs and those students taught by non-NBCTs. Students identified as full pay lunch taught by NBCTs had a higher mathematics mean scale score growth than those students identified as full pay lunch taught by non-NBCTs. Students identified as free/reduced lunch status taught by non-NBCTs had comparable mean scale score growth with those students identified as free/reduced lunch status taught by NBCTs, but not statistically significant.

DEDICATION

I dedicate this dissertation to my wife, Ciara, and my sons Jaquez, Martez, Jaylon, and Zayvion Harris. To my wife, words cannot express my sincere gratitude for your support and encouragement. I truly thank God for blessing me with a lovely family.

This dissertation is also dedicated to my mother, Laverne Harris, and my sisters and brother for always believing in me. I would like to thank all of you for your prayers. It was through all your prayers that I was able to complete this dissertation.

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CHAPTER I

INTRODUCTION

Konstantopoulos and Chung (2011) noted the primary goal of education in the

United States is to provide opportunities for all students to grow academically and to

reduce inequality in achievement. But as noted by Darling-Hammond (2007) and by

Haycock (2001), students in low socioeconomic and high minority schools tend to have

teachers that are inexperienced and less qualified to teach the subject area. Darling-

Hammond (2000) indicated that teachers are the most important factor in student

achievement. National Board for Professional Teaching Standards (NBPTS) contends

that those teachers who obtained national board certification have the expertise needed to

improve student achievement (NBPTS, 2012). As Vandervoort, Beardsley, and Berliner

(2004) stated, "the expectation, therefore, is that the students of Board certified teachers

will make [achievement gains] that tend to be greater than those obtained by the students

of teachers who have not undergone the demanding Board certification process" (p. 3).

Harman (2001) and Baratz-Snowden (1993) have noted that several profound

deficiencies in America's education were brought to the forefront in 1983 by a report

titled, *A Nation At Risk: Imperative of Education Reform*. Furthermore, the authors noted

that *A Nation At Risk* highlighted the mediocrities of American's education system by

revealing poor performance on international tests, and acknowledging the lack of

knowledge, skills, and training of teachers. In response to *A Nation At Risk,* the Carnegie

Forum of Education and the Economy established the Task Force on Teaching as a Profession (NBPTS, 2012). In 1986, the Task Force provided a report titled, *A Nation Prepared: Teacher for the 21st Century*, which recommended a creation of a board that defines standards for what teachers need to know and be able to do. In addition, the Task Force believed that the teaching profession needed to codify the knowledge and skills required by experience teachers, and then certify teachers who meet those standards. Based on the Task Force's recommendations, the NBPTS was created in 1987. The goals of NBPTS were to establish rigorous standards for all teachers, to develop a system to assess and certify teachers who meet the standards, and to improve student learning. NBPTS (2012) established national certification in 25 specific content areas for experienced teachers who demonstrate their advanced teaching skills and abilities.

Darling-Hammond (2007) noted there have been various reauthorizations of federal policies to improve education in America and that No Child Left Behind Act (NCLB) of 2001 was intended to raise educational achievement and close the achievement gap. NCLB was intended to hold state and local educational agencies accountable for enhancing the quality of education for all students. NCLB legislation focused its attention on identifying highly qualified teachers. NCLB required all states to ensure that all students are instructed by highly qualified teachers by 2005. Darling-Hammond noted that under NCLB, to be highly qualified, a teacher must have: (a) fulfilled the state's certified and/or licensed requirements; (b) obtained at least a bachelor's degree from a four-year institution; and (c) demonstrated competence in each core academic subject area in which the teacher teaches.

According to Holloway (2004), NCLB aimed to ensure all students regardless of race, socioeconomic status, and gender received an equitable, high quality education whereby no child is left behind in the quest. NCLB (2001) mandated that states administer an annual state-wide assessment to measure student achievement in reading and mathematics in grades third through eighth. In the state of Mississippi, the Mississippi Department of Education (MDE, 2011a) developed the Mississippi Curriculum Test (MCT), which was revised in 2007 and renamed Mississippi Curriculum Test, Second Edition (MCT2), to measure achievement of students in grades three through eight in the areas of reading/language arts and mathematics. NCLB (2001) required schools to ensure that 100% of students in the United States test at levels identified as proficient by the year 2014 as measured by state-wide assessments.

In spite of best efforts to provide highly qualified teachers to improve student achievement, many students, especially low socioeconomic status and minority students, continued to underachieve on standardized test in the area of mathematics (Haycock, 2001; Holloway, 2004; Loveless & Coughlan, 2004). Unfortunately, fewer than 100 % of fourth grade students in Mississippi are scoring proficient or above on MCT2, especially in mathematics. The 2010-2011 MCT2 mathematics assessment indicated discrepancies between students by race and socioeconomic status based on the eligibility for free/reduced or full pay lunch. The results of 2010-2011 MCT2 mathematics assessment revealed that 70% of Caucasian and 48% of African American; and 49% of reduced/free lunch status and 76% of full pay lunch status of students scored proficient or above. Overall, the 2010-2011 MCT2 mathematics assessment results indicated that only 58% of students scored proficient or above in fourth grade (MDE, 2012). Furthermore, fourth

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grade students in Mississippi scoring proficient or above in mathematics on the 2011

National Assessment of Educational Progress (NAEP) is even more troublesome as

compared to the nation. NAEP is a national assessment that measures student

achievement in various subject areas (NAEP, 2012). The results from 2011 NAEP

assessment in mathematics revealed that 38% of Caucasian students, 10% of African

American students, 47% of students not eligible for free/reduced lunch status, and 17% of

students eligible for free/reduced lunch status in Mississippi scored proficient or above as

compared to 52%, 10%, 57%, and 19% of students in the nation. Overall, 25% of

students in Mississippi scored proficient or above on NAEP in the area of mathematics as

compared to 40% of students in the nation.

Although there have been various educational reform initiatives, NBPTS (2012)

contended that the only way of providing a quality education and enhancing the academic

performance for all students will require quality teachers. In contrast to federal legislation

defining a highly qualified teacher, the NBPTS (2012) process requires teachers to meet

rigorous standards through intensive study, expert evaluation, self-assessment, and peer

review in order to become national board certified. Unlike state-level certification and/or

licensure process which typically does not include a demonstration of effective

instructional skills necessary to teach, NBPTS requires candidates to submit a portfolio

including a video of candidate's effective teaching practices and a written justification for

instructional practices. Through the process of national board certification, teachers

develop a deep understanding of content knowledge, which leads to advancement in

student learning and achievement and to teachers becoming better professionals (NBPTS,

2012). In addition, NBPTS outlined five core propositions as indicators for determining

quality teachers: (a) committing to student learning, (b) knowing the subject content, (c) managing and monitoring students, (d) thinking systematically about teaching practices, and (e) being members of learning communities. NBPTS maintains that only those teachers who have proven their ability to meet the five core propositions and improve student learning earned national board certification status.

Statement of the Problem

Less-qualified teachers are most likely to teach in low socioeconomic and predominately minority schools (Darling-Hammond, 2004). In previous studies, researchers noted that NBCTs are less likely to teach economically disadvantaged and minority students (Goldhaber, Choi, & Cramer, 2007; Humphrey, Koppich, & Hough, 2005). The data on the distribution of NBCTs are consistent with the pattern of highly-qualified teachers; those teachers are teaching in high-performing, affluent schools.

Teachers who teach in low socioeconomic, minority schools confront many unique challenges that teachers in affluent schools would not normally encounter, such as exposure to violence and the inability to form partnership with parents (Campbell & Schwart, 1996; Colbert, 1991; Heymann & Earle, 2000). However, NCLB still holds those teachers accountable for improving student achievement. Researchers have implied that highly-qualified teachers are a dominant factor in student achievement regardless of the school setting and student demographic (Darling-Hammond, 2004; Konstantopoulos & Chung, 2011). However, the results of MCT2 and NAEP revealed a discrepancy among students by race and socioeconomic status. NBPTS (2012) contended that the advanced certification of being national board certified elevates the academic achievement of all students regardless of race and socioeconomic status. Several studies

have examined the influence of NBCTs and student achievement in the area of mathematics, but yielded mixed results (Cavalluzzo, 2004; Goldhaber & Anthony, 2004; Harris & Sass, 2009; Vandevoort et al., 2004). Collectively, those studies addressed state-wide assessments in the area of mathematics at the elementary, middle, and secondary level, but did not incorporate demographic data of schools, race, or socioeconomic status of students.

The problem for this study is the state of Mississippi invests millions of dollars to teachers for attaining national board certification; even though, there is little, fragmented data on the impact NBCTs have on minority and economically disadvantaged students. Researchers suggest that there needs to be more research and benchmarking on NBCTs teaching in schools other than those that are high performing, low-minority, and high socioeconomic (Goldhaber et al., 2007; Humphrey et al., 2005).

Purpose of the Study

According to Vandervoort et al. (2004), NBCTs, who are considered to be effective teachers, are capable of enhancing the achievement growth among all students regardless of school settings. The purpose of this study is to determine if there is a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by race and socio-economic status, taught by NBCTs and non-NBCTs in a low socioeconomic, high minority, Title I school.

Research Questions

As a means of fulfilling the purposes of the present study, two research questions were developed. The following represents the questions that will be answered in this study:

1. Is there a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between fourth grade African American and Caucasian students taught by NBCTs and those taught by non-NBCTs, while controlling socioeconomic status and third grade MCT2 mathematics scale scores?

2. Is there a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between fourth grade students by socioeconomic status based on eligibility for free/reduced or full pay lunch taught by NBCTs and those taught by non-NBCTs, while controlling race and third grade MCT2 mathematics scale scores?

Theoretical Framework

The theoretical framework for this study is that the effectiveness of a teacher is the most essential factor for increasing student achievement as compared to other factors such as socioeconomic status and race of students (NPBTS, 2012). Researchers agree that instructional practices, knowledge of content in subject area, and management of student learning are essential elements in defining the effectiveness of a teacher (Danielson, 2007; Darling-Hammond & Baratz-Snowden, 2007; NPBTS, 2012). However, teachers and schools are judged based on how students perform on standardized tests. NCLB (2001) mandated the improvement in student academic achievement as demonstrated by

standardized test performance or schools would incur penalties; thus suggesting that effective teachers are able to increase student performance. Researchers have noted that the socioeconomic status and ethnicity of students may moderate teachers' ability to enhance student learning (Darling-Hammond, 2004; Holloway, 2004; Konstantopoulos & Chung, 2011). Furthermore, teachers who increase student achievement in one school setting may not have the same impact in a different school setting, due to the school and student demographic data (Darling-Hammond, 2004).

Regardless of other components that define the effectiveness of a teacher, Goldhaber and Anthony (2004) contended that effective teachers are defined by their ability to produce gains in student achievement. In devising a certification at a national level for exemplary teachers, NBPTS (2012) was designed to offer professional growth for experienced teachers after which would lead to the improvement in teaching and student learning. Similar to Goldhaber and Anthony (2004), Cavalluzzo (2004) asserted that national board certification is the highest level of teaching certification and those who successfully complete the process by exhibiting the five core propositions are distinguished as effective teachers and produce academic advancement in students. In support of NBCT's capability of improving student achievement at a higher gain than non-NBCTs, the state of Mississippi provides monetary incentives for teachers who obtain national board certification (MDE, 2011b). NBPTS (2012) asserted that the expertise and leadership of NBCTs have the potential to positively influence student achievement in low-performing and low socioeconomic schools. It would be expected that if NBPTS's theory of NBCTs holds, then students taught by NBCTs would score

higher than students taught by non-NBCTs despite other factors that may have an

influence on student performance.

Conceptual Framework

The conceptual framework of the study consisted of two groups of teachers and

four groups of students in a low socioeconomic, high minority, Title I school: (a) students

in 4th grade taught by NBCTs and (b) students in 4th grade taught by non-NBCTs. The

researcher obtained existing MCT2 mathematics data on mean scale score growth of

students. The purpose of the study is to determine if there a statistically significant

difference in mathematics mean scale score growth on the MCT2 between students by

race and socioeconomic status, taught by NBCTs and non-NBCTs in a low

socioeconomic, high minority, Title I school. As shown below, the illustration of the

conceptual framework for the study provides a graphical display of major components in

the study (see Figure 1).
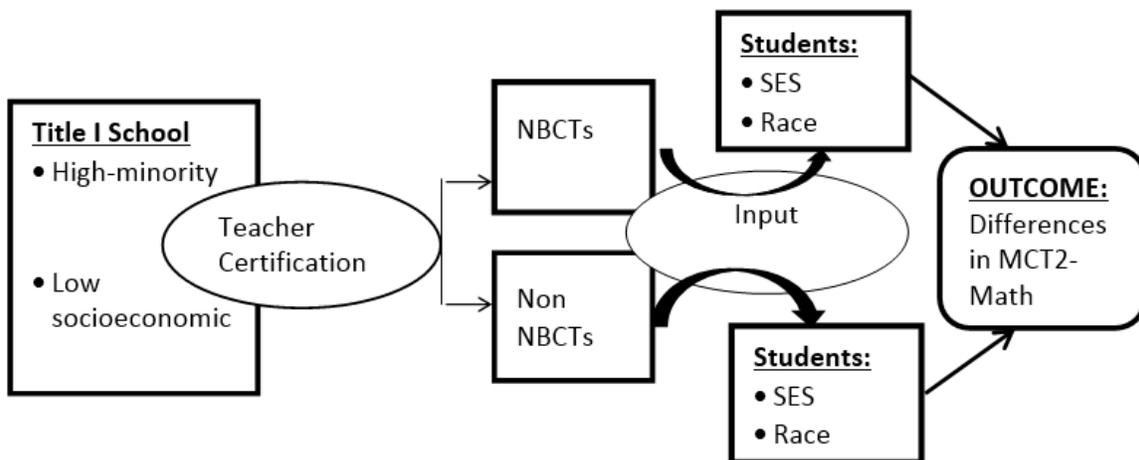
Figure 1.   Conceptual Framework

Definition of Terms

The following is a list of terms that were used throughout this study. The definitions provide clarification for important terminology.

Highly qualified teacher - refers to a teacher who is (a) fully certified and/or licensed by the state; (b) holds at least a bachelor's degree from a four-year institution; and (c) demonstrates competence in each core academic subject area in which the teacher teaches (USDE, 2001).

Mississippi Curriculum Test, 2ⁿᵈ Edition (MCT2) - a criterion-referenced state-wide assessments that measure student achievement in reading/language arts and mathematics in grades third through eighth (MDE, 2011a). The MCT2 allows Mississippi to be in compliance with federal legislation NCLB of 2001 (MDE, 2011a). The MCT2 measured student performance in reading/language arts and mathematics competency areas of vocabulary, reading, writing, grammar number and operation, measurement, geometry, algebra, and data analysis and probability, (MDE, 2011a).

National Board Certified Teachers (NBCTs) - those teachers who successfully completed 10 assessments as measured by the NBPTS. In addition, teachers are highly qualified according to state of Mississippi (NBPTS, 2012).

Non-National Board Certified Teachers (non-NBCTs) - those teachers who are fully certified and/or licensed by the state of Mississippi, but do not have national board certification.

Title I school - schools with enrollment of at least 40 percent of students from

     low-income families based on students eligibility for free or reduced lunch

     (USDE, 2008).

Delimitations

The study was conducted with certain delimitations. The following delimitations

are listed:

1. MCT2 mathematics data were obtained from a rural, low socioeconomic, high minority, Title I school in Mississippi during the 2009-2010 and 2010-2011 school year were used. The researcher chose MCT2 mathematics scale scores because students scored the lower in the area of mathematics than in the areas of reading and language arts.

2. Only NBCTs with national board certification in the area of Generalist-Middle Childhood were used in the study even though 24 areas of certification are offered.

3. The scale scores of fourth grade African American and Caucasian students taught by NBCTs or non-NBCTs who took the MCT2 during 2009-2010 and 2010-2011 school year were included in the study. Asian and Hispanic students were excluded because of low percentage in student population.

4. Of the 15 fourth grade teachers, only 4 NBCTs and 11 non-NBCTs have a minimum of three years of teaching experience and taught the same subject at the same school.

Limitation

There was one limitation for this study. The research did not take into consideration that students are exposed to multiple teachers with or without national board certification during their education, and student achievement may be attributed to other teachers' influence.

Significance of the Study

As previously stated, states provide monetary incentives for teachers achieving national board certification; therefore, legislators continue to seek compelling evidence supporting NBCTs impact on student achievement (Berry, 2007). In 2001, nationally, the financial stipend for achieving national board certification reached nearly $1 billion annually (Podgursky, 2001). With the rise of NBCTs from 44 in 1997 to 2,700 in 2012, the cost of providing a financial supplement to teachers' salaries in Mississippi has substantially increased (MDE, 2011b). Ranking sixth in the nation in total number of NBCTs and third per capita, the budget for supporting national board certification in Mississippi has increased from $6,954 in 1997 to $22,776,466 in 2010 and was estimated to rise to $24,500,000 by 2013 (MDE, 2011b).

The accountability for student performance on standardized tests has become the basis of education policy in the United States (Darling-Hammond & Youngs, 2002).The outcomes of the 2011 NAEP and 2010-2011 MCT2 assessments revealed that there is still a need for improvement. Furthermore, the results from those assessments suggested that race and socioeconomic status are factors that may influence student achievement in mathematics. If teachers are going to be held accountable for students' performance, it is essential that educators examine teacher quality and its association with higher student

performance on standardized test. According to NBPTS (2012), teachers who are national board certified have demonstrated effective teaching practices that contribute to improving student learning.

The distribution of NBCTs is underrepresented in schools with high concentrations of minority students and students of low socioeconomic status (Goldhaber et al., 2007; Humphrey et al., 2005). In a study conducted by Humphrey et al. (2005), the researchers analyzed the distribution of NBCTs from North Carolina, Florida, South Carolina, Ohio, and Mississippi. Of the 18,806 NBCTs, only 12% or 2,297 taught in schools with 75% or more students eligible for free or reduced lunch; 16% or 3,076 taught in schools serving 75% or more minority students; and 19% or 3,521 taught in low-performing schools. In the state of Mississippi, of the 1,567 NBCTs, only 18% or 279 taught in schools with 75% or more students eligible for free or reduced lunch; 16% or 248 taught in schools serving 75% or more minority students; and 11% or 167 taught in low-performing schools (Humphrey et al., 2005).

The information provided by the results of this study can be useful to educators seeking professional learning opportunity in order to meet requirements under NCLB by increasing student performance and reducing disparities among subgroups by ensuring 100% of students score proficient or above on state-wide assessments. Furthermore, the results from this study can be used by legislators in Mississippi as a guide in determining whether national board certification are beneficial to all students, especially those schools that are underrepresented in being taught by NBCTs, and deciding whether to continue or sustain funds allocated for NBCTs. Studies have been conducted that either supported or disputed evidence of NBCTs' ability to increase student achievement (Cavalluzzo, 2004;

Goldhaber & Anthony, 2004; Harris & Sass, 2009; Phillip, 2008; Rouse & Hollomon, 2005; Vandevoort et al., 2004). However, there is a gap in research that exists on the impact NBCTs have on students from high-minority, low socioeconomic, and low-performing schools. As for examining the impact of NBCTs on student achievement, the present study has incorporated student demographics such as race and socioeconomic status; as well as, the demographic of school as being low socioeconomic, high minority, and Title I. This line of research of NBCTs is particularly important, as previous studies have not well-documented whether NBCTs have an impact on minority and economically disadvantaged students' achievement.

CHAPTER II

REVIEW OF LITERATURE

This chapter contains a review of the literature that is relevant to understanding NBPTS and the relationship between NBCTs and student achievement. The chapter is outlined in five sections: (a) National Board Certification Process, (b) Five Core Propositions of NBPTS, (c) Challenges Teaching in Low-socioeconomic, High-minority Schools, (d) Effective Teaching, and (e) Research Related to NBCTs and Student Achievement. The chapter concludes with a summary.

National Board Certification Process

The NBPTS (2012) offers a voluntary certification for experience teachers who demonstrate highly effective instructional practices. According to NBPTS (2012), to seek national board certification, "teachers must meet the following requirements prior to applying: (1) hold a bachelor's degree, (2) completed three full years of teaching/counseling experience, and (3) possess a valid state teaching/counseling license" (p. 4). In the process of becoming national board certification, teachers must submit four portfolio entries that exhibit teaching practices related to the five core propositions (NBPTS, 2012). The portfolios must include "descriptions of the teaching and learning in the classroom, video-tapes of and commentaries on teacher's interactions with students, and examples of and commentaries on students' work" (Park, Oliver, Johnson, Graham,

& Oppong, 2007, p.369). In addition to submitting portfolios, teachers must complete on online assessment to demonstrate content knowledge in their specific certification area (NBPTS, 2012).

The national board certification process may take up to three years to complete and cost upward of $2,500 (NBPTS, 2012). Currently, NBPTS offers 25 certificates in a variety of subject areas (see Figure 2). In 2011, there were over 97,000 NBCTs nationwide and 3,317 NBCTs in Mississippi. The state of Mississippi pays the $2,500 test administration fee (MDE, 2011b). Furthermore, the supplement for being national board certified varies from state to state; the state of Mississippi pays a salary supplement of $6,000 per year (NBPTS, 2012).

Art	Literacy: Reading – Language Arts
• Early and Middle Childhood • Early Adolescence through Young Adulthood	• Early and Middle Childhood
Career and Technical Education	**Mathematics**
• Early Adolescence through Young Adulthood	• Early Adolescence • Adolescence and Young Adulthood
English as a New Language	**Music**
• Early and Middle Childhood • Early Adolescence through Young Adulthood	• Early and Middle Childhood • Early Adolescence through Young Adulthood
English Language Arts	**Physical Education**
• Early Adolescence • Adolescence and Young Adulthood	• Early and Middle Childhood • Early Adolescence through Young Adulthood
Exceptional Needs Specialist	**School Counseling**
• Early Childhood through Young Adulthood	• Early Childhood through Young Adulthood
Generalist	**Science**
• Early Childhood • Middle Childhood	• Early Adolescence • Adolescence and Young Adulthood
Health	**Social Studies – History**
• Early Adolescence through Young Adulthood	• Early Adolescence • Adolescence and Young Adulthood
Library Media	**World Languages Other than English**
• Early Childhood through Young Adulthood	• Early Adolescence through Young Adulthood

Figure 2.   NBPTS Certification Areas / Age Categories

National board certification is a rigorous process that examines the effectiveness

of teachers' instructional planning and preparation. National board certification requires

teachers to demonstrate and thoroughly explain how their knowledge and skills meet the Five Core Propositions (Coskie & Place, 2008). According to NBPTS (2012), teachers attaining national board certification have met the highest standards established for the profession.

Five Core Propositions of NBPTS

According to NBPTS (2012), standards for the 25 certifications were developed by a committee of educators from different fields. The committee consisted of classroom teachers and other relevant teaching field, such as state and district staff developers, curriculum specialists, and college and university professors of education. The committee developed standards based on the Five Core Propositions. The NBPTS identified five core propositions, which set the foundation for characterizing NBCTs (NBPTS, 2012). The Five Core Propositions served as the basis for NBPTS to recognize teachers "who effectively enhance student learning and demonstrate high levels of knowledge, skills, abilities, and commitment [to teaching]" (p. 3). NBPTS outlined the following as the five core propositions all teachers must know and be able to accomplish in order to attain certification:

- The first proposition is that teachers are committed to student learning. NBCTs must be committed to ensuring knowledge is available to all students. NBCTs must believe all students can learn. NBCTs must be able to recognize individual student differences as well as family and cultural differences and provide diverse instructions to meet the needs of all students. NBCTs must be concerned with the development of students' character and civic responsibility.

- The second proposition is that teachers know the subjects they teach and how to teach those subjects to students. In addition, NBCTs must possess an in-depth knowledge and understanding of content in the subject area they teach. NBCTs must be aware of the misconceptions students may have about the subjects and use a variety of instructional strategies to teach for understanding.

- The third proposition is that teachers are responsible for managing and monitoring student learning. NBCTs must incorporate a wide-range of instructional techniques in order to keep students motivated and engaged in learning. NBCTs must know how to create a conducive learning environment. NBCTs must use multiple methods for assessing students' performance and understand how to use assessments in order to guide instruction. In addition, NBCTs must be able to thoroughly explain students' academic progress.

- The fourth proposition is that teachers think systematically about their practice and learn from their experience. NBCTs must be aware of learning theories and current issues affecting education in the United States. Furthermore, NBCTs must be able to self-reflect on their teaching practices to improve preparation and planning for instruction.

- The fifth proposition is that teachers are members of learning communities and know how to establish a partnership with all stakeholders. NBCTs must collaborate with colleagues and other professional to improve student learning. NBCTs must be a part of the evaluation and planning process for creating a productive school-wide learning environment.

NBPTS (2012) affirmed that "the rich amalgams of knowledge, skills, dispositions and beliefs that will characterize NBCTs are clustered under the five core propositions" (p. 7). The five core propositions function as the core components that would enhance the quality of teaching and improve student learning in America's schools (Harman, 2001). Also, the five core propositions serve as standards of excellence by ensuring NBCTs have an in-depth knowledge of content, managed a classroom effectively, re-evaluated teaching and learning, participated in professional development, and developed partnership with community (NBPTS, 2012). However, certain school settings may hinder NBCTs' effort to establish a partnership with parents and create a productive learning environment.

Challenges Teaching in Low-socioeconomic, High-minority Schools

Teachers are the most important factor in a child's education (Konstantopoulos & Chung, 2011). Because low socioeconomic, high-minority schools often impose challenges for teachers, students in these schools often lack the educational opportunities of being taught by highly-qualified teachers (Darling-Hammond, 2004).

Colbert (1991) found that in low socioeconomic, minority schools, teachers struggle with increasing parental support and involvement. Many low-income, minority parents are not involved in their children's education because they dropout of school, feel uncomfortable in a school setting, or are insecure with helping their children with class assignments. In addition, Colbert found minority parents' experiences of schools have been detrimental in their decision to be directly involved in their child's schooling. The research by Colbert examined African-American parents' perceptions regarding interactions with school personnel. The participants in the study consisted of 23 African-

American parents with children attending k-6 public schools in a large mid-western metropolitan area. Colbert noted the data gathered consisted of interviews from parents based on a 52-item interview developed from the framework outlined by Comer (1984) and Ogbu (1981, 1985). The results revealed that 65% of parents reported that as children, they were unclear about or had no idea of the purpose of school; 45% of parents communicated a strong sense of anger and frustration toward schools and reported conveying it to their children; and 50% of parents felt that they had little or no influence in the school. Therefore, minority parents' negative experiences and perceptions of schools may contribute to their lack of parental involvement.

In addition, the majority of children in low socioeconomic, minority schools come from single parent families wherein parents are working more than one job and are unable to attend school functions (Heymann & Earle, 2000). The working conditions of parents often determine whether parents can meet with teachers, specialists, and counselors to address their children's needs. Heymann and Earle (2000) examined the availability of paid leave and flexible schedule between low-income and high-income parents' jobs. The federal poverty threshold was used to identify low-income parents. Data obtained by Heymann and Earle were from the National Longitudinal Survey of Youth on 1,878 employed mothers who had at least one child under the age of 18 were analyzed. The authors concluded that 70% of low-income parents' jobs do not have paid sick leave, 46% have no paid vacation, and 67% have no flexible schedule as compared to 36%, 22%, and 47% of high-income parents' jobs. Heymann and Earle found that, due to the loss of wages of missing work, low-income families cannot financially afford to be physically engaged in parental involvement at the school.

The exposure to violence in schools can have a profound effect on the educational environment (Campbell & Schwartz, 1996). Researchers have indicated that the rates of violence and injury are substantially higher in schools with high concentrations of minority and economically disadvantaged students (Campbell & Schwartz, 1996; Price, Telljohann, Dake, & Zyle, 2002). Campbell and Schwartz (1996), for example, examined the exposure to violence between students from a suburban school and students from a high minority, economically disadvantaged urban school. The participants consisted of 228 sixth grade students from a suburban school and 209 sixth grade students from an urban school in Pennsylvania. Data from a 56-item questionnaire survey were analyzed. The results indicated that 48% of students from a high minority, economically disadvantaged school reported that they had been robbed, 27% had been stabbed, and 24% had been caught in gun fire as compared to 26%, 7%, and 4% of suburban students. From this study, Campbell and Schwartz concluded that students in high minority, economically disadvantaged urban schools are more likely to be exposed to violence than those in suburban schools.

Price et al. (2002) conducted a study to assess elementary school students' experience with weapon carrying and violence. The participants in the study were 1,912 fourth grade and fifth grade students from a Midwestern school district consisting of a high minority population. Data from a 31-item questionnaire survey addressing violence and weapon carrying were analyzed. The results indicated that 57% of students were worried about being physically attacked in the classroom; 43% of students were hit by another student in the past year; 44% of students were pushed or shoved by another student; 40% of students felt that gang activity made them feel unsafe at school; and 8%

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of students had carried a weapon such as a knife, gun, or club within the past 30 days. Price et al. (2002) concluded that students in high minority and economically disadvantage schools are more likely to be confronted with physical aggression and violence.

As a byproduct the five NBPTS core propositions, NBCTs are capable of establishing a partnership with stakeholders and creating a productive learning environment. Taken all together, the line of literature suggests that challenges associated with teaching in low socioeconomic, high minority schools may hinder NBCTs from developing partnerships and creating a conductive learning environment. It further suggests that the exposure of violence and inability to form partnerships with parents may provide an explanation of why highly qualified teachers, specifically NBCTs, are less likely to teach in low socioeconomic, high minority schools (Campbell & Schwart, 1996; Colbert, 1991; Heymann & Earle, 2000; Price et al, 2002). Thus, the findings may provide explanations: (a) to the reason why NBCTs are more likely to teach in high performing, affluent schools and (b) for the need to examine the impact of NBCTs on students in low socioeconomic and high minority schools.

While researchers (Darling-Hammond, 2007; Darling-Hammond & Berry, 2006; Haycock, 2001; NBPTS, 2012) concluded highly qualified teachers play a significant role in improving student achievement, Carey (2004) stated that:

No matter which [studies are] examined, no matter which measure of teacher qualities [are used], the pattern is always the same that [economically disadvantaged] students, low-performing students, and students of [minority] are far more likely than other students to have teachers who are inexperienced,

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uncertified, poorly educated, and underperforming. Many of those teachers

demonstrate most or all those unfortunate qualities all at the same time. (p. 8)

In conclusion, studies examining national board certification and student

performance indicated that majority of NBCTs are more likely to teach students of higher

socioeconomic status and non-minority (Cavalluzzo, 2004; Goldhaber et al., 2005;

Humphrey et al., 2005). Studies conducted have shown that students who are taught by

national board certified teachers (NBCTs) have higher achievement gains than those

students who are taught by non-NBCTs (Cavalluzzo, 2004; Goldhaber & Anthony, 2004;

Vandevoort et al., 2004). Among the studies of NBCTs and student achievement

(Cavalluzzo, 2004; Goldhaber & Anthony, 2004; Harris & Sass, 2009; Phillip, 2008;

Rouse &Hollomon, 2005; Vandevoort et al., 2004), Goldhaber and Anthony (2004) was

the only study that indicated the characteristics of the students by race and socioeconomic

status, and the characteristics of the school as being urban, rural, or suburban. Goldhaber

and Anthony (2004) did not provide data on the distribution of NBCTs among urban,

rural, or suburban schools and did not examine the influence of NBCTs by school setting.

Consequently, it would be informative to examine whether NBCTs can improve student

achievement in low socioeconomic and high-minority schools.

Effective Teaching

According to Palardy and Rumberger (2008), there is a general agreement that

teachers make a difference in student achievement, but there is a lack of consensus about

what is effective teaching and which aspects of teacher effectiveness matter the most.

Stronge, Ward, and Grant (2011) stated, "[an effective teacher] is an elusive concept to

define when [individuals] consider the complex task of teaching and the multitude of

contexts in which teachers work" (p. 340). Although NBPTS recognized that the five

core propositions are effective teaching practices, NBPTS does not specify which

instructional practices teacher must incorporate in order to maximize student learning.

National board teacher candidates must be knowledgeable of exemplary instructional

strategies and practices that promote student achievement (Harmon, 2001). Extensive

studies have been conducted on instructional practices that promote advancement in

student learning and a conducive classroom environment.

Brown (2004) conducted a qualitative study to determine how urban teachers

managed their classrooms. The researcher gathered data from audio-taped interviews and

telephone conferences. The participants in the study consisted of 13 teachers from urban

schools in seven American cities. All 13 teachers taught in schools in which majority of

students were indicated as low socioeconomic status based on eligibility for free/reduced

lunch. According to findings, urban teachers were successful in managing their

classrooms by: developing a personal relationship with each student, taking time out of

each day to communicate with students about non-academic issues, allowing students

many opportunities for socialization as a part of instructional activities, upholding clear

expectations for behavior and enforcing expectations, and primarily using non-punitive

methods in their approach to handling disruptive behavior. Given that teachers must

effectively manage their classroom, which is part of the five core proposition outlined by

NBPTS, the study provides strategies that are beneficial to monitoring and managing

appropriate behavior for students in low socioeconomic, urban schools.

In an exploratory study, Flores and Kaylor (2007) investigated the effects of

direct instruction with middle school students identified as at risk for failure in

mathematics. Direct instruction consisted of: (a) each lesson beginning with an introduction of new skills followed by teachers demonstrating and modeling concepts; (b) students being actively involved in the lesson through frequent group verbal responses; (c) incorrect responses being corrected immediately followed by teachers giving the correct response, students engaged in more guided practice, and students giving the correct response; (d) skills and concepts being broken down into small units and systematically combined to form more complex skills; (e) teachers using math manipulatives; and (f) students not being engaged in independent practice until they have demonstrated mastery in previous guided practice with the teacher. The participants in the study were seventh grade students attending a rural district outside of a large southwestern city. The 30 students who participated in the study were identified as being at risk for failure in mathematics and failed the annual state assessment in the area of mathematics two or more times. Prior to study, students only received traditional instructions. During this study, participants received direct instruction on Mondays and Wednesdays and traditional instruction on Tuesdays and Thursdays. A pre-test and post-test were administered to students to determine the effects of direct instruction. The assessment included the following objectives: (a) translating a whole number into a fraction, (b) translating a fraction into a whole number, (c) multiplying fractions with like denominators, (d) adding/subtracting fractions with like denominators, (e) adding/subtracting mixed numbers with like denominators, and (f) multiplying whole numbers and fractions. The data were analyzed using a *t*-test.

Prior to direct instruction, the mean performance of items correct for the pre-test was 20%, with scores ranging from 0-57%. After students participated in direct

instruction, the mean performance of items correct for the post-test was 77%, with scores ranging for 36%-100%. Flores and Kaylor (2007) concluded that direct instruction had a significant impact on improving student performance.

Similar to Flores and Kaylor (2007), Cerezo (2004) investigated the instructional practices for at-risk students in mathematics and science. The researcher examined the learning processes and the changes in self-efficacy among students involved in problem-based learning. According to Cerezo (2004), problem-based learning is a learning process in which students apply reasoning, questioning, researching, and critical thinking to find a solution to the problem. Furthermore, the method of instruction in problem-based learning is organized around the investigation of real-world problems and provides students the opportunity to work in groups, collaborate with other groups, decipher information in order to find a solution, and then present the solution to the whole group with an in-depth explanation.

For this study, teachers were instructed to implement problem-based learning with their classes. There were five 8th grade classes consisting of four science classes and one math class, two 7thgrade math classes, and two 6th grade science classes that implemented problem-based learning. The researcher concentrated on female students at-risk of failing middle school math or science class. Cerezo (2004) analyzed data from video-taped class sessions and interviews from 14 female students at-risk of failing middle school math or science class. The results indicated that problem-based learning (a) sparked students' interest in learning; (b) assisted them in developing a more in-depth understanding of the concepts; (c) helped them to be organized, pay attention, stay on task, learn from others, process information, and use concepts in real-life situations; and (d) and tended to

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enhance their ability to sort, list, and solve problems. Based on findings, the researcher concluded that problem-based learning is a successful method of learning for students at-risk of failing.

In another study linking instructional practices to student achievement, Wenglinski (2004) examined what kinds of instructional practices were effective for reducing the achievement gap between Caucasian and minority students. The study analyzed data from 13,511 fourth graders who took the NAEP in mathematics and teacher questionnaire on classroom practices using hierarchical linear modeling (HLM). A total of 20 instructional practices were analyzed in the study (Wenglinski, 2004). The author found that some instructional practices were beneficial in reducing the achievement gap on NAEP in mathematics, which included: (a) teachers providing manipulatives for students to solve math problems; (b) teachers allowing more time in class on math activities; (c) teachers requiring students to complete math projects; (d) teachers providing students the opportunity to write about math concepts; and (e) teachers engaging students to solve real world math problems. According to NBPTS (2012), the process of becoming national board certified requires teacher candidates to submit a video-tape of instructional practices.

Although there are various definitions of an effective teacher, there are commonalities that define an effective teacher. While researchers have indicated that effective instructional practices promote student learning, NBPTS (2012) noted that NBCTs are knowledgeable of the content area they teach and able to implement the appropriate instructional practices that best meet the needs of their students in order to maximize academic achievement (Brown, 2004; Cerezo, 2004; Flores & Kaylor, 2007;

Wenglinski, 2004). On the other hand, other researchers primarily link effective teachers to academic growth of students regardless of race and socioeconomic status (Konstantopoulos & Sun, 2012; Palardy & Rumberger, 2008; Sanders & Rivers, 1996; Stronge et al., 2011).

Effective Teachers and Student Achievement

Prior the era of accountability under NCLB, Sanders and Rivers (1996) associated teacher effectiveness with the promotion of academic growth. Sanders and Rivers examined the importance of individual teachers on student achievement, based on data collected on a cohort of students from second grade to fifth grade. The findings revealed that students placed with three high-performing teachers in a row scored on average at the 96th percentile (mean score of 785) on the Tennessee's statewide mathematics assessment by the end of fifth grade. When students with comparable achievement at the beginning of third grade were placed with three low-performing teachers in a row, their average score on the same mathematics assessment was at the 44th percentile (mean score of 720). With equivalent achievement at the beginning of third grade, the students with three high-performing teachers in a row had a larger increase in mean score by 54 points as compared to those students placed with three years of low-performing teachers. The results from the study suggested that the most important factor affecting student learning is teachers.

In recent studies, Palardy and Rumberger (2008) investigated the following question, "To what degree do differences in teacher effectiveness affect student achievement gain?" (p. 112). The researchers used data from the National Center for Education Statistics. The sample size of the study included 3,496 first grade students, 877

classrooms, and 253 schools. A hierarchical linear model (HLM) was used to analyze the effect of teacher quality on student achievement gain in first grade. The findings indicated that students taught by effective teachers had more than one-third of school year higher achievement gain in reading and math as compared to students taught by average teachers. From the study, the researchers concluded that student achievement gains were strongly associated with teacher effectiveness. However, the study did not indicate whether a state-wide assessment was used to measure student achievement and did not examine whether teacher effectiveness was moderated by student race and socioeconomic status.

Stronge et al. (2011) conducted a study to examine student achievement gain scores in reading and mathematics and classroom practices of effective teachers labeled as top quartile versus less effective teachers labeled as bottom quartile. The data included two years of student test scores in reading and math from fifth grade teachers from three public school districts in a state located in the southeastern United States. The study examined 931 students taught by top-quartile teachers versus 1,053 students taught by bottom-quartile teachers in terms of student gains. To calculate student gains, the researchers used end-of-course fourth grade scores in reading and math as pre-test and end-of-course fifth grade scores in reading and math as post-test. A HLM was used to estimate the growth for all students included in the sample to predict the expected achievement growth. In the HLM, the researchers used student-level and classroom-level variables as predictors of student performance. The student-level variables in the model were gender, ethnicity, free or reduced lunch status, English as a second language special education status, and prior achievement by fourth-grade reading mathematics scores. The

classroom-level variables were gender, ethnicity, free or reduced lunch status, eligibility for special education service, English-language learner, and class size. For reading, the results indicated a difference in gains was 0.59 standard deviations in one year. Basically, students taught by bottom-quartile teachers scored at the 21st percentile on state's reading assessment, whereas students in top-quartile teachers scored at the 54th percentile. For mathematics, the results for mathematics indicated a difference in gains score of 0.45 standard deviations. The students taught by bottom-quartile teachers scored at the 38th percentile; and students taught by the top-quartile teachers scored at the 70th percentile. Stronge et al. concluded that there are differences in student achievement in reading and mathematics between effective and less effective teachers.

A study conducted by Konstantopoulos and Sun (2012) coincided with the research by Stronge et al. (2011). Konstantopoulos and Sun (2012) suggested that effective teachers may be more likely to benefit students in the early grades. The researchers used mathematics and reading scores from Stanford Achievement Test (SAT-9) as a part of Project Star in the state of Tennessee. According to Konstantopoulos and Sun (2012), a quantile regression, similar to linear regression, was used to predict how teachers in one year can affect the achievement of students from grade to grade. The results from the longitudinal analysis indicated the students who have had high-effective teachers in successive grades from kindergarten through third benefited at least one-fourth of a standard deviation in fourth grade. From the analysis, researchers concluded that the estimates are positive for students who have had high-effective teachers and negative for those students who have had low-effective teachers.

Collectively, the studies (Konstantopoulos & Sun, 2012; Palardy & Rumberger, 2008; Sanders & Rivers, 1996; Stronge et al., 2011) suggest that teachers have a different impact on student achievement. Students taught by effective teachers yielded higher rates of academic achievement than those students taught by less effective teachers. It is noteworthy that of the several studies cited regarding effective teacher and student achievement, only one study, conducted by Stronge et al. (2011), included student demographic variables, such as race and socioeconomic status. Even though empirical studies associated effective teachers with better student outcomes, researchers acknowledged that there were differences in teaching practices between effective teachers and non-effective teachers (Konstantopoulos & Sun, 2012; Palardy & Rumberger, 2008; Sander & Rivers, 1996; Stronge et al., 2011). Along those lines, NBPTS (2012) concluded that teachers who hold a national board certification have demonstrated high levels of knowledge, skills, and abilities, which led to advancement in student performance (NBPTS, 2012). According Goldhaber and Anthony (2004), national board certification provides a valid sign of teacher effectiveness. Vandervoort et al., (2004) indicated that students of NBCTs will make yearly achievement gains that tend to be greater than the students of teachers who have not obtained national board certification.

Research Related to NBCTs and Student Achievement

Although there is not conclusive evidence to support NBCTs increasing student achievement, most studies have concluded that NBCTs have a positive impact on student achievement (Cavalluzzo, 2004; Goldhaber & Anthony, 2004; Harris & Sass, 2009; Phillip, 2008; Rouse & Hollomon, 2005; Vandevoort et al., 2004). Goldhaber and Anthony (2004) conducted a large scale study to assess the relationship between NBCTs

and elementary students' achievement. The participants were 390,449 students in Grades 4-5. Student demographic information included race, gender, learning disability, free or reduced-price lunch status, and grade level. Teacher demographic data included race, gender, age, license, degree level, years of teaching experience, and Praxis or National Teacher Exams scores. In addition, the school demographics such as rural, urban, and suburban were included in the study. Of those students, approximately 9,000 were taught by teachers who were applicants but not national board certified and approximately 6,000 were taught by NBCTs. A standardized test administered as a part of the North Carolina accountability system was used to measure student achievement growth. Goldhaber and Anthony (2004) indicated that student achievement growth was determined by "subtracting the previous year's end-of-grade test from subsequent year's end-of-grade test in that subject" (p. 9). A multiple linear regression was used to analyze the data. Based on results, students taught by NBCTs had higher achievement growth in one year in math ($M = 10.21$) and reading ($M = 6.18$), than those students taught by teachers who were not applicant/non-NBCTs in math ($M = 9.75$) and reading ($M = 5.69$), and those students taught by teacher who were applicants/non-NBCTs in math ($M = 9.14$) and reading ($M = 5.83$). The findings in the study concluded that students taught by NBCTs had a higher achievement gain in math and reading than non-NBCTs. Goldhaber and Anthony (2003) did not disaggregate the analysis by comparing students separately by race and socioeconomic status taught by NBCTs versus non-NBCTs. Goldhaber and Anthony (2003) noted that highly qualified teachers were more likely to be teaching in higher performing, low-minority, more affluent schools and the "pattern [was]…more pronounced for NBCTs" (p. 15). Consequently, there is a critical need to investigate the

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impact of NBCTs on student achievement in low socioeconomic, high-minority, low performing schools.

Using a statistical analysis similar to Goldhaber and Anthony (2004), Cavalluzzo (2004) investigated whether national board certification was an effective indicator of teacher quality. The participants in the study consisted of approximately 108,000 students in grades 9-10, 61 NBCTs, and 1,947 non-NBCTs. Of those students, 3,049 were instructed by NBCTs and 98,801 were instructed by non-NBCTs. A multiple linear regression was used to analyze the data. The researcher controlled for following teacher variables: certification, experience, and advanced degrees. Other variables included were school size, per-pupil expenditure, student absenteeism, number of suspension, and student performance level. The researcher used the state of Florida end-of-grade exam in mathematics, from the years of 2001-2003, to measure student performance. In this study, students of NBCTs had a higher score ($M = 2016.84$) than those students of non-NBCTs ($M = 1856.55$). The results indicated that national board certification was an effective indicator of teacher quality. It is worth noting that Cavalluzzo (2004) stated that students of NBCTs are less likely to be reported as eligible for free or reduced price lunch and less likely to be African Americans. Although Cavalluzzo analyzed mathematics data at the secondary level and included demographic information, other possible influential variables such as the race and socioeconomic status of students were not included in study. A further study is warranted that analyzes mathematics data at the elementary level and examines those variables of students.

Unlike Goldhaber and Anthony (2004) and Cavalluzzo (2004), Vandervoort et al. (2004) suggested that student demographic data are not needed and do not have an

influence on NBCTs improving student achievement. Simply, the implication is that students of NBCTs are likely to achieve better results on standardized test than those students of non-board certified teacher. The researchers examined the relationship between NBCTs and student achievement gain as measured by performance on Stanford Achievement Test-9th (SAT-9) in the area of reading, math, and language arts. The researchers used existing data from the years 1999-2003 for Grades 3 through 6. Fourteen school districts and approximately 209,000 elementary students in the state of Arizona were included in the study. Data were obtained for the Arizona Department of Education. The researcher used analysis of covariance (ANCOVA) to analyze data. According to the results, in 1999-2000, students taught by NBCTs on average gained about one and a third month more in reading achievement, three and a half months more in mathematics, and one and a quarter month more in language arts compared to students taught by non-NBCTs. In 2000-2001, students taught by NBCTs on average gained about one and a half month more in reading achievement, about a half month more in mathematics, and two month advantage in language arts compared to students taught by non-NBCTs. In 2001-2002, students taught by NBCTs on average gained about a half month advantage in reading, about a month advantage in mathematics, and about less than quarter month in language arts compared to students taught by non-NBCTs. In 2002-2003, students taught by NBCTs on average gained about two and a quarter months more in reading, about a half month advantage in mathematics, and about half a month advantage in language arts compared to students taught by non-NBCTs. In this study, the students taught by NBCTs on average had a greater impact on SAT-9 as compared to students taught by non-NBCTs.

Phillips (2008) conducted a study to describe the differences between students taught by NBCTs and those taught by non-NBCTs in relation to percent scores on South Carolina's Physical Education Assessment Program. The South Carolina's Physical Education Assessment Program measured student competency in the areas of motor skill performance, cognitive fitness knowledge, outside-of-class participation, and health-related fitness levels. The participants in the study consisted of 12 students from NBCTs and 396 students from non-NBCTs. An *ex post facto* design was used to investigate the relationship of national board certification and student competency in physical education in South Carolina. The results indicated that students taught by NBCTs produced higher levels of student competency in motor skill performance ($M = 73.27$), cognitive fitness knowledge ($M = 80.63$), six-week physical activities outside of class participation verified by an adult ($M = 84.92$), and health-related fitness levels ($M = 55.57$) than those students taught by non-NBCTs in motor skill performance ($M = 59.78$), cognitive fitness knowledge($M = 67.94$), six-week physical activities outside of class participation verified by an adult ($M = 68.73$), and health-related fitness levels ($M = 33.85$). The results from this study supported the positive effect NBCTs have on student achievement. Resembling the study by Vandevoort et al. (2004), Phillips only used national board certification status of teachers as the independent variable and students' scores on a state-wide assessment as the dependent variable. Without including demographic variables, the researcher did not take into account of other variables having an influence the dependent variable.

With inconsistency in findings on NBCTs and the impact on student achievement, Rouse and Hollomon (2005) conducted a study to determine if business and marketing

students who were taught by NBCTs experienced an increase in student achievement levels on the North Carolina Vocational Competency Achievement Tracking System (VOCATS) during the 2002-2003 and 2003-2004 academic year. Teachers participating in the study were selected using a matched pair design based on experience, grade level taught, and type of licensure. The participants consisted of six NBCTs and six non-NBCTs, 729 students in 2002-2003, and 741 students in 2003-2004. The students' scores on the VOCATS were reported by achievement levels, with Level 1 and 2 (not proficient) and Level 3 and 4 (proficient). In 2002-2003, there were 360 students' test scores from NBCTs and 369 students' test scores from non-NBCTs. The results indicated that there were no significant differences in achievement levels. Of the 360 students from NBCTs, 122 students (34%) scored at achievement levels of 1 and 2. There were 238 students (66%) who scored at achievement levels 3 and 4. Of the 369 students from non-NBCTs, 137 students (37%) scored at achievement levels of 1 and 2. There were 232 students (63%) who scored at achievement levels 3 and 4. In 2003-2004, there were 366 students' test scores from NBCTs and 375 students' test scores from non-NBCTs. The results indicated that there were no significant differences in achievement levels. Of the 366 students from NBCTs, 110 students (30%) scored at achievement levels of 1 and 2. There were 256 students (70%) who scored at achievement levels 3 and 4. Of the 375 students from non-NBCTs, 139 students (37%) scored at achievement levels of 1 and 2. There were 236 students (63%) who scored at achievement levels 3 and 4. From this study, Rouse and Hollomon concluded that students from NBCTs and non-NBCTs performed comparably on the North Carolina VOCATS.

Harris and Sass (2009) conducted a study to determine the impact NBCTs have on students' test scores from both low-stake and high-stake exams. The source of data was from the "Sunshine State Standards" Florida Comprehensive Achievement Test (FCAT-SSS) also known as (FCAT-Norm-Referenced Test) and the Stanford-9 (SAT-9) during the years of 2001 – 2004. The data were gathered from the Florida Department of Education. Participants in the study consisted of over 1 million students, nearly 30,000 math teachers with over 1,200 of whom were NBCTs, and 32,000 reading/language arts teachers with over 1,500 of whom were NBCTs. The researchers analyzed data from FCAT-SSS and FCAT-NRT in reading and math for all 3rd through 10th graders in Florida. The estimated impact on student achievement taught by NBCTs versus non-NBCTs ranged from .01 to .02 standard deviations. The results indicated that there were no significant differences in student achievement between NBCTs and non-NBCTs.

As previously noted, studies on NBCTs and student achievement had limitations (Cavalluzzo, 2004; Goldhaber & Anthony, 2004; Phillip, 2008; Vandevoort et al., 2004). Studies (Harris & Sass, 2009; Rouse & Hollomon, 2005) yielding no significant differences in NBCTs and student achievement had greater limitations by only including a single independent variable, which may raise concern with the results. It is worth noting that each study consisted of or excluded different types of student and teacher demographic data, which may indicate a possible explanation for the mixed results. Additional differences in external threats, such as sample size, subject area, grade level, and duration may further provide an insight to the inconsistent findings in determining whether NBCTs enhance student performance.

As previous studies examined the impact NBCTs have on student achievement, some studies supported the association of NBCTs and the academic growth of students, while other studies concluded that teachers who achieve national board certification are no more effective than those teachers without national board certification. It is interesting that of the several studies cited regarding NBCTs and student achievement, only one study, conducted by Goldhaber and Anthony (2004), accounted for students and school demographics.

The literature in this section on NBCTs and student achievement may be summarized by the premise that majority of researchers believed that those teachers who achieve national board certification exhibit an exemplary level of teacher quality, which enables them to positively influence all students' achievement in any school setting. A further study of NBCTs teaching in certain school settings while accounting for student demographic data is needed to add to empirical studies to help validate or dispute NBPTS proclaimed assertion that NBCTs are "better equipped to deliver quality instruction that enhances student academic proficiency" (Rouse & Hollomon, 2004, p. 141).

Summary

Educators are aware that education in the United States has entered into an era of accountability (Darling-Hammond & Youngs, 2012). Through NCLB, legislators have passed policies that require local and state education agencies to improve the quality of education for all students at all grade levels (Brown-Jeffy, 2008; Carpenter, Ramirez, & Severn, 2012). Researchers have suggested that the best way to improve student achievement is by ensuring students are taught by effective teachers (Darling-Hammond, 2000; Darling-Hammond & Baratz-Snowden, 2007; Palardy & Rumberger, 2008;

Stronge et al., 2011). In comparison, NBPTS (2012) contends that the most important action to enhance schools and student learning is to strengthen teachers. NBPTS attests that teachers who obtain national board certification have demonstrated knowledge and skills necessary to enhance student achievement.

The NBPTS is rooted in the belief that the five core propositions serve as national standards for defining an effective teacher. Through the rigorous process of national board certification, teachers must demonstrate a series of performance-based assessments that meet the five core propositions. By fulfilling the requirements of national board certification, teachers have proven that they possess exemplary teaching practices needed to advance student performance (Berry, 2007; NBPTS, 2012). With the five core propositions as the cornerstone, NBPTS has developed a national certification that recognizes effective teaching practices for all teachers regardless of state-level teaching licensure and/or certification.

Numerous studies examining the academic performance of students taught by NBCTs have concluded that those students outperform or perform comparably to students taught by non-NBCTs (Cavalluzzo, 2004; Goldhaber & Anthony, 2004; Phillip, 2008; Rouse & Hollomon, 2005; Vandevoort et al., 2004). While studies either support or oppose the improvement in academic gain for students taught by NBCTs, there is limited research when it comes to NBCTs teaching in high-minority, low socioeconomic schools.

CHAPTER III

METHODOLOGY

The purpose of the study was to determine if there was a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by race and socioeconomic status, taught by NBCTs and non-NBCTs in a low socioeconomic, high minority, Title I school. Chapter III discusses the methodology that was used in this study. The chapter include: (a) research design, (b) description of data, (c) instrumentation, (d) data collection procedure, (e) and data analysis.

Research Design

According to Creswell (2008), quantitative research is essentially about collecting numerical data to explain a particular phenomenon. This study employed a causal-comparative research design. The researcher obtained existing data to examine the research questions of differences in mathematics mean scale score growth on the MCT2 mathematics assessment between students by race and socio-economic status, taught by NBCTs and non-NBCTs in a low socioeconomic, high minority, Title I school.

Causal-comparative research designs attempt to determine the cause or reason for existing differences in the behavior or status of groups of subjects (Fraenkel & Wallen, 2009). Causal-comparative research is also referred to as *ex post facto* because the effect

and alleged cause have already occurred and are studied by researcher in retrospect (Gay & Airasian, 2009). A causal-comparative research design attempts to explore causation or suggest relationship between variables (Fraenkel & Wallen, 2009).

A causal-comparative research design is appropriate for the purpose of this study because the researcher examined the differences between two groups, while controlling other variables known as covariates. Causal-comparative research designs permit the investigation of a number of variables. However, independent variables in causal-comparative studies are variables that cannot be manipulated (Fraenkel & Wallen, 2009). The constraints that prevent independent variables from being manipulated are that independent variable already occurred, that it is impossible to manipulate the independent variable, or that it is unethical to manipulate independent variable (Gay, Mills, & Airasian, 2009).

Description of Data

The data for this study consisted of mathematics scale scores on MCT2 of students taught by NBCT or non-NBCT in a low socioeconomic, high minority, Title I school. The school is located in a school district in rural east central Mississippi. During the 2010-2011 school year, the fourth grade population consisted of approximately 360 students. Of the fourth grade population, about 70% were African American; and 25% were Caucasian. Approximately 70% of the students qualified for free or reduced lunch.

The 15 fourth grade teachers were highly qualified based on requirements by MDE, but only 4 out of the 15 fourth grade teachers were national board certified. The four NBCTs were certified in the area of Generalist-Middle Childhood. The NBCTs and non-NBCTs fourth grade teacher had a minimum of three years of teaching experience

and taught the same subject at the same school. Thus, the students' scores taught by 4

NBCTs and students' scores taught by 11 non-NBCTs were used in the study.

Instrumentation

The researcher obtained MCT2 data from the school district's EZ Test Tracker.

EZ Test Tracker is a data management tool used by school districts to collect,

disaggregate, and analyze criterion- and norm-reference tests by teachers and students

(Shelly & Baer, 2003). The school district in the study used EZ Test Tracker to store

results of MCT2 for Grades 3 through 8. The data consisted of scale scores in the area of

mathematics on a cohort of students during their third grade school year in 2009-2010

and fourth grade school year in 2010-2011.

Mississippi Curriculum Test, 2nd Edition (MCT2)

MCT2 is a criterion referenced test that assesses students' achievement in Grades

3 through 8 in the areas of reading/language arts and mathematics against the *2007*

Mississippi Language Arts Revised and the 2007 Mississippi Mathematics Framework

Revised. According to MDE (2011a), the MCT2 test for mathematics in Grades 3 through

7 measures students' knowledge of and skill levels in general mathematics. As for Grade

8, MCT2 test for mathematics measures students' knowledge of and skill levels in pre-

algebra. The assessment consists of multiple-choice questions that vary according to

MCT2 mathematics competency areas. According to MDE, the student mastery of grade-

level curriculum for third through seventh grade students is measured based upon the

following mathematics competency areas listed in Table 1.

Table 1

Number of Test Items in Each Competency Area

Competency	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7
Numbers and Operations: Analyze relationships among numbers and the four basic operations. Compute fluently and make reasonable estimates	17	16	15	15	12
Algebra: Explain, analyze, and generate patterns, relationships, and functions using algebraic symbols, demonstrate an understanding of the properties of the basic operations, and analyze change in various contexts.	7	7	8	10	13
Geometry: Develop mathematical arguments about geometric relationships and describe spatial relationships using coordinate geometry.	7	7	10	9	10
Measurement: Develop concepts and apply appropriate tools and techniques to determine units of measure.	7	8	9	8	7
Data Analysis & Probability: Formulate questions that can be addressed with data and select and use appropriate statistical methods to analyze data. Apply basic concepts of probability.	7	7	8	8	8
Total Core Items (Scored)	45	45	50	50	50
Experimental Test Items (Not Scored)	10	10	10	10	10
Total Number of Test Items	55	55	60	60	60

In addition to the core test items, each grade level test consisted of 10 additional experimental test items for which no scores will be given (MDE, 2011a). The number of questions a student answered correctly is called a raw score. The raw score is converted to a scale score. Scale scores are statistical conversions of raw scores that adjust for variations in the difficulty of items in different tests as shown in Table 2 (MDE, 2010a). Once the items are scored, the results are categorized by performance levels: minimal, basic, proficient, and advanced.

Table 2

Scale Score and Raw Score Chart

Math/ Grade level	Minimal		Basic		Proficient		Advanced		Maximum Scale Score	Raw Score Corresponding to Max Scale Score
	Scale Score Range	Raw Score Range	Scale Score Range	Raw Score Range	Scale Score Range	Raw Score Range	Scale Score Range	Raw Score Range		
3rd Grade	105-137	0-19	138-149	20-29	150-164	30-40	165-186	41-45	186	45
4th Grade	116-140	0-18	141-149	19-26	150-164	27-39	165-187	40-45	187	45
5th Grade	110-140	0-18	141-149	19-26	150-163	27-40	164-190	41-50	190	50
6th Grade	115-141	0-19	142-149	20-27	150-163	28-42	164-185	43-50	185	50
7th Grade	112-141	0-19	142-149	20-26	150-163	27-41	164-185	42-50	185	50

The MDE (2011a) definitions of possible scores are:

Advanced [scores represent] students at the advanced level consistently perform

in a manner clearly beyond that required to be successful in the grade or

course in the content area.

Proficient [scores represent] students at the proficient level demonstrate solid

academic performance and mastery of the knowledge and skills required

for success in the grade or course in the content area.

Basic [scores represent] students at the basic level demonstrate partial mastery of

the knowledge and skills in the course and may experience difficulty in the

next grade or course in the content area.

Minimal [scores represent] Students at the minimal level inconsistently

demonstrate the knowledge or skills. (p. 4)

Reliability

According to Fraenkel and Wallen (2009), the reliability is the consistency of the results obtained from a measurement and the extent to which it remains consistent over time. As for MCT2, "the focus of reliability is to ascertain the relationships among scores derived from individual items" (MDE, 2010b, p. 64). The reliability of the MCT2 was estimated by the use of Cronbach's alpha. Cronbach's alpha is used as a measure of the reliability of a psychometric test score (Fraenkel & Wallen, 2009). According to the information in the *Technical Manual for 2009-2010 Test Administration*, the Cronbach's alpha correlation coefficient for the MCT2 ranged from 0.87 to 0.91 (MDE, 2010b). Fraenkel and Wallen noted that Cronbach's alpha correlation coefficients of at least .70 or higher are satisfactory for research purposes.

Validity

According to the information in the *Technical Manual for 2009-2010 Test Administration* (MDE, 2010b), validity "refers to a collection of evidence that demonstrates test fairness and a valid… interpretation of the test scores" (p. 64). There are different types of measures used to establish validity for the MCT2. Content validity is the degree to which a test measures an intended content area (Fraenkel & Wallen, 2006). Content validity is presumed for the MCT2 because all core items were developed to measure students' knowledge of and skill level in general mathematics based Mississippi Curriculum Framework (MDE, 2010b).

Data Collection Procedure

The researcher contacted the school district's superintendent to acquire permission to conduct study. Afterwards, the researcher submitted a letter of permission and request to conduct research to Mississippi State University's Institutional Review Board (IRB) for the Protection of Human Subjects in Research. Once granted permission (see Appendix A), the researcher obtained data from the school district's EZ Test Tracker. Finally, the researcher transferred data without using teachers' and students' names and other identifying information to Statistical Package for the Social Sciences (SPSS) for analysis.

Data Analysis

The researcher used an ANCOVA to determine if there is a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by race and socio-economic status, taught by NBCTs and non-NBCTs. A data analysis procedure such as multiple regression analysis or hierarchical linear regression was not used for this study. Multiple regression analysis and hierarchical linear regression are used to measure the influence of independent variables that can predict the outcome of the dependent variable (Miller & Chapman, 2001). ANCOVA is appropriate for this study because, as noted by Miller and Chapman (2001), it is used to compare means between groups. They further note that ANCOVA is suited to adjust scores on the dependent variable based on initial differences of other variables (covariate) that influence the dependent variable being measured as was required in this study.

Similar to studies conducted by Goldhaber and Anthony (2004) and by Stronge et al. (2011), student achievement growth was determined by subtracting previous year's test scores from the following year's test scores. To account for pre-existing test scores differences between students taught by NBCTs and non-NBCTs, students' third grade (2009-2010) MCT2 mathematics scale scores were used as a baseline for each student. The students' fourth grade (2010-2011) MCT2 mathematics scale scores minus students' third grade (2009-2010) MCT2 mathematics scale scores were used to calculate MCT2 mathematics scale score growth of students taught by NBCTs and non-NBCTs over the course of the school year. The dependent variable was the MCT2 mathematics scale score growth; the independent variables were race and socioeconomic status and teacher certification as being national board certified or non-national board certified; the covariates were third grade MCT2 mathematics scale scores and student's demographics as being race and gender. Before using ANCOVA, the following assumptions were tested: (a) homogeneity of variance and (b) homogeneity of regression coefficient (Miller & Chapman, 2001). Statistical analysis for all research questions were performed using SPSS. Specifically, a General Linear Model was used in SPSS. All analyses were computed at the .05 alpha level.

CHAPTER IV

RESULTS

Chapter IV presents the findings of the analyses in response to the research questions. The purpose of the study was to determine if there was a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by race and socio-economic status, taught by NBCTs and non-NBCTs in a low socioeconomic, high minority, Title I school. Teacher's national board certification status; and student's race as being African American or Caucasian and socioeconomic status based on eligibility for free/reduced or full pay lunch, third grade MCT mathematics scale scores, and MCT2 mathematics mean scale score growth were selected as units of analysis in this study.

Data Analysis

During the 2010-2011 school year, the fourth grade consisted of approximately 360 students. The 2009-2010 third grade and 2010-2011 fourth grade MCT2 mathematics scale scores were obtained for this study. Of the fourth grade students, about 70% were African American; and about 25% were Caucasians. Approximately 70% of the students qualified for free or reduced lunch. Since the MCT2 mathematics scale scores of African American and Caucasian students from 2009-2010 and 2010-2011 were required for the study, scores from students of other race and those who did not take the test both years

were eliminated. Of the approximately 360 students, MCT2 mathematics scores were only obtained for 311 students; 231 (74%) of the students were African American and 80 (26%) were Caucasian, and 227 (72%) of the students qualified for free or reduced lunch. The selected teacher and student demographic data are summarized in following tables.

Table 3 displays the race of the students examined in this study. As displayed in Table 3, 74% of the students were African Americans and 26% of the students were Caucasian.

Table 3

Demographics of Students by Race

	Frequency	Percentage
African American	231	74
Caucasian	80	26
Total	311	100

Table 4 displays the socioeconomic status based on eligibility for free/reduced or full pay lunch of the students examined in this study. As displayed in Table 4, 72% of the students qualified for free/reduced lunch and 28% of the students were identified as full pay lunch status.

Table 4

Demographics of Students by Socioeconomic Status

	Frequency	Percentage
Free/Reduced Lunch	227	72
Full Pay Lunch	84	28
Total	311	100

Table 5 displays national board certification of the teachers examined in this study. As seen in the table, 27% of the teachers were national board certified and 73% of teachers were non-national board certified.

Table 5

National Board Certification of Teachers

	Frequency	Percentage
National Board Certification	4	27
Non-national Board Certification	11	73
Total	15	100

The 2010-2011 fourth grade MCT mathematics mean scale scores minus 2009-2010 third grade MCT2 mathematics mean scale scores were used as MCT2 mathematics mean scale score growth. Prior to analyzing the data to answer the research questions, descriptive analysis were computed on 2010 MCT2 and 2011 MCT2 mathematics mean scale scores. Tables 6-9 show the means of the mathematics scale scores.

Table 6

Mathematics Mean Scores by SES – 2010 MCT2- 3rd Grade

Treatment	SES	Mean	Std. Deviation	N
NonNBCTs	free/reduced	144.94	13.029	177
	full pay	153.46	13.294	48
	Total	146.76	13.516	225
NBCTs	free/reduced	145.12	11.628	50
	full pay	156.86	14.535	36
	Total	150.03	14.103	86
Total	free/reduced	144.98	12.709	227
	full pay	154.92	13.857	84
	Total	147.67	13.736	311

Table 7

Mathematics Mean Scores by Race – 2010 MCT2 – 3ʳᵈ Grade

Treatment	SES	Mean	Std. Deviation	N
NonNBCTs	African American	143.63	11.976	172
	Caucasian	156.91	13.342	53
	Total	146.76	13.516	225
NBCTs	African American	145.68	12.561	59
	Caucasian	159.56	12.690	27
	Total	150.03	14.103	86
Total	African American	144.16	12.133	231
	Caucasian	157.80	13.106	80
	Total	147.67	13.736	311

Table 8

Mathematics Mean Scores by SES – 2011 MCT2 – 4ᵗʰ Grade

Treatment	SES	Mean	Std. Deviation	N
NonNBCTs	free/reduced	147.73	12.086	177
	full pay	153.81	13.059	48
	Total	149.02	12.523	225
NBCTs	free/reduced	147.00	12.685	50
	full pay	160.22	13.163	36
	Total	152.53	14.393	86
Total	free/reduced	147.56	12.196	227
	full pay	156.56	13.410	84
	Total	149.99	13.138	311

Table 9

Mathematics Mean Scores by Race – 2011 MCT2 – 4th Grade

Treatment	SES	Mean	Std. Deviation	*N*
NonNBCTs	African American	146.13	11.022	172
	Caucasian	158.40	12.599	53
	Total	149.02	12.523	225
NBCTs	African American	148.49	13.012	59
	Caucasian	161.37	13.465	27
	Total	152.53	14.393	86
Total	African American	146.73	11.580	231
	Caucasian	159.40	12.891	80
	Total	149.99	13.138	311

Analysis for Research Question One

Research question one addressed whether there is a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between fourth grade African American and Caucasian students taught by NBCTs and those taught by non-NBCTs, while controlling socioeconomic status and third grade MCT2 mathematics scale scores. Prior to using ANCOVA, the following assumptions were checked and judged to have been met: (a) homogeneity of variance and (b) homogeneity of regression. The check of homogeneity of variance (see Table 10), via Levene's Test, yielded no evidence of problems with the assumption, $p > .05$.

Table 10

*Levene's Test of Homogeneity of Variances(Treatment*Race)*

	F	*df1*	*df2*	Sig
MCT2 Mathematics Mean Scale Score Growth	.645	3	307	.587

A check for homogeneity of regression yielded no evidence of problems with assumption. The factors (Treatment*Race) with covariates (third grade MCT2 and socioeconomic status do not interact [$p = .106 > .05$]; therefore, the assumption of homogeneity of regression was met.

A check for normality of the dependent variable, via Shapiro-Wilk, yielded evidence of problems with that assumption at the .05 alpha level (see Tables 11 and 12). The MCT2 mathematics mean scale score growth of African American and Caucasian students taught by NBCTs did not conform to a normal distribution. The MCT2 mathematics mean scale score growth of Caucasian students taught by non-NBCTs met normality; however, the MCT2 mathematics mean score growth of African American students taught by non-NBCTs did not confirm to a normal distribution. Tabachnick and Fidell (2001) stated that ANCOVA is quite robust to any violations.

Table 11

*Shapiro-Wilk's Test of Normality (NBCTs*Race)*

	Treatment	Race	Statistic	*df*	Sig.
MCT2 Mathematics Mean Scale Score Growth	NBCTs	African American	.949	59	.014
		Caucasian	.900	27	.014

Table 12

Shapiro-Wilk's Test of Normality (Non-NBCTs*Race)

	Treatment	Race	Statistic	*df*	Sig.
MCT2 Mathematics Mean Scale Score Growth	Non-NBCTs	African American	.978	172	.034
		Caucasian	.971	80	.171

To examine research question one, a two-way ANCOVA was used to determine the effect of treatment (NBCTs or non-NBCTs) and race (African American or Caucasian) on mathematics mean scale score growth on the MCT2 mathematics assessment, while controlling for socioeconomic status and third grade MCT2 mathematics scale scores. Table 13 shows the means and standard deviation of mean scale score growth on the MCT2 mathematics assessments.

Table 13

Treatment by Race Descriptive Statistics

TREAT	RACE	Adjusted Mean	Unadjusted Mean	Std. Deviation	*N*
Non NBCTs	African American	1.40	2.49	9.05	172
	Caucasian	4.04	1.49	9.49	53
	Total		2.25	9.15	225
NBCTs	African American	2.24	2.81	8.17	59
	Caucasian	4.97	1.81	6.79	27
	Total		2.50	7.73	86

R Squared = .170 (Adjusted R Squared = .156)

Neither of the main effects was statistically significant, treatment: $F(1, 305) =$ .580, $p = .447$; race: $F(1, 305) = 4.129$, $p = .053$. There was not a statistically significant interaction effect; the interaction effect between treatment (NBCTs or non-NBCTs) and race of students (African American or Caucasian) was not statistically significant $F(1, 305) = .002$, $p > .05$, $\eta^2 = .000$. The pairwise comparisons were not statistically significant ($p = .498$, $p = .632$), and suggested that there were no statistically significant differences in mathematics mean scale score growth between African American students taught by NBCTs (adjusted mean= 2.24, $SD = 8.17$, $n = 59$) and African American students taught by non-NBCTs (adjusted mean = 1.40, $SD = 9.05$, $n = 172$); Caucasian students taught by NBCTs (adjusted mean= 4.97, $SD = 6.79$, $n = 27$) and Caucasian students taught by non-NBCTs (adjusted mean = 4.04, $SD = 9.49$, $n = 53$). Using student's socioeconomic status and third grade MCT2 mathematics scale scores as covariates, the covariate of third grade MCT2 mathematics scale scores $F(1, 305) =$ 61.003, $p < .001$) was statistically significantly related to growth scores. Tables 14 and 15 display the results of the analysis used to determine whether there was a statistically significant difference in mathematics mean scale score growth on MCT2 mathematics assessment between students by race taught by NBCTs and those taught by non-NBCTs. The results of research question one revealed that there was not a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between African American and Caucasian students by taught by NBCTs and those taught by non-NBCTs, while controlling for socioeconomic status and third grade MCT2 mathematics scale scores.

Table 14

Analysis of Covariance Summary – Treat*Race

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4049.017[a]	5	809.803	12.474	.000
Intercept	4149.334	1	4149.334	63.913	.000
SES	19.589	1	19.589	.302	.583
MCT2-3rd	3960.402	1	3960.402	61.003	.000
Treatment	37.680	1	37.680	.580	.447
Race	268.076	1	268.076	4.129	.053
Treat*Race	.112	1	.112	.002	.967
Error	19801.182	305	64.922		
Total	25531.000	311			
Corrected Total	23850.199	310			

R Squared = .170 (Adjusted R Squared = .156)

Table 15

Pairwise Comparisons: Treat*Race

Race(I) TREAT	(J) TREAT		Mean Difference (I – J)	Sig
African American	NBCTs	NonNBCTs	.833	.498
Caucasian	NBCTs	NonNBCTs	.927	.632

Analysis for Research Question Two

Research question two addressed whether there is a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between fourth grade students by socioeconomic status based on eligibility for free/reduced or full pay lunch taught by NBCTs and those taught by non-NBCTs, while controlling race and third grade MCT2 mathematics scale scores. Prior to using ANCOVA, the following assumptions were checked and judged to have met: (a) homogeneity of variance and (b) homogeneity of regression. The check of homogeneity

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of variance, via Levene's Test, yielded no evidence of problems with the assumption, $p >$ .05 (see Table 16).

Table 16

Levene's Test of Homogeneity of Variances (Treatment*SES)

	F	df1	df2	Sig
MCT2 Mathematics Mean Scale Score Growth	1.355	3	307	.257

A check for homogeneity of regression yielded no evidence of problems with assumption. The factors (Treatment*SES) with covariates (third grade MCT2 and race) do not interact [$p = .068 > .05$]; therefore, the assumption of homogeneity of regression was met.

A check for normality of the dependent variable, via Shapiro-Wilk, yielded statistically significant results for the MCT2 mathematics mean scale score growth of students by socioeconomic status based on eligibility for free/reduced or full pay lunch taught by NBCTs indicated that the assumption of normality was not met (see Table 17). The MCT2 mathematics mean scale score growth of students by socioeconomic status based on eligibility for free/reduced or full pay lunch taught by non-NBCTs met the assumption of normality (see Table 18) As previously stated, Tabachnick and Fidell (2001) stated that ANCOVA is quite robust to any violations.

Table 17

*Shapiro-Wilk's Test of Normality (NBCTs*SES)*

	Treatment	SES	Statistic	*df*	Sig.
MCT2 Mathematics Mean Scale Score Growth	NBCTs	Free/Reduced	.950	50	.036
		Full Pay	.933	36	.031

Table 18

*Shapiro-Wilk's Test of Normality (Non-NBCTs*SES)*

	Treatment	SES	Statistic	*df*	Sig.
MCT2 Mathematics Mean Scale Score Growth	NBCTs	Free/Reduced	.988	177	.136
		Full Pay	.956	48	.068

To examine research question two, a two-way ANCOVA was used to determine the effect of treatment (NBCTs or non-NBCTs) and socioeconomic status based on eligibility for free/reduced or full pay lunch on mathematics mean scale score growth on the MCT2 mathematics assessment, while controlling for race and third grade MCT2 mathematics scale scores. Table 19 shows the means and standard deviation of mean scale score growth on the MCT2 mathematics assessments.

Table 19

Treatment by SES Descriptive Statistics

TREAT	SES	Adjusted Mean	Unadjusted Mean	Std. Deviation	N
Non NBCTs	free/reduced	2.25	2.77	8.80	177
	full pay	1.26	.35	10.18	48
	Total		2.25	9.15	225
NBCTs	free/reduced	1.48	1.88	8.53	50
	full pay	5.22	3.36	6.49	36
	Total		2.50	7.73	86

Neither of the main effects was statistically significant, treatment: $F(1, 305) = 2.137$, $p = .145$; socioeconomic status: $F(1, 305) = 1.279$, $p = .259$. There was a statistically significant interaction effect; the interaction effect between treatment (NBCTs or non-NBCTs) and socioeconomic status of students (free/reduced or full pay lunch) were statistically significant $F(1, 305) = 4.705$, $p < .05$, with a small effect size ($\eta^2 = .15$). The pairwise comparison of students eligible for full pay lunch taught by NBCTs and those students taught by non-NBCTs was statistically significant ($p = .026$). Students eligible for full pay lunch taught by NBCTs (adjusted mean = 5.22, $SD = 6.49$, $n = 36$) had higher MCT2 mathematics mean scale score growth than those students taught by non-NBCTs (adjusted mean = 1.26, $SD = 10.18$, $n = 48$). The pairwise comparison of students eligible for free/reduced lunch taught by NBCTs and those students taught by non-NBCTs were not statistically significant ($p = .548$), and suggested that there was not a statistically significant differences in mathematics mean scale score growth between students eligible for free/reduced lunch taught by non-NBCTs (adjusted mean = 2.25, SD

= 8.80, n = 177) and those students taught by NBCTs (adjusted mean = 1.48, SD = 8.53,

n = 50). Both the covariate of third grade MCT2 mathematics scale scores F (1, 305) =

63.387, p < .001) and race F (1, 305) = 4.623, p = .032) were statistically significantly

related to growth scores. Tables 20 and 21 display the results of the analysis used to

determine whether there was a statistically significant difference in mathematics mean

scale score growth on MCT2 mathematics assessment between students by

socioeconomic status based on free/reduced or full pay lunch taught by NBCTs and those

students taught by non-NBCTs. The results of research question two revealed that there

was a statistically significant difference in mathematics mean scale score growth on the

MCT2 mathematics assessment between fourth grade students by socioeconomic status

based on eligibility for free/reduced or full pay lunch taught by NBCTs and those taught

by non-NBCTs, while controlling for race and third grade MCT2 mathematics scale

scores.

Table 20

Analysis of Covariance Summary – Treat*SES

Source	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.
Corrected Model	4349.709[a]	5	869.942	9.855	.000
Intercept	4244.081	1	4244.081	66.380	.000
MCT2-3rd	4052.718	1	4052.718	63.387	.000
Race	295.547	1	295.547	4.623	.032
SES	81.782	1	81.782	1.279	.259
Treatment	136.650	1	136.650	2.137	.145
Treat*SES	300.803	1	300.803	4.705	.031
Error	19500.049	305	64.116		
Total	25531.000	311			
Corrected Total	23850.199	310			

R Squared = .182 (Adjusted R Squared = .169)

Table 21

Pairwise Comparisons: Treat*SES

SES (I) TREAT	(J) TREAT		Mean Difference (I – J)	Sig
Free/Reduced	NBCTs	NonNBCTs	-.777	.470
Full Pay	NBCTs	NonNBCTs	3.962*	.026

Summary

The purpose of the study was to determine if there is a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students taught by NBCTs and those taught by non-NBCTs in a low socioeconomic, high minority, Title I school. Specifically, the study addressed two research questions. Research question one addressed whether there is a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between fourth grade students by race taught by NBCTs and those taught by non-NBCTs, while controlling socioeconomic status and third grade MCT2 mathematics scale scores. The results of the analysis for research question one indicated that there was not a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by race taught by NBCTs and those taught by non-NBCTs. African American and Caucasian students taught by NBCTs had a comparable mathematics mean scale score growth with African American and Caucasian students taught by non-NBCTs.

Research question two addressed whether there is a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics

assessment between fourth grade students by socioeconomic status based on eligibility for free/reduced or full pay lunch taught by NBCTs and those taught by non-NBCTs, while controlling race and third grade MCT2 mathematics scale scores. The results of the analysis for research question two indicated that there was a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by socioeconomic status based on eligibility for full pay lunch taught by NBCTs and those students taught by non-NBCTs. Students identified as full pay lunch taught by NBCTs had a higher mathematics mean scale score growth than those students identified as full pay lunch taught by non-NBCTs. However, there was not a statistically significant mathematics mean scale score growth between students identified as free/reduced lunch status taught by NBCTs and those students indentified as free/reduced lunch status taught by non-NBCTs. Students identified as free/reduced lunch status taught by NBCTs had comparable mathematics mean scale score growth with those students identified as free/reduced lunch status taught by non-NBCTs.

CHAPTER V

SUMMARY, DISCUSSION, AND CONCLUSION

Summary

This chapter includes the summary of the study and discussion of the findings. The chapter concludes with recommendations for further research.

The United States has established national goals to ensure that all students receive an equitable, high quality education. However, students in low socioeconomic and high minority schools tend to be taught by less qualified teachers. The accountability provisions in NCLB aimed to reduce inequality in education by requiring all states to ensure that all students are taught by highly-qualified teachers. Furthermore, NCLB mandated that all students be proficient in mathematics by the year 2014 as measured by state-wide assessment. According to the 2011 MCT2 and NAEP results, 42% of students in Mississippi scored below proficient level on MCT2 in the area of mathematics and 75% scored below proficient level on NAEP in the area of mathematics. Researchers have indicated that a major component for increasing student achievement is by improving teacher effectiveness. National board certification is a voluntary certification system that claims to identify highly accomplished teachers. Although some research has validated that claim, there is still inconclusive evidence supporting teachers obtaining national board certification ability to increase student achievement on standardized test as compared students of non-NBCTs.

Researchers have associated teacher effectiveness with the academic growth of students on standardized tests. As a mean of certifying effective teachers, NBPTS contends that teachers who obtain national board certification have demonstrated exemplary knowledge, skills, and ability needed to enhance all student achievement regardless of factors associated with students attending low socioeconomic, high minority schools. Researchers suggested that NBCTs are capable of producing higher student achievement gains than those teachers that are not board certified. However, studies on NBCTs and student achievement as compared to non-NBCTs have yielded mixed results (Cavalluzzo, 2004; Goldhaber & Anthony, 2004; Phillip, 2008; Rouse & Hollomon, 2005; Vandevoort et al., 2004). Goldhaber et al. (2007) and Humphrey et al. (2005) have noted that NBCTs are least likely to teach in low-socioeconomic, high minority schools. The purpose of the study was to determine if there is a difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by race and socio-economic status, taught by NBCTs and by non-NBCTs in a low socioeconomic, high minority, Title I school.

The data for this study consisted of mathematics scale scores from MCT2 of fourth grade students from a low socioeconomic, high minority, Title I school located in a school district in rural east central Mississippi. Of the 360 fourth grade students, only scores from 311 students were used in the study. To fulfill the purpose of the study, the 2010-2011 fourth grade MCT mathematics mean scale scores minus the previous 2009-2010 third grade MCT2 mathematics mean scale scores were used as MCT2 mathematics mean scale growth and were analyzed to answer the two research questions that guided the study.

A causal-comparative research design and a statistical analysis procedure of ANCOVA were used to answer two research questions for this study. The following represent the two research questions and the answers to those questions:

1. Is there a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between fourth grade African American and Caucasian students taught by NBCTs and those taught by non-NBCTs, while controlling socioeconomic status and third grade MCT2 mathematics scale scores? There was not a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between African American and Caucasian students by taught by NBCTs and those taught by non-NBCTs. African American and Caucasian students taught by NBCTs had a comparable mathematics mean scale score growth with African American and Caucasian students taught by non-NBCTs.

2. Is there a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between fourth grade students by socioeconomic status based on eligibility for free/reduced or full pay lunch taught by NBCTs and those taught by non-NBCTs, while controlling race and third grade MCT2 mathematics scale scores? There was a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by socioeconomic status based on eligibility for free/reduced or full pay lunch taught by NBCTs and those taught by non-NBCTs. Students identified as

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full pay lunch taught by NBCTs had a higher mathematics mean scale score growth than those students identified as full pay lunch taught by non-NBCTs. However, students identified as free/reduced lunch status taught by NBCTs had a comparable mathematics mean scale score growth with those students identified as free/reduced lunch status taught by non-NBCTs and was not statistically significant.

Discussion

The results of this study may be compared to previous studies on NBCTs and student achievement. The findings in research question one yielded results similar to research studies by Rouse and Hollomon (2005) and by Harris and Sass (2009), which indicated that there was not a statistically significant difference in scores on a statewide assessment between students taught by NBCTs and those students taught by non-NBCTs. The present study further indicated that there was not a statistical significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between African American and Caucasian students by taught by NBCTs and those taught by non-NBCTs. African American and Caucasian students taught by NBCTs had a comparable mean scale score growth with African American and Caucasian students taught by non-NBCTs.

Rouse and Hollomon (2005) found that there was not a significant difference in achievement level on VOCATS between high school students taught by NBCTs and those students taught by non-NBCTs. Like the present study, a statewide assessment was used to determine the difference in achievement between students taught by NBCTs and non-NBCTs. The difference was that the present study assessed scores from MCT2

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mathematics assessment for a group of fourth grade students and included student demographic variables, such as race and socioeconomic status. However, while the findings from the present study and the study conducted by Rouse and Hollomon are consistent, the present study controlled influential factors, such as student demographic data, that may contribute to the difference in students' mathematics mean scale score growth.

In a longitudinal study, Harris and Sass (2009) found that there was not a significant difference on the FCAT-SSS and the SAT-9 in the area of math and reading between students taught by NBCTs and those students taught by non-NBCTs. Like the present study, a statewide assessment in the area of mathematics was used to examine student achievement. However, similar to a previous study (Rouse & Hollomon, 2005), Harris and Sass (2009) did not take into account that the school's population based on race and socioeconomic status may influence outcome. While the present study examined student achievement growth in one year in a low socioeconomic, high minority school, the findings were consistent with the study conducted by Harris and Sass (2009). The studies conducted by Rouse and Hollomon (2005) and by Harris and Sass (2009) resulted in findings similar to the present study, in which all of the studies concluded that there was not a statistically significant difference in state-wide assessment scores between students taught by NBCTs and those students taught by non-NBCTs.

In contrast, the findings in research question two yielded results similar to research studies by Goldhaber and Anthony (2004), Cavalluzzo (2004), and Vandervoort et al. (2004). The findings revealed that there was a statistically significant difference in scores on a statewide assessment between students taught by NBCTs and those students

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taught by non-NBCTs. The results from the present study indicated that there was a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by socioeconomic status; students identified as full pay lunch taught by NBCTs had a higher mathematics mean scale score growth than those students identified as full pay lunch taught by non-NBCTs. Goldhaber and Anthony (2004) concluded that students taught by NBCTs had higher achievement gain in mathematics and reading than non-NBCTs. In contrast with the present study, Goldhaber and Anthony (2004) conducted a large scale study. Like the present study, the researchers determined student achievement growth by subtracting the previous year's scores from the following year's scores, and then analyzed the data. In addition, the present study and the study conducted by Goldhaber and Anthony included student and school demographic variables that may have an influence on the outcome of NBCTs impact on student achievement. However, while findings of both studies are consistent, Goldhaber and Anthony's findings did not analyze data by comparing students' scores by socioeconomic status and race taught by NBCTs and students taught by non-NBCTs.

In the area of mathematics, Cavalluzzo (2004) conducted a study at the secondary level using the Florida end-of-grade exam to investigate whether national board certification was an effective indictor of teacher quality. The study used a multiple linear regression to analyze the data and controlled the following teacher variables, such as certification, experience, and advanced degrees; and other variables, such as school size, per-pupil expenditure, student absenteeism, number of suspension, and student performance level. In this study, students of NBCTs outperformed those students taught by non-NBCTs. Although the present study used an ANCOVA to analyze data of

mathematics mean scale score growth at the elementary level and controlled only two variables, the findings indicate that students identified as full pay lunch taught by NBCTs had a higher mathematics mean scale score growth than those students identified as full pay lunch taught by non-NBCTs, while controlling race and third grade MCT2 scores.

Unlike previous studies (Cavalluzzo, 2004; Goldhaber & Anthony, 2004) Vandervoort et al. (2004) reported that student demographic variables do not have an influence on NBCTs' ability to increase student achievement. Their study examined the impacts of NBCTs on student achievement as compared to non-NBCTs, as measured by performance on SAT-9 in the area of reading, math, and language arts during the years of 1999-2003 for Grades 3 through 6. In their study, students of NBCTs had higher gain on SAT-9 as compared to students of non-NBCTs. While the study conducted by Vandervoort et al. did not account for any demographic variables, the results in findings are consistent with previous studies (Cavalluzzo, 2004; Goldhaber & Anthony, 2004) and the present study that concluded NBCTs had a greater impact on student achievement than students taught by non-NBCTs.

As Darling-Hammond (2007) noted, under NCLB it is imperative that students regardless of race, socioeconomic status, and gender score at proficient level or above on state-wide assessments by 2014. State and national assessments disaggregate data based on subgroups of students by race, gender, and socioeconomic status. Students identified as full pay lunch outperformed all subgroups. In spite of performing higher than other subgroups on 2010-2011 MCT2 and NAEP assessments in the area of mathematics, not all students identified as full pay lunch meet the proficiency requirement under NCLB. This indicates there is still a need to improve the performance not only for the highest

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scoring subgroup, but also other subgroups on state and national assessments. As previously stated, Vandervoort et al. (2004) noted that students of NBCTs will produce higher achievement gains than those students taught by non-NBCTs. The implication is that the establishment of a national certification set forth by NBPTS would strengthen teachers, and thus improve the academic achievement of all students. However, the findings in the present study revealed that NBCTs only had a significant impact on students by socioeconomic status, specifically those students identified as pay full lunch, and not students by race as compared to non-NBCTs. It is interesting that studies by Goldhaber et al. (2005) and by Humphrey et al. (2007) indicated that NBCTs are more like to teach economically advantaged students, thus alluding to a possible explanation to why NBCTs only had a significant impact on students identified as full pay lunch. Furthermore, Darling-Hammond (2004), Holloway (2004), and Konstantopoulos and Chung (2011) contended that student and school demographics may have an influence on teachers' ability to improve student performance, and thus suggesting a possible explanation to why the inability of NBCTs to significantly increase the performance of students by race and of students identified a free/reduced lunch as compared to non-NBCTs in a low socioeconomic, high-minority, Title I school.

The present study sought to determine if there was a statistically significant difference between mathematics mean scale score growth on the MCT2 mathematics of students taught by NBCTs and those taught by non-NBCTs, while controlling selected student demographic data. The student data were race, socioeconomic status, and third grade MCT2 mathematics scale scores. The following teacher credential was selected as the focus of this study: national board certification or non-national board status. The

results of the present study revealed that there was not a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by race taught by NBCTs and those taught by non-NBCTs, but also revealed that there was a statistically significant difference in mathematics mean scale score growth on the MCT2 mathematics assessment between students by socioeconomic status taught by NBCTs and those taught by non-NBCTs. Thus, the findings suggested that NBCTs had an impact on economically advantaged students. For students of low socioeconomic status, NBCTs did not make a difference in student achievement. As NBPTS proclaimed that NBCTs are intended to serve all students, based on results of the present study, NBCTs only had a statistically significant impact on those students who are scoring the highest on MCT2 and NAEP assessment in the area of mathematics. Due to the mixed results of the present study and inconsistency in findings from other studies determining if there are differences on standardized test scores of students taught by NBCTs and students taught by NBCTs, the continuation of research is warranted.

Conclusion

The present study extends previous studies of NCBTs and student achievement. First, the present study compared differences on a state-wide assessment between students by race and socioeconomic status, taught by NBCTs and non-NBCTs. Second, the present study incorporated the demographics of low socioeconomic status and high minority population in a Title I school.

As evidenced by the present study and other studies, research on NBCTs and student achievement yielded mixed results. The results from the present study indicated that students by socioeconomic status based on full pay lunch taught by NBCTs had

higher mathematics mean scale score growth on MCT2 than those students taught by non-NBCTs after controlling for race and prior achievement. However, students by race taught by NBCTs had comparable mathematics mean scale score growth on MCT2 with those students taught by non-NBCTs after controlling for socioeconomic status and prior achievement.

Given the inconsistency in results of NBCTs and student achievement, NBPTS belief that national board certification is an indication of effective teachers as compared to those teachers without board certification may be subject to question. While additional research is warranted, educational leaders and legislators should pay attention to the findings in the present study and other related research. Contradictory findings should cause educational leaders and legislators to re-evaluate NBCTs' abilities to improve student achievement and providing a financial stipend solely based on national board certification.

The intention of NBPTS is to certify effective teachers and to improve the quality of education for all students. Based on MCT2 and NAEP assessments, there is still a discrepancy among subgroups by race and socioeconomic status. However, effective teachers, specifically NBCTs, are considered the single most important factor for enhancing student achievement regardless of race and socioeconomic status. The findings in the present study indicated that the magnitude of NBCTs' ability to impact student achievement may depend on student demographics. Whether NBCTs serve as a signal of an effective teacher, NBPTS, at least in part, should consider that certain school settings and student demographics may hinder teachers from obtaining national board certification and NBCTs capability to increase student achievement.

Recommendations for Future Studies

Based on the findings of this study, further research is recommended in the following areas. First, this study focused on students' scores taught by 4 NBCTs and student's scores taught by 11 non-NBCTs from one fourth grade Title I school in Mississippi. Future research should be conducted that examines a larger sample of NBCTs teaching in low socioeconomic and high-minority schools with various grades to determine if the results of this study are consistent with findings related to other grade levels.

Second, future research should include other subject areas, such as reading and language arts, on state-wide assessments to determine if the results of this study are consistent with findings in other subject areas.

Third, this study focused on NBPTS certificate in the area of Generalist-Middle Childhood. Future research should be conducted on other specific NBPTS certificates to determine if the results of this study are consistent with findings related to other certificate areas.

Fourth, this study is limited to students taught by NBCTs during one academic school year without controlling previous number of years taught by NBCTs. Future research should be conducted that examines students taught by NBCTs for two or more years to determine the impact that those teachers have on student achievement.

Fifth, this study used a quantitative research to compare the difference in scores on a state-wide assessment between students by race and socioeconomic status, taught by NBCTs and non-NBCTs. Future research should use qualitative methods to determine what is occurring in the classrooms taught by NBCTs to help understand what sort of

impact NBCTs have on students overall, and separately by race and socioeconomic status.

Finally, it is worth noting that the state of Mississippi is paying an additional $6,000 a year to teachers holding national board certification. The MDE should conduct a longitudinal study on NBCTs to analyze student gains or lack thereof, and determine whether to continue, decrease, or sustain funds allocated for national board certification.

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APPENDIX A

NOTIFICATION OF APPROVAL TO CONDUCT RESEARCH

January 23, 2013

Watress Harris
2367 Old Highway 12
Starkville, MS 39759

RE: IRB Study #13-030: An Analysis of the Effect of National Board Certified Teachers on Mathematics Achievement for Title 1 Students

Dear Mr. Harris:

This email serves as official documentation that the above referenced project was reviewed and approved via administrative review on 1/23/2013 in accordance with 45 CFR 46.101(b)(4). Continuing review is not necessary for this project. However, in accordance with SOP 01-03 Administrative Review of Applications, a new IRB application must be submitted if the study is ongoing after 5 years from the date of approval. Additionally, any modification to the project must be reviewed and approved by the IRB prior to implementation. Any failure to adhere to the approved protocol could result in suspension or termination of your project. The IRB reserves the right, at any time during the project period, to observe you and the additional researchers on this project.

Please note that the MSU IRB is in the process of seeking accreditation for our human subjects protection program. One of these changes is the implementation of an approval stamp for consent forms. The approval stamp will assist in ensuring the IRB approved version of the consent form is used in the actual conduct of research. Your stamped consent form will be attached in a separate email. **You must use copies of the stamped consent form for obtaining consent from participants.**

Please refer to your IRB number (#13-030) when contacting our office regarding this application.

Thank you for your cooperation and good luck to you in conducting this research project. If you have questions or concerns, please contact me at cwilliams@research.msstate.edu or call 662-325-5220.

Sincerely,

Christine Williams, MPPA, CIP
IRB Compliance Administrator

cc: Kay Brocato (advisor)