THE INITIAL IMPACT OF NO CHILD LEFT BEHIND WITH A FOCUS ON TIME FOR ELEMENTARY SCIENCE AND EQUITY IN SCIENCE, MATH, AND READING

by

GEORGE W. GRIFFITH

A.S., Pennsylvania State University, 1992
B.S., Clarion University of Pennsylvania, 1998
M.S., Fort Hays State University, 2004

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Curriculum and Instruction
College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2009

Abstract

This research examines the impact of the "No Child Left Behind" (NCLB) Act on elementary science education in the states of Colorado, Kansas, Missouri, Nebraska, and Oklahoma. Elementary teachers (n=928 total for all states) responded to an online survey, which included both closed-ended and open-ended questions pertaining to the time spent on science instruction and any changes made in science instruction since the implementation of NCLB. More than half of these teachers indicated they have cut time from science instruction since NCLB became law. Follow-up questions with regard to why changes were made in science instruction were also included in the survey. The need to increase time for math and reading instruction was a belief expressed by many of the respondents with other respondents stating a member of their administration mandated changes. This research also examines results from the National Assessment of Educational Progress (NAEP) for each of these states to determine if the changes made in response to NCLB helped meet the goal of closing the achievement gap between the disaggregated subgroups of gender, race, and socioeconomic status (SES). The data from the NAEP shows only a few significant changes occurred; however, some included a significant increase in the achievement gap.

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Acknowledgements

I would like to express my appreciation to my doctoral committee for providing their expert guidance during the development of my dissertation.

I am especially grateful to my major professor Dr. Larry Scharmann for his wisdom, support, and sense of humor that was invaluable to me during this process. His commitment to science education and the education of pre-service science educators has been the inspiration behind my goal to earn my doctorate.

I would like to thank all the teachers who took the time out of their hectic day to voluntarily complete the survey, which provided the information needed to complete this research. These teachers are dedicated to the youth of their state and are the guiding light of America's youth.

I would finally like to thank my friends and colleagues who were willing to take the time to provide me feedback and sounding board when I needed one. Special thanks to Debbie Maddux, Dr. Scott Smith, Cheryl Tansey, and Tiffany Van Der Veen for their support the past three years.

Dedication

First I would like to dedicate this to my loving wife, Cheri, who believed in me when I doubted myself. Her love and support has been my motivation in completing this research in a timely manner. Without her support, I know my success would have been more difficult and possibly incomplete.

I also dedicate this to my Mom who gave me life and was always there when I needed her. She was and is the best Mom a guy could hope for.

To my sister, Cindy, who gave me a second chance at life and as a result completed this journey with me. I would not have been able to be here today if it was not for her love and generosity in giving me a kidney to save my life.

Finally I would like to include a special dedication to my baby brother, Herbie, who passed from this world in June of 2008. He was always good for a laugh even when he made me mad which is a gift he had that I and many others sorely miss. I will always feel his presence in my life and remember that we both started college at the same time. Although he was not cut out for school, he had a gift far more valuable as he was always there when he was needed and never turned down anyone in need.

I love you all.

CHAPTER 1 - Introduction

Introduction

Although the federal government played a limited role in public education by supplying supplemental funds for categorical programs starting in the 1950s and 1960s, the federal government's role changed dramatically with the passage of the 'No Child Left Behind Act" (NCLB) of 2002 (McGuinn, 2006). The highlights of NCLB include annual testing, academic improvement, corrective actions, report cards, teacher quality, reading first, transferability, and public charter schools (McGuinn, 2006). The early years of NCLB focused on reading and mathematics achievement with mandatory testing in grades three through eight and once in high school. It is the target of NCLB to have all students and disaggregated subgroups reach 100 percent proficiency by the year 2014. Science assessments were required by NCLB starting with the 2007-2008 school year with one grade being tested at each of three levels which include elementary, middle, and high school; however, no target levels of achievement were set for science (United States Department of Education [USDE], 2002). Thus, mathematics and reading remain priorities possessing target levels; creating potential consequences for other subjects – such as science. This study examined the intentional and unintentional consequences of NCLB with a focus on the impact of annual testing of reading and mathematics on the instruction of science at the elementary school level and the impact NCLB has had on academic improvement within and between disaggregated subgroups.

A decrease in the time for science instruction at the elementary level was a concern expressed during the 2006 meeting of the Council of State Science Supervisors. The specific issue addressed during this discussion concerned alarming reports by numerous elementary teachers that they were being required to reduce time for science instruction and other non-assessed subject areas in order to spend additional time on the subjects for which their districts were being held more immediately accountable. It was further reported that many of these teachers indicated that their district or school leadership specifically directed them to focus on teaching math and reading because they were the topics that affect a school's accountability according to Annual Yearly Progress (AYP) set forth in NCLB (personal communication, April 2006). These reported declines in science instructional time were occurring, unfortunately, when a need for "the teaching of elementary science has never been greater" (Lee & Houseal, 2003, p. 39).

These reported declines in time for elementary science instruction would also be considered an unintentional consequence of NCLB's focus on reading and mathematics. The information initially gathered by the researcher at the meeting of the Council of State Science Supervisors was anecdotal, lacking any empirical research to support it at that time. Providing research-based data that could refute or support the claim made by teachers of how they were required to implement NCLB, was one focus of this research. This research also focused on one of the intentional goals of NCLB, which was the decrease in the achievement gaps between disaggregated groups. In addition, this research examined the process of change in relation to how a federal mandate like NCLB was implemented at the local level and what, if any, model of change was able to predict the consequences of this mandate. Chapter I is organized in the following manner: overview of the issue, statement of the problem, purpose of study, research questions, significance of the study, limitations of the study, key definitions, and summary.

Overview of Issues

Science Instruction

A recent President of the National Science Teachers' Association (NSTA), Linda Froschauer (2006, p. 5), stated, "… science is not being reformed in our elementary schools because some teachers are directed to omit it." Ultimately, science education has suffered because of demands on schools to emphasize math and reading (Froschauer, 2006; Mundry, 2006). Although Froschauer (2006) did not provide any data to support her statement, a 2006 report from the Center on Education Policy (CEP) addressed a number of effects of "No Child Left Behind" (NCLB) legislation. One of the effects presented in the four-year study from the CEP was that schools were decreasing instructional time in non-assessed areas because of NCLB. The report indicated that:

> seventy-one percent of the school districts [the CEP] surveyed reported that they have reduced elementary school instructional time in at least one other subject to make more time for reading and mathematics – the subjects tested for NCLB. In some case study districts, struggling students receive double periods of reading or math or both – sometimes missing certain subjects altogether (CEP, 2006, p. 2).

A number of factors, outside of NCLB, also have been reported in the recent past to negatively influence the amount of science covered in elementary schools. According to Lee and Houseal (2003), there were already many internal and external factors that resulted in a decrease in adequate elementary science education. They defined the factors in the following way:

> The external factors include time, money, supplies, material and equipment, classroom management, dealing with diverse learners and individual differences,

> and support from colleagues, administrators, and the community. The internal factors include content preparation, self-confidence levels, anxiety, attitude, and professional identity toward teaching science.
>
> In addition to these factors, however, individuals associated with science education were beginning to feel the negative impact that NCLB's emphasis on reading and math was having on science education as science educators were being forced to defend their discipline against districts who wanted to spend more time on math and language arts (Vasquez, Teferi, & Schicht, 2003) (Lee & Houseal, 2003, p. 39).

Even before NCLB, many in education considered elementary science to be an undervalued school subject (Spillane, Diamond, Walker, Halverson, & Jita, 2001). Although researchers have provided a number of reasons for why the amount of time for elementary science may be limited and compromised (Finson and Beaver, 1994; Plourde, 2002; and Lee and Houseal, 2003), the CEP has indicated that the changes mandated by NCLB created another factor which seems to worsen the problem.

Changes are often difficult under the best of circumstances, but when changes are mandated, they can have a negative impact especially in any area not addressed specifically by the mandate. The changes that have occurred, resulting in decreased instructional time, may have been attributed to how districts, schools, and individual educators deal with mandated change processes as noted by Fullan (1996). One of the eight lessons about change presented by Fullan (1996) was that "you cannot mandate what matters" (p. 496) when attempting to make an educational change. Teachers typically resist reforms imposed on them by an external force especially if it directly influences what occurs in their classrooms (McAdams, 1997; Kirst, Anhalt, & Marine, 1997). This resistance may have been a result of education having a history of implementing reforms and interventions that have not been successful because the change agents failed to understand the culture of what they are trying to change (McAdams, 1997). Fullan and Miles (1992) stated they:

> believe that serious educational reform will never be achieved until there is a significant increase in the number of people -- leaders and other participants alike -- who have come to internalize and habitually act on basic knowledge of how successful change takes place (p. 744).

A problem with a change like NCLB, or any other educational reform, is that "schools are more likely to implement superficial changes in content, objectives, and structure than changes in culture, role behavior, and conceptions of teaching" (Fullan, 2001, p. 64). These quick, superficial changes (e.g., change in length of day, instructional time per subject) attempted by schools in a time of perceived crisis can ultimately cause a situation to become worse (Fullan & Miles, 1992). Fullan (1996) proposed that a mandated change could result in consequences that are unintended in implementing new policy. An example of an unintended consequence may be the decrease in instructional time for non-assessed content areas resulting from the policies set forth in NCLB. The CEP Report (2006) continued to discuss the different perspectives of school officials; with some viewed the extra time in reading and math as a way to close the achievement gap while others felt students were having their participation in other subjects and/or activities squelched. In the fall of 2006, the NSTA was making an effort, along with other science organizations, to have science included in AYP when NCLB is reauthorized. A strong science education is important for our society, as stated by JoAnn Vasquez (2006), "not since the Soviet Union's launch of the Sputnik satellite – 48 years ago – has the need to improve science education in America been as clear and as urgent as it is today" (p. ix).

Achievement Gap

One of the goals set forth in NCLB is to reduce the achievement gap between disaggregated subgroups (i.e., gender, race, and socioeconomic status). The achievement gap between disaggregated subgroups has been a long-term problem, which has been examined by a number of researchers. Sadker and Sadker (1994) detailed the discrepancies in achievement between girls and boys. Some of the contributing factors to a gender achievement gap in mathematics and science examined by Sadker and Sadker (1994) included lessons that were gender-biased against girls, a decrease in self-esteem of girls, societal and social pressures, and the result of being short-circuited. Altshuler and Schmautz (2006) discussed the influence of culture and race on test results of Hispanics, specifically examining low academic self-concept, low perception of self-efficacy, and oppression-induced frustrations, which resulted in decreased academic performance. Kellow and Jones (2008) examined African-American students and how perceptions of ability, achievement goal orientation, anxiety, and the perceptions of stereotype threat have a negative impact on academic performance specifically related to standardized tests. Researchers have identified a number of problems that negatively impact student performance that results from being from a low income home or poor community which include a lack of pay for high quality teachers, inadequate school plant, a lower level of parental involvement, inadequate healthcare, starting school at a lower academic level than their peers, etc. (Harris, 2007; Rogers, 2006; and Tuerk, 2005). This research examined data to determine if the goal of NCLB to close the achievement gap between subgroups was met since its implementation in 2002.

Statement of the Problem

Many reports (e.g. Nation at Risk, et al.) indicate problems with education policies and reform issues at the national level that do not necessarily affect individual states. States responding to national level criticisms sometimes fail to discriminate local or state impacts that may be different from those reported nationally. In a country that was the first to land a man on the moon, the *NSTA Reports* ("U.S. Students," 2008) that our students' science scores were behind other developed nations, placing tenth on the 2003 Test in International Mathematics and Science Study (TIMSS). Students in the United States also placed 22nd based on the 2008 report of the Program for International Student Assessment (PISA). Socioeconomic status was identified as having a major impact on why the United States was in 22nd place. As a result of performing lower than other developed nations and the reported decrease in instructional time for curriculum other than language arts and mathematics as reported by CEP (2006), a need existed to determine:

(a) how the time provided for elementary science instruction has been affected since the implementation of NCLB;

(b) how the mandated changes set forth by NCLB have been implemented at the elementary level and what role administration plays in their implementation;

(c) if NCLB has added to the previously identified problem of inadequate science education found in many K-6 programs;

(d) if there is a need to include science as a measure of a school's AYP when NCLB is reauthorized;

(e) if the funding for professional development and materials changed since the implementation of NCLB; and

(f) if NCLB has resulted in a decrease in the achievement gap between subgroups based on gender, race, and/or socioeconomic status.

Purpose of Study

The purposes of this study were to determine what influences NCLB has had on K-6 science education in five Midwestern States: (a) identifying any change in science instruction at the elementary level as a result of NCLB, (b) enhancing an understanding of how NCLB may or may not impact elementary science education and what role administration plays in any changes being made, (c) identifying any positive or negative effects as a result of how NCLB has been implemented at the state level; (d) determining if science needs to be included as a measure of a school's AYP when NCLB is reauthorized; (e) evaluating available professional development for elementary science educators, and (f) determining any negative or positive impact on the achievement gap based on gender, race, or socioeconomic status (SES).

Research Questions

Research Question 1: In what way, if any, has NCLB influenced instructional changes in elementary science education?

a) Have administrators required teachers to decrease the amount of time on science instruction since the implementation of NCLB? If so, why did they require teachers to make these changes? If not, why?

b) Do elementary educators feel they needed to make changes in the amount of time for science instruction since NCLB has been enacted? If so, why did they feel they needed to make these changes? If not, why?

c) How does the current amount of time spent on science education compare to the time spent on science education before NCLB?

d) How has NCLB influenced how teachers and/or their districts prioritize budgets for professional development?

Research Question 2: Has NCLB had an impact on the achievement gap in reading, science or mathematics disaggregated by gender, race, or SES?

a) Has the achievement gap disaggregated by gender changed since the implementation of NCLB?

b) Has the achievement gap disaggregated by race changed since the implementation of NCLB?

c) Has the achievement gap disaggregated by socioeconomic status changed since the implementation of NCLB?

Research Hypothesis

The null hypothesis for research question number one was there would not be any instructional changes in elementary science education resulting from the implementation of “No Child Left Behind” (NCLB). The null hypothesis for research question number two was that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB (statistically tested at a 0.05 level of significance).

Significance of the Study

Recent studies (CEP, 2006; Griffith & Scharmann, 2008; Marx & Harris, 2006; McMurrer, 2008) have indicated a decrease in the instructional time devoted to science education. The researcher was able to add to the recent research on the influence of NCLB on content areas not evaluated at the level of language arts and mathematics. The researcher was also able to add to the body of research on the achievement gap based on gender, race, and SES during the years NCLB has been policy.

Key Definitions

Advanced: This level of achievement signifies superior performance (National Center for Education Statistics [NCES] website, Retrieved May 31, 2009).

Achievement Gap: the difference in academic performance between specific groups of students (Achievement Gap, 2004).

Annual Yearly Progress (AYP): schools, districts, and states are required to have all students meet or exceed state standards as measured by state assessments in the area of reading and mathematics by 2014. The annual assessment of student progress is required to increase each year during period NCLB was enacted from 2002 and 2014. This annual growth is called AYP (USDE, 2002).

Basic: This level of achievement "denotes partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade" (NCES website, Retrieved May 31, 2009).

Criterion-referenced test: A test developed to measure specific content or objectives that are identified as important by the test developers. Ranking on this type of assessment is based on the judgment of experts in the specific content area being measured and a specific passing score is set (Cizek, 1998)

Model of Change: a major perspective of the change process based on empirical studies and practical applications (Ellsworth, 2000).

No Child Left Behind (NCLB): Public Law 107-110 is an act that was passed in 2001 which focuses on the use of flexibility, accountability, and school choice in an attempt to close the achievement gap (USDE, 2002).

Norm-referenced test: A test developed to determine the rank of student knowledge of content that is considered universal for a specific grade level. Student ranking is based on the score of the norm group, which is identified as the 50th percentile and with quartiles identified above and below the norm, or mean (Cizek, 1998).

Power: the chance of rejecting a null hypothesis that is actually false (Huck, 2004).

Proficient: This level of achievement "represents solid academic performance for each grade assessed. Students reaching this level have demonstrated competency over challenging subject matter, including subject-matter knowledge, application of such knowledge to real-world situations, and analytical skills appropriate to the subject matter" (NCES website, Retrieved May 31, 2009).

Short-circuited: when girls are interrupted in their attempt at accomplishing a task by an adult who does not expect them to be capable of doing the task (Sadker & Sadker, 1994).

Socioeconomic Status (SES): "A measure of an individual or family's relative economic and social ranking" (NCES website, Retrieved May 31, 2009).

Standards-referenced test: A test similar to a criterion-referenced test; however, standards-referenced tests are linked to concrete statements that set performance expectations at various levels. This form of assessment are tied to content standards which are developed by experts in a specific content area and based on what students should be able to know about a specific content area (Cizek, 1998)

Type I Error: the rejection of a null hypothesis that is true (Gay & Airasian, 2003).

Type II Error: retaining a null hypothesis that is actually false (Huck, 2004).

CHAPTER 2 - Literature Review

The first section of this chapter provides information on the decrease in instructional time in curricular areas other than math or language arts that has been reported by a limited number of studies (CEP, 2006; Griffith & Scharmann, 2008; Marx & Harris, 2006; McMurrer, 2008). The second section reviews the role of the federal government in education by examining the level of involvement that national policies and laws have had on education since the 1960s. Educational change theories are examined in the third section of this chapter with discussion on the Diffusion of Innovations Model, the Conditions of Change Model, the Concerns-Based-Adoption Model, and the New Meaning of Educational Change. The level of success of any change, especially those related to education, is dependent upon how the changes are implemented. The last section of this chapter discusses the achievement gap focusing on the subgroups of gender, socioeconomic status, and race/race. The information in the last section provides information about the number of factors that impact individual student success. All of the information provided in Chapter 2, was used buy the researcher in the development of the null hypothesis for each research question.

Decrease in Instructional Time for Science

A limited number of recent studies have examined the influence of "No Child Left Behind" (NCLB) on the elementary school curriculum. These recent studies have indicated that NCLB has had a negative influence on the amount of instructional time for curricular areas outside of Mathematics and Reading/Language Arts (CEP, 2006; Griffith & Scharmann, 2008; Marx & Harris, 2006; McMurrer, 2008). In 2006, the Center for Education Policy (CEP) reported that there has been a decrease in instructional time in non-assessed curriculum since the implementation of NCLB. In a recent study of Kansas science teachers (N=164) Griffith and Scharmann supported the data reported by the CEP study. Griffith and Scharmann indicated that 59.1 percent of the teachers reported they decreased the amount of science instruction in order to focus on reading/language arts and mathematics with just over 35 percent of these teachers spending 60 minutes or less per week on science instruction. Just over one-fifth of these teachers indicated they had given a grade for science without teaching science or evaluating it (Griffith & Scharmann, 2008). According to Marx and Harris (2006):

> The pressure of NCLB accountability, in which students in grades 3-8 are assessed on language arts and mathematics annually, has led principals and teachers to direct time and resources toward language arts and mathematics, and, due to limited hours in the school year, to diminishing time for science (p. 469).

This reported increase in time for language arts and mathematics and decline in time for science instruction was supported in a February 2008 CEP report by Jennifer McMurrer where she discussed the decrease in the instructional time for subjects beyond math and reading in elementary schools since the implementation of NCLB. The key findings by McMurrer indicated a large number of districts increasing instructional time for English/language arts (ELA) and mathematics while cutting time in other content areas. According to McMurrer (2008), “eight out of ten districts that reported increasing time for ELA did so by at least 75 minutes per week, and more than half (54 percent) did so by 150 minutes or more per week.” Of those districts that reported increasing time for mathematics, “63 percent added at least 75 minutes per week, and 19 percent added 150 minutes or more per week.” Of the schools that indicated they increased time for ELA or math, over 70 percent of these districts reported cutting time from other content areas with 53 percent of the districts reducing time for science instruction by at least 75 minutes per week. The Science Consultant from the Missouri State Department of Education, Shuan Bates, also indicated a concern that time for science instruction may have "…drastically decreased in grades K-3, with the money and accreditation of [schools] on the line with communication arts and mathematics a district has to spend all their resources and time meeting the AYP goals each year" (personal communication, June 30, 2009). These recent studies have indicated a change in instruction time in response to NCLB. These studies indicated districts have chosen to increase instructional time for subject areas that are assessed for NCLB while decreasing instructional time for subjects that are not tied to a school's Annual Yearly Progress (AYP) set by NCLB. This research examined the impact NCLB has had on the five state region including Colorado, Kansas, Nebraska, Missouri, and Oklahoma.

Federal Education Reform

The role of the federal government in public education has changed over a number of decades with each step leading to the current educational reform known as "No Child Left Behind" (NCLB). Patrick McGuinn (2006) discussed the federal government's role in education in his book *No Child Left Behind and the Transformation of Federal Education Policy, 1965-2005*. According to McGuinn, the federal government's role in education became more involved in 1862 with the passage of the Morrill Act which led to the formation of land-grant colleges and in 1867 with the formation of the United States Department of Education. The level of influence of the federal government remained limited until the Smith-Hughes Act was passed in 1917, which provided annual funding for vocational programs at primary and secondary levels.

Change in the federal government's role in public education remained stagnant until the late 1950s when the fear that the United States had fallen behind in the development of new technology arose. This fear was driven by the Soviet Union's launch of Sputnik on October 4, 1957 and the competition between these two countries during the Cold War. The next two policies presented by McGuinn (2006) that attempted to address the threat of communism as well as racism and poverty were the Civil Rights Act of 1964 and the Elementary and Secondary Education Act (ESEA) of 1965. The passage of the Civil Rights Act and specifically Title VI made it illegal for the federal government to fund segregated educational programs. By making it illegal to federally fund programs based on race, any national educational reforms or education bills presented after 1964 would not be bogged down by racial issues. According to Harvey Kantor (1991):

> the Elementary and Secondary Education Act of 1965 – was not only a dramatic increase in the federal financial commitment to education but an equally dramatic expansion of the role of the federal government into areas of decision making that had long been the almost exclusive domain of local educators. (p. 72)

McGuinn (2006) stated, "ESEA was intended to be primarily a redistributive bill, to put a floor under spending in the nation's poorest communities and to lend federal muscle to efforts to innovate and improve educational services" (p. 31). Both researchers (Kantor, 1991; McGuinn, 2006) contended the goal of the ESEA was to provide educational funding called "categorical aid" for children based on financial need. "Though the act [ESEA] represented a significant break with past policy, it did not mandate reform in school procedures and organization. Nor did it threaten the local establishment's control of educational decision making" (Kantor, 1991 p.73). One reason for this lack of mandated reform or even a demonstration by local and state education agencies to show progress as a result of receiving federal, funds was the lack of consensus on how to address, or even if the inequities in education based on socioeconomic status (SES) could be diminished? The lack of understanding of the educational inequalities between the poor and the middle class led to the establishment of a number of different programs being included in the ESEA (McGuinn, 2006). The initial adoption of ESEA was ineffective in meeting its goals due to the lack of adequate funding and a lack of understanding on how to meet the educational needs of children living in poverty. ESEA, however, had a symbolic significance in that "an important threshold had been crossed and an important federal role in education policy was cemented" (McGuinn, 2006, p. 33). This major change in education policy was discussed by Tirozzi and Uro (1997):

> A significant shift in the federal role of education began in the mid-1960s. Established in 1965 as part of President Lyndon Johnson's War on Poverty, the Elementary and Secondary Education Act (ESEA) was enacted as the single largest investment of federal funds in kindergarten through Grade 12 education, primarily to help the poor children in our schools and communities. Over the eight reauthorizations of ESEA, Congress has amended and expanded it to create programs to help children who speak limited English, migrant children, Native American children, neglected and delinquent youngsters, and other children with unique needs. (p. 242)

After the ESEA of 1965, there was very little direct federal involvement in education. Benjamin Superfine (2005) noted "during the period stretching from the early 1960s through the end of the 1970s, the federal commitment to education was marked by governmental action that primarily employed a hands-off approach to what actually went on in schools and classrooms" (p. 14). According to researchers (Kantor, 1991; McGuinn, 2006; Superfine, 2005; Tirozzi & Uro, 1997), the next step in education reform was made following the publication of *A Nation At*

Risk (National Commission on Excellence in Education [NCEE], 1984). Some of the driving factors presented in *A Nation At Risk* (NCEE, 1984) indicated a need for major reform in education. The factors driving reform included:

- America was far behind on standardized tests when compared with other industrialized nations;
- about 23 million adults, 13 percent of 17-year-olds and almost 40 percent of minority children in the United States were functionally illiterate;
- high school student scores on standardized tests were at a 26 year low; achievement of more than half the students classified as gifted did not perform in school comparably to their tested ability;
- a steady decline in the College Board's Scholastic Aptitude Test (SAT) scores with a 50 point drop in verbal skills and a 40 point drop in math skills from 1963 to 1980;
- students who scored a 650 or higher on the SAT's declined dramatically; fewer 17-year-olds possessed "higher order" thinking skills;
- the science achievement scores of 17-year-olds steadily declined in the testing years of 1969, 1973, and 1977;
- from 1975 to 1980 public four-year colleges increased the number of remedial math courses by 72 percent; achievement scores of college graduates were lower; and
- business and military leaders complained they had to spend millions of dollars to train their new employees who lacked basic writing, reading, spelling and math skills (p. 8-9).

According to the NCEE (1984), the level of education of the average students graduating from college and high school during the time *A Nation At Risk* was published was lower than that of average graduates from 25 to 30 years before its publication, which was a major concern (p. 13). The bleak picture presented in this report led to the next round of federal reforms with more national involvement in education. As stated by Tirozzi and Uro (1997):

> The time was right for a substantive reform of federally funded education programs embodied in the ESEA. In addition to the reauthorization of the ESEA, another significant development that provided a framework for school reform was a congressional movement toward establishing national education goals. (p. 242)

While running for president in 1988, George H. W. Bush pledged to be an "education president." Bush "… abandoned the Regan administration's proposal to eliminate the Department of Education and instead called for using federal influence to promote school improvement based on academic standards and tests" (McGuinn, 2006, p.51). To follow up on his pledge to be an education president, President Bush called a meeting of the nation's governors to discuss the state of education in America. This 1989 meeting was named the Charlottesville Education Summit and was attended by Governor William Clinton of Arkansas who, along with President Bush, supported national academic standards (McGuinn, 2006; Superfine, 2005). Although President Bush did not change his education initiatives based on the goals set at this summit, "he did attempt to involve the federal government more formally in the standards movement with the 1991 proposal of a bill entitled America 2000" (Superfine, 2005, p. 15). America 2000 was not able to pass Congress for a number of philosophical and political reasons resulting in the Bush presidency ending "… without passage of a single major school reform bill" (McGuinn, 2006, p. 67).

The next major education reform bill had to wait until after the election of President William J. Clinton in 1992. On March 4, 1994, the Goals 2000 Act was signed into law by President Clinton. Goals 2000 supported national education goals that provided voluntary guidance for states and local education agencies working to improve their educational systems. In addition, Goals 2000 was a commitment to maintain and improve upon the educational ideas presented at the 1989 Charlottesville Education Summit (Tirozzi & Uro, 1997). The final version of Goals 2000 established eight goals as follows:

- all children will start school ready to learn; increase the graduation rate in high school to at least 90 percent;
- upon leaving the 4^{th}, 8^{th}, and 12^{th} grades all students will demonstrate competency in challenging content areas; the nation's teachers will have access to continued professional development;
- students in the United States will rank first in the world in math and science achievement;
- all adults will be literate and have the skills to compete in a global economy;
- all schools in the United States will be disciplined learning environments that are drug free and be free of alcohol, weapons, and violence; and
- provide a means for parental involvement (Short & Talley, 1997).

According to Benjamin Superfine (2005); "at the time of its signing, Goals 2000 represented one of the greatest intrusions of the federal government into education policy, an area traditionally reserved to the states" (p. 10). The purpose of Goals 2000 was to provide a standards-based framework that could be used as a model for other educational reform. "The most important distinction [between Goals 2000 and other federal education reforms] was the more robust federal role in standards development envisioned under Goals 2000" (McGuinn, 2006, p. 87). According to researchers (McGuinn, 2006; Superfine, 2005), the weakness of Goals 2000 in its final form was the lack of an accountability system, and it limited the federal role in the development of national standards and assessments. Goals 2000 ultimately became a federal grant program for education with no level of accountability; however, it did initiate the need for greater federal involvement based on two ideas President Clinton emphasized. President Clinton's "linking education to economic growth established a strong and publicly accessible rationale for broader federal involvement in school reform efforts. Clinton's emphasis on the need for increased education reform, as opposed to merely increased spending, was also very important" (McGuinn, 2006, p. 98). President Clinton's proactive federal agenda was carried on to the 2000 presidential campaign between Vice-President Al Gore and George W. Bush.

"Education was, for the first time, the dominant issue of a presidential campaign, with voters ranking it as their most important priority" (McGuinn, 2006, p. 146). After winning the 2000 presidential election, President G. W. Bush placed education first on his domestic agenda and moved for bipartisan support in the passage of a new version of the ESEA called the "No Child Left Behind Act" (NCLB), which he signed into law on January 8, 2002. Some of the main differences between NCLB and previous education reforms include: NCLB required what was only encouraged by Goals 2000 and NCLB had a fundamental change in focus from the original ESEA in that it did not just focus on poor children (McGuinn, 2006). According to researchers (Johnson, 2006; McGuinn, 2006), NCLB is the first federal education reform that has an accountability system which:

1. mandates content standards;

2. mandates reading and math assessments for all students in grades three through eight and once in high school;
3. requires corrective action for schools and districts not meeting AYP;
4. requires highly qualified teachers in all core content areas;
5. requires state report cards covering school, district, and state performance data; and
6. requires all students to score at "meeting standards" or above by the year 2014.

States failing to meet these criteria could ultimately be penalized by the loss of federal funds for education. Although NCLB is different from the first ESEA in that the focus is not just children with low SES backgrounds, it does have a goal of reducing the achievement gap based on gender, race, English Language Learners (ELL), as well as SES. The first line of the NCLB Act of 2001 (United States Department of Education [USDE], 2002) states, it is an act, "to close the achievement gap with accountability, flexibility, and choice so that no child is left behind." According to Lisa Robbins (2007, p. 17) "Since the signing of No Child Left Behind in 2002, closing the achievement gap has topped the nation's education policy agenda." The importance of education reform was addressed by Michael Fullan (2001) when he wrote, "The urgent reasons for reform are now familiar. The global society is increasingly complex, requiring educated citizens who can learn continuously, and who can work with diversity, locally and internationally" (p. 6). However, Andrew Johnson (2006) states, since NCLB "… is not based on educational research or research-based theory, it offers no innovations nor does anything to improve the fundamental quality of education" (p. 34). Johnson (2006) concludes:

> If we want fundamental change in the equality of education, then we must focus on the quality of education. We need to take a qualitative look at the teaching

> methodologies and curricula used in schools and classrooms and make changes in the way we educate. (p. 36)

The level of influence that NCLB has on changing education may not be known for some time; however, some studies (CEP, 2006; Griffith & Scharmann, 2008; and McMurrer, 2008) have examined the law's initial impacts. What will the next federal education reform look like, a slightly modified version of the current NCLB law or a reform with a completely different direction? Fullan (2001) addresses what it will take for any educational reform to be effective:

> It requires intensive action sustained over several years to make it possible both physically and attitudinally for teachers to work naturally together in joint planning; observation of each other's practices, and seeking, testing, and revising teaching strategies on a continuous basis. Reform is not just putting into place the latest policy. (p. 7)

According to Tyack and Cuban, "not all [educational] reforms are born equal; some enjoy strong political sponsors while others are political orphans" (1995, p. 7). The support for the reauthorization of NCLB and how well it is financed will be determined by the support of the next President and congress. The success of any policy will also be determined how much buy-in the educational community has to any changes made and will be influenced by the change model used to present the policy to individuals who are charged with its implementation.

Models of Change

"Nothing may be more important in the 21st century than learning to manage change" (Fullan, 2008, p. 59). Education reform requires changes at virtually every level in the education system and how the state and local governments, school administrators, and ultimately teachers deal with these changes are influenced by a number of factors. According to James Ellsworth (2000):

> Educators are constantly dealing with change as they strive to be responsive to the needs of their students and society. At times the task can be overwhelming. The constancy of change – or lack of understanding of its course – can lead them to take a "wait and see" stance: to respond only to serious crises as they emerge. (p. xiii).

Researchers (Ellsworth, 2000; Ely, 1999; Fullan, 2001; Hall & Hord, 2001; Rogers, 1995) have examined a number of different change models to respond to the constant change of flux in education. Four of these models are discussed in this study and include the Diffusion of Innovations Model of Everett Rogers, Conditions of Change Model of Donald Ely, Concerns-Based-Adoption Model (CBAM) presented by Gene Hall and Shirley Hord, and The New Meaning of Educational Change Model as presented by Michael Fullan.

Diffusion of Innovations Model

In his 1995 book, *Diffusion of Innovation*s, Everett Rogers examined how the attributes of an innovation can influence the rate at which the innovation is adopted. Rogers (1995) defines the *rate of adoption* as "the relative speed with which an innovation is adopted by members of a social system" (p.206). The rate of adoption is measured by how many individuals adopt an innovation in a set period. According to Rogers (1995) "from 49 to 87 percent of the variance in the rate of adoption is explained by five attributes: relative advantage, compatibility, complexity, trialability, and observability" (p. 206). However, he goes on to explain that there are four additional variables which influence the rate of adoption of an innovation which include: "(1) the type of innovation-decision, (2) the nature of communication channels diffusing the innovation at various stages in the innovation-decision process, (3) the nature of the school system in which the innovation is diffusing, and (4) the extent of the change agents' promotion efforts in diffusing the innovation" (Rogers, 1995, p. 206).

Rogers (1995) defines the first attribute to innovation, *relative advantage*, as how much the innovation is seen as an improvement over what it is replacing and examines this through what he calls "sub-dimensions." These sub-dimensions ask the questions: (1) What is the economic benefit of adopting the change? (2) How much will it cost to implement it? (3) Will it improve comfort? (4) Will it result in an increase in social prestige? (5) Will it save time and/or money? (6) How much time will it take to reap the rewards after implementation? (Ellsworth, 2000). Although economic factors play a key role in the adoption of a number of innovations and others are adopted based on the prestige they can bring to an individual, one problem identified by Rogers (1995) that results from focusing too much on these two sub-dimensions is "overadoption." "Rogers makes three specific points concerning relative advantage that may be of particular importance to practitioners of educational change" (Ellsworth, 2000, p. 53). Rogers' three points include *overadoption*, *preventive innovations*, and *use of incentives* (1995, pp. 215-221). "*Overadoption* is the adoption of an innovation by an individual when experts feel that he or she should reject it" (Rogers, 1995, p. 215). Overadoption results when the individual adopting the innovation has an inadequate level of knowledge about it and /or lacks the ability to foresee possible unwanted results from its implementation. Rogers states that "certain individuals have such a penchant for anything new that they occasionally appear to be suckers for change. They adopt what they shouldn't" (1995, p. 215). It is important to remember to "guard against assuming that the decision to adopt an innovation is always good or appropriate" (Ellsworth, 2000, p. 53). Rogers identifies "preventive innovations" as "those where the reward occurs long after adoption and those where the only reward is avoidance of an unpleasant event" (Ellsworth, 2000, p. 53). According to Rogers, preventive innovations diffuse at a slower rate because the relative advantage is hard to recognize (1995, p. 217).

In order to help get individuals on board with the adoption of an innovation; "many change agencies award incentives or subsidies to clients to speed up the rate of adoption" (Rogers, 1995, p. 219). There are many different forms of incentives including: adopter versus diffuser, individual versus system, positive versus negative, monetary versus non-monetary, and immediate versus delayed. The adopter versus diffuser incentive is when the incentive is given to the adopter or someone who is supposed to convince another person to adopt the innovation. The individual versus system incentive is where incentives may be given to each adopter or the change agent, or these incentives can be given to the system to which the adopter is a member. A positive incentive is when compensation is given to reinforce a preferred behavior, and a negative incentive is an unwanted consequence (e.g., fines or financial penalties) for not adopting the innovation. The difference between a monetary and a non-monetary incentive is that a monetary incentive is the payment of money where non-monetary would be some type of commodity, product, or service. The immediate versus delayed incentive is self-explanatory in that immediate incentives are given when the adoption occurs and delayed incentives are given later. Any one or any combination of these incentives can be used to influence the rate of diffusion of an innovation. Deciding on which incentives to use depends on the effect it will have on the perceived attributes of innovations (Rogers, 1995). Rogers also examines mandates for adoption in which higher-level social organizations, like the federal and state governments, can influence if and how quickly an innovation may diffuse (Rogers, 1995). An example of the federal government using a negative incentive is the threat to withhold federal education funds for states that do not follow the mandates set by NCLB.

As for the other attributes of innovations presented by Rogers, the researcher identifies them as influential to change in education. The second attribute, c*ompatibility*, is identified by Rogers as an attribute of change that can be a major barrier to the adoption of an innovation. Compatibility is defined by Rogers as how well the innovation fits with the adopters' belief and value systems. According to Rogers, "an innovation can be compatible or incompatible (1) with socio-cultural values, and beliefs, (2) with previously introduced ideas, or (3) with client needs for the innovation" (1995, p. 224). Compatibility connects the new idea with the individual in a meaningful way. There is a positive relationship between perceived compatibility and how quickly an innovation is adopted. Rogers describes the third attribute, *complexity*, as the perception of how hard the innovation is to understand and implement. "The perceived complexity of an innovation is negatively related to its rate of adoption" (Rogers, 1995, p. 250). *Trialability*, listed as the fourth attribute to innovation, is defined by Rogers as "the degree to which an innovation may be experimented with on a limited basis. The perceived trialability of an innovation is positively related to its rate of adoption" (1995, p. 251). The last attribute of innovation Rogers explained was *observability,* which is the level to which the impact of the innovation can be seen by others. Observability of a new idea is also positively correlated with its rate of adoption (Rogers, 1995).

Conditions of Change Model

According to Ely (1999), his initial investigation of his Conditions of Change model began in 1975 where he developed a list of eight conditions that he felt would explain how to effectively implement change. The eight conditions he identified included dissatisfaction with the status quo, existence of knowledge and skills, availability of resources, availability of time, the existence of rewards or incentives, participation, commitment, and leadership. Ellsworth (2000) classifies Ely's Condition of Change Model as one that is the "broadest and most far-reaching of the classical change models" (p. 67). Ely validated these eight conditions through research of a number of different educational and cultural settings (Ellsworth, 2000; Ely, 1999). "Ely was the first to emphasize the environmental conditions that promote change" (Ellsworth, 2000, p. 66).

By examining each of the conditions identified by Ely, it is evident why the Conditions of Change model is considered an environmentally based change model. Condition one, "dissatisfaction with the status quo," was not listed as an important condition in the motivation of change, but it does have an influence on the process. This condition comes about when things are seen as being wrong and can be made better. This change is made in response to emotional factors that are often connected to leadership. The condition that Ely often found to be at the top of the list as being a factor in change was condition two, the "existence of knowledge and skills." Ely (1999) describes knowledge and skills as "those required by the ultimate users of the innovation" that are often connected with "resources, rewards and incentives, leadership, and commitment" (p .4). Change cannot be made unless the resources are available to make them work. Condition three, the "availability of resources," can include money to purchase the required resources or the actual resources themselves including items like "…hardware, software, publications, audiovisual media and other teaching materials" (p. 4). Ely (1999) identifies this condition as one "…linked to commitment, leadership and rewards and incentives" (p. 4). The "availability of time" is the fourth condition and is important because the people implementing the change need to have enough time to "…acquire the knowledge and skills, plan for use, adapt, integrate, and reflect upon what they are doing" (Ely, 1999, p. 4). Although this can mean that individuals are willing to use their personal time for this process, it is more important for the organization to provide paid time to implement the change process. "Time is linked to participation, commitment, leadership and rewards and incentives" (Ely, 1999, p. 4). Ely listed the "rewards and incentive" condition fifth and found it to be the least important of the conditions he identified; however, it was identified in most of the studies he researched. Although Ely considered the sixth condition, "participation," as an ambiguous one, he found that it was considered an important condition in all of the studies he researched. Ely (1999) defines participation as "…shared decision making, communication among all parties involved in the process and, when direct participation is not possible, the implementers should feel that their ideas are represented through a surrogate" (p. 5). "Commitment" was listed seventh on Ely's list and is described as a demonstration of "…firm and visible evidence that there is endorsement and continuing support for the implementation of the innovation" (1999, p. 5). According to Ely (1999):

> This factor may be expressed by the primary leader (a principal of a school, for example) or a group, such as a board of directors. This condition is usually measured by the perceptions of the implementers rather than public acknowledgement of policy. It is closely linked to: participation, commitment, time, resources, and rewards and incentives. (p. 5)

"Leadership" is the eighth and final condition listed by Ely. There are two levels of leadership according to Ely's model. One level of leadership is executive leadership, which can include an executive officer or a board of directors. The second level of leadership is at the project level in which this leader is more involved and more directly connected to the ongoing, daily activities associated with the change. According to Ely (1999), “Once the executive leadership is evident, then the project leadership becomes even more important because the person who can help with the implementation is closer to the user” (p. 5). Ellsworth (2000) states that:

> It is important to understand that few change agents will have direct control over all environmental variables this framework implies, so it may not be possible to affect all of them in the suggested manner. However, it seems reasonable to expect that improved knowledge of the status of each of the conditions will enhance the ability of participants in the change effort to make decisions that are more effective. This, in turn, may often translate into an improved capacity for influencing the conditions in the desired direction. (p. 67)

Ely concludes that his eight conditions are found in varying stages when examining how successful an innovation has been implemented; however, what is not always understood is what role setting has on implementation. “It appears from the studies that the setting and nature of innovation are major factors in influencing the degree to which each condition is present” (1999, p. 7).

Concerns-Based-Adoption Model

The Concerns-Based-Adoption Model (CBAM) was first presented by Gene Hall, Richard Wallace, and William Dossett in 1973. Ellsworth (2000) considers CBAM “a powerful framework for assessing and tracking change’s progress at the level of the individual adopter, where success is ultimately determined” (p. 158). The major elements of CBAM presented by Hall and Shirley Hord (2001) include: “the individuals who implement the change, the change facilitators who provide assistance, and the resource system from which supports are drawn” (p. 1). CBAM also provides “three diagnostic tools: Stages of Concern, Levels of Use, and

Innovation Configurations. The resulting information can be used to match resources with the needs of the users and thus provide interventions" (Hall & Hord, 2001, p. 1). These aspects of the CBAM model are also influenced by environmental factors including the individual school and district level forces, the community, the state and federal governments, as well as global factors (Hall & Hord, 2001).

Hall and Hord (2001) discuss the personal side of change when examining the Stages of Concern:

> Feelings and perceptions about the innovation and the change process can be sorted and classified in what we call *concerns*. In fact, there is a developmental pattern to how our feelings and perceptions evolve as the change process unfolds, which we have named the *Stages of Concerns*. These stages give us a way of thinking about people's feelings and perceptions about change. (p. 57)

The original Stages of Concern (SoC) include "unrelated" (i.e., not interested in the change), "self" (i.e., not sure I can do it), "task" (i.e., takes too much time), and "impact" (i.e., being able to see the results of the change), which have been further refined by Hall and Hord in the following way:

1. the self stage of concern has been separated into two stages, which include informational and personal;
2. the impact stage of concern has been separated into three stages called consequence, collaboration, and refocusing.
3. the unrelated stage of concern has been relabeled as awareness; and
4. the task stage of concern has been relabeled as management.

The informational stage of concern is expressed as a desire to know more about the innovation. The personal stage of concern is expressed as a query of how the innovation will affect the individual. The consequence SoC is expressed as a concern about the individual's clients and how they are affected. The collaboration SoC is expressed as a concern of how one individual's implementation is related with a co-worker's implementation. The last SoC, refocusing, is expressed as a desire to implement something an individual has developed that may seem to be an improvement of the innovation. The awareness stage of concern is expressed as a lack of concern about the innovation. The management stage of concern is expressed as a concern about the amount of time the individual is spending in preparation of implementing aspects of the innovation (Hall & Hord, 2001). Hall and Hord clarify the SoC by stating:

> The research studies clearly document that there is a quasi-developmental path to the concerns as the change process unfolds. However, the flow of concerns is not always guaranteed, nor does it always move in one direction. *If* the innovation is appropriate, if the principal is initiating, and if the change process is carefully facilitated, then teachers will move from early self concerns to task concerns (during the first years of use), and will ultimately move to impact concerns (after three to five years). (2001, p. 63)

Hall and Hord (2001) recommend keeping the guiding principles in mind when using SoC in a diagnostic way to facilitate interventions.

Through their research, Hall and Hord identified eight levels of how people behave with a change that fall into two major groups, nonusers and users. The three types of nonusers include Level of Use 0 Nonuse, Level of Use I Orientation, and Level of Use II Preparation. Level of Use 0 Nonuse is indicated when an individual has little or no knowledge of the change and does not demonstrate any behaviors related to it. An individual classified as a Level of Use I Orientation user makes an effort or expresses a desire to learn about the innovation. When a person is classified as a Level of Use II Preparation user, he/she has decided to implement the innovation and set a timetable to do so. There are five types of Users, which are classified as Level of Use III Mechanical, Level of Use IVA Routine, Level of Use IVB Refinement, Level of Use V Integration, and Level of Use VI Renewal. When a user is actively engaged in using the innovation and is working to make the change fit them, the individual is classified at Level of Use III Mechanical. If a user has had enough time for the innovation to become routine, has mastered how to use it, and has developed a way to work with it in a regular manner; the user is classified as a Level of Use IVA Routine user. Users will reach a point at which they will reflect on how well their clients/students are benefiting from their implementation of the innovation and adapt the innovation to increase the benefit for their clients/students. These types of users are classified as Level of Use IVB Refinement users. To be classified as a Level of Use V Integration type user, the individual shares his/her adaptations with other users in a collaborative way. When users reach the Level of Use VI Renewal classification, they are examining how they can make major changes to the innovation or completely replace it with another. Although these levels of use are listed in a linear manner, they do not necessarily follow this line of hierarchy and are independent from each other (Hall and Hord, 2001).

Hall and Hord indicate a recurrent problem with change is a lack of clear understanding of what the implementers, change facilitators, and policy-makers are really expected to do. They attribute the slow pace of change in many educational systems to this lack of understanding of what the change is and how it should be put in place. In order to understand and identify what the vision of a change is, Hall and Hord created the Innovations Configurations diagnostic dimension for the CBAM model. Any change has to be developed or created by an individual or entity (e.g., state; federal; or local governments) that created or designed the change; Hall and Hord use the term developer to identify these sources. "The concept of Innovation Configurations addresses both the idealized images of a change developer as well as the various operational forms of the change that can be observed in the classroom" (Hall & Hord, 2001, p. 38). The operational forms of an innovation result from the tendency of the individual implementer's interpretation of what is expected. To help overcome the problem of an innovation being implemented in various forms within one organization, Hall and Hord recommend the development of an Innovation Configuration Map (ICM) that helps specify how an innovation should be implemented. The ICM "is composed of 'word picture' descriptions of different operational forms of an innovation or change" (Hall & Hord, 2001, p.41). Hall and Hord recommend using a number of individuals to help in the development of an ICM, and the results should be shared with all parties. In addition to providing a clear picture of how a change should look, this process also provides an opportunity for all parties to take ownership in the process (Hall & Hord, 2001).

The CBAM model presented by Hall and Hord (2001) also includes the role of change facilitators and the function of interventions. In order for school change to be successful, change facilitators need to provide key support for the implementers of the innovation. The individual identified as the major change facilitator in a school system is the principal; however, "the principal is not alone in this endeavor" (Hall & Hord, 2001, p. 107). The support provided by the change facilitator is called interventions which are defined by Hall and Hord as "any *action* or *event* that influences the individuals involved or expected to be involved in the [change] process" (2001, p. 105). In the course of their research, Hall and Hord (2001) identified six functions of intervention which include:

- Function I: the development, articulation, and communication of a shared vision of the intended change;
- Function II: planning and providing of resources;
- Function III: investment of professional learning;
- Function IV: checking of progress;
- Function V: providing of continuous assistance; and
- Function VI creating a context of supportive change.

All of the aspects of CBAM model discussed provide "a powerful framework for assessing and tracking change's progress at the level of individual adopter, where success is ultimately determined" (Ellsworth, 2000, p.158).

The New Meaning of Educational Change

In Michael Fullan's third edition (2001) titled, *The New Meaning of Educational Change*, he identifies educational change as "a dynamic process involving interacting variables over time" (p. 71). Fullan proceeds to identify nine factors involved in the implementation of educational change, which he groups into three main categories. The first category is "Characteristics of Change" which includes the factors of need, clarity, complexity, and quality/practicality. The second category is "Local Characteristics" which involves the factors district, community, principal, and teacher. The final category is called "External Factors" which includes the factors of government and other agencies. All of these factors working in combination are important in effective implementation of change because "single-factor theories of change are doomed to failure" (Fullan, 2001, p. 93).

Fullan examines each of the factors closely and discusses how each has an impact on the implementation of an innovation. According to Fullan (2001), it is important to carefully examine how an innovation meets the identified priority need. "Several large-scale studies in the United States confirm the importance of relating need to decisions about innovations or change directions" (p. 75). Fullan identifies need as a clear and important factor in implementing change; however, he indicates the role of need is not always clear due to three identified complications. One of these complications is change overload, which is affected by a need's importance compared to other needs. Second, when a change is complex, the exact need is not always clear from the start. The third complication is how need impacts the other eight factors in the formation of various forms a change can take. In response to the form that a change takes, "need" can become more or less clear as the innovation is implemented (2001).

The second factor in the Characteristics of Change category, clarity, "is a perennial problem in the change process" (Fullan, 2001, p. 76). Clarity is a problem in the change process even when it is agreed that change is needed. The level of complexity of a change is directly proportional to the lack of clarity. "In short, a lack of clarity – diffuse goals and unspecified means of implementation – represents a major problem at the implementation stage" (Fullan, 2001, p. 77). Another problem associated with clarity is identified as false clarity. According to Fullan (2001), "False clarity occurs when change is interpreted in an oversimplified way; that is, the proposed change has more to it than people perceive or realize" (p. 77). When an innovation is not clear, unspecified, or oversimplified, the level at which it is implemented is negatively impacted. How clear a change or innovation can be, is related to its level of complexity which is Fullan's third factor in the Characteristics of Change category (2001).

Complexity is defined by Fullan (2001) as “the difficulty and extent of change required of individuals responsible for implementation” (p. 78). The more complex a change is, the more difficult it can be to implement; however, it also has the potential to create a larger amount of change. For example, NCLB has a target of having 100 percent of students meet proficiency by the year 2014 and many teachers, including the researcher, identify this as an unattainable target. The government could have set a target of having 75 percent of the students meet proficiency in the same time frame, which would be more realistic. However, if we meet a more realistic target of say 75 percent or even surpass it by five percent, we are still doing less than if we make 95 percent proficiency and fail to meet the more difficult target of 100 percent. Fullan addresses the levels of complexity of change in a similar way stating that more complex change has the potential to produce a larger amount of change because more change is being attempted (2001).

The Local Characteristics category of change addresses factors also known as stakeholders who act as change agents. Fullan (2001) stresses “that the support of central administrators is critical for change in district practice” (p. 81). District administrators are important because the conditions for implementation are put in place by these change agents. The district administrators provide support and knowledge of the innovation as well as understanding the intricacies of implementing the change that directly impacts the quality of executing it (Fullan, 2001). There is a connection between the district-level change agent and the Board/ Community change agents. A board can have an indirect impact on the implementation of change during their selection of a superintendent or by terminating a reform-oriented district leader. In order for meaningful change to take place, the board of education and the district leadership must actively work with one another to bring about change. In districts where the board of education and the superintendent have an antagonistic relationship, the opportunity for meaningful change is very limited. The impact of community change agents is their ability to influence the board of education to make the needed changes or lobby board members to resist change at all costs (Fullan, 2001).

The school level leader, principal, is the next change agent Fullan discusses. According to Fullan (2001), “All major research on innovation and school effectiveness shows that the principal strongly influences the likelihood of change, but it also indicates that most principals do not play instructional or change leadership roles” (p. 82). The impact of building principals is they have the opportunity to develop common objectives, create a climate of collaboration, and develop measures that can be used to evaluate results; the principal can shape the conditions needed for success (Fullan, 2001). Ultimately, the principal can be the most important source of help; however, they can also be a major source of hindrance to change especially in how they influence the third group of change agents, teachers.

Teachers are important change agents who directly influence the success of any educational change. This is because “regardless of what governments, school boards, or administrators require-it is the teacher who is in the classroom day after day with the students” (Ellsworth, 2000, p. 84). Ellsworth continues to clarify that, “if the teacher resists implementation, implements without critical components, or merely maintains a facade of implementation, then educational change will not succeed” (2000, p. 84). In order for teachers to become effective change agents, they need to have a teaching environment that provides the opportunity for them to obtain collegiality with peers. Within the school community, Fullan measures collegiality “by the frequency of communication, mutual support, help, and so forth” and identifies collegiality as “a strong indicator of implementation success” (2001, p. 124). To be effective change agents who produce significant educational change, teachers need to have a change in their beliefs, their style of teaching, and the materials they use. Although teachers need change to overcome boredom and frustration as well as a way to prevent burnout, they have to increase their ability to deal with change in order to limit the negative impact of intrusive, external forces of change (Fullan, 2001).

The intrusive, external factors that impact many teachers, principals, school boards, communities, and district leaders come from the state and federal governments. The dilemma faced by both state and federal governments is:

> Their world is one of wanting quick solutions for urgent problems. Yet bringing about change on a large scale is enormously complex. If it is difficult to manage change in one classroom, one school, one school district, imagine the scale of the problems faced by one state or province or country in which numerous agencies and levels and tens or hundreds of thousands of people are involved. (Fullan, 2001, p. 219)

Governments have a problem in developing a policy that effectively includes accountability, incentives, and capacity building because they result in the desire to have too little or too much control in the process. Fullan (2001) concludes that "policies need to be aligned to minimize distractions, and mobilize resources for continuous improvement" (p. 236).

Ellsworth (2000) suggests the *Meaning of Educational Change* model as a framework that "is the only one to treat individual actors in educational settings according to their diverse characteristics" (p. 41). This focus on the change agents explains why Ellsworth describes this change model as a change agent model (2000).

Upon examination of all these models, Ellsworth (2000) states "lasting, successful change cannot wear blinders: it must recognize the interdependence of all members and all components of the system being changed, and unite then to transcend that system's limitations" (p. 238). The examination of NCLB and the impact it has on elementary science education is directly related to how change is instituted in education at all levels from the halls of congress to the classroom teacher and everywhere in between. Ellsworth (2000) concludes that:

> These are exciting – and challenging – times to be a part of education. The transformation we must undertake is a dramatic one: we are, quite literally, called upon to equip the citizens and the workforce of the information age with knowledge tools they will require to drive and maintain the engines of progress. (p. 246)

Based on Fullan's *The New Meaning of Educational Change*, which represents a continuum of nine factors of change, the researcher examined how the agents closest to the students – superintendents, principals, and teachers – influenced changes that were introduced as a result of NCLB..

Achievement Gap

"The No Child Left Behind (NCLB) Act is praiseworthy for the special attention it gives to improved learning for children who have been ignored or left behind in the past" (Linn, 2005). "It has been long noted that minority groups and disadvantaged populations trail in school achievement" (Kinkead, 2005). Although sexism and/or racism are identified as barriers to achievement in science, it is also true that students from homes identified as having fewer socioeconomic resources needed to be successful in science education also face similar barriers (Hanson, 2007). One of the goals of NCLB was to reduce the academic achievement gap between subgroups (e.g., race, gender, and socioeconomic status) so that all students make AYP by the year 2014. This goal, along with many of the other aspects of NCLB, was built on prior education reforms including the 1994 ESEA and Goals 2000. The major difference between NCLB and the 1994 ESEA and Goals 2000 was that NCLB was a mandate that carried a penalty if states do not meet specific benchmarks (McGuinn, 2006). The number of subgroups in a district or school has been demonstrated to impact the ability of a district or school to make AYP. Seventy-five percent or more of California schools which had just one or two subgroups reported achieving AYP, while just 25 percent of schools in California made AYP when they had six or more subgroups (Marx & Harris, 2006). An understanding of the history of the achievement gap in the areas of gender, race, and socioeconomic status is important when examining how a federal education policy may or may not be effective in decreasing the achievement gap.

Achievement Gap in Science Based on Gender

According to Myra and David Sadker (1994), elementary students' self-esteem and achievement are largely influenced by the amount of attention children receive from their teachers. One study shows that the order of attention given in elementary classroom instruction started with White males getting the most, minority males second in line, followed by White females, and finally minority females (Sadker & Sadker, 1994). There have been a number of other studies documenting the inequity of science instruction based on gender because of teacher instruction and textbooks (Bazler & Simonis, 1991; Bianchini, 1993; Tobin, 1988). The purpose of Title IX, the federal antidiscrimination in education law, was to mandate equality in educational opportunities in order to ensure gender equity, in general (Spencer, Porche, & Tolman, 2003). However, even in a school that was committed to gender equity, Spencer, Porche and Tolman (2003) concluded there continued to be a disparity in the educational experiences between girls and boys. The increased demand for advanced technical skills in the workplace demonstrates the importance in providing all students with a complex understanding science, mathematics, and technology; however, "…women continue to be underrepresented in mathematics, science and engineering careers in the United States" (Reid & Roberts, 2006, p. 289).

One reason for some of this continued disparity was explained by Guzzetti and Williams (1996) who concluded that female students can be limited "by their fear of the male students (not of the teacher) and of challenging the social norms that permeated classroom interactions" (p. 17). Social norms are determined through verbal and nonverbal interaction with peers of both sexes and from family and societal pressures and expectations. Stake and Nickens (2005) propose, "One means of shoring up girls' science social networks may be to provide science enrichment programs that are supportive of all students and promote the development of positive relationships among participants" (p. 3).

Another reason discussed by Guzzetti and Williams was the probability of males having a greater chance to become more engaged in the learning process while female engagement in the learning process is more likely to be discouraged through both verbal and nonverbal communication from the teacher. A higher expectation and pressure on males has been presented as an additional reason for the difference in achievement between girls and boys in science. Koutsoulis and Campbell (2001) found that more pressure is put on males to do well in mathematics and science than on females. The limited expectations of women by various cultures have been identified as a factor that plays a limiting role on the performance of girls in science. Gender roles for women in certain cultures as well as mainstream America can still be very limiting (Holloway, 1993; Nieto, 2000). These social norms have a stifling impact on the self-confidence girls have in curricular areas traditionally considered male oriented as well as limiting the level of interest girls express in these areas (Sadker & Sadker, 1994). Other researchers have found that girls have a lower interest in science and math than males (Weisgram & Bigler, 2006). Weisgram and Bigler (2006) used interventions at the middle grade levels in an attempt to overcome this lack of interest, which resulted in a small but significant increase in girls' level of interest in science. Weisgram and Bigler (2006) indicated that "girls who were more convinced of the altruistic value of science showed higher levels of science self-efficacy and utility, and interest in science than girls who were less convinced of the altruistic value of science" (p. 344).

Although most of these studies have focused on middle and high school students, stereotypes based on gender roles in science is also evident in elementary students (Andre, Whigham, Hendrickson, & Chambers, S., 1999). Andre et al. (1999) state that interventions dealing with gender equity in science are more important at the elementary level. Elementary science education is vital because "the abilities from one grade level to the next are very similar but become more complex as the grade level increases" (National Research Council, 2000, p. 19) so a good base of knowledge needs to be established at the earliest possible age. According to Clewell and Campbell (2002):

> Research studies have shown that girls and boys at a very early age develop affinities for different kinds of science, with girls tending to favor the natural sciences and boys opting for physical sciences. Some studies have suggested that differences in the types of out-of-school experiences available to girls and boys may influence these divergent preferences. Interventions to give girls more out-of-school exposure to activities where they can tinker with objects or investigate

physical phenomena may help address some of the root causes of women's aversion to physical sciences. (p. 277)

In the absence of intervention programs and the decrease in instructional time for science indicated by a number of researchers (CEP, 2006; Griffith & Scharmann, 2008; Marx & Harris, 2006; McMurrer, 2008), will educators be able to meet the goal set by NCLB to close the achievement gap between girls and boys? Alternatively, will the focus on making AYP in math and reading and the use of standardized assessments as a measure in reaching this goal have a negative impact on the gender gap in science? This study examined the achievement gap between males and females in order to determine if NCLB achieved its goal of narrowing the achievement gap between these subgroups.

Achievement Gap in Science Based on Race

NCLB's greatest contribution "is the spotlight it has turned on the achievement of demographic subgroups, whose underperformance used to lie hidden within school district and state averages" (Educational Testing Service [ETS], 2009). "Despite significant advances in recent decades inequities in educational outcomes across racial and income groups are still large" (Harris, 2007, p. 367). An example of the inequity present between students from minority groups and their White counterparts is the results from the NAEP referenced by Lewis, Marlon, Hancock, and Hill-Jackson which "… revealed that by the end of the 12th grade, African-American students demonstrated mastery in reading and mathematic concepts similar to that of a White eighth grade student" (2008, p.130). One reason for these inequities based on race may be due to the conflict between the school culture and a student's culture at home. Giddings (1999) examined how a student's academic achievement in science can be affected by the differences in cultural beliefs in the home and the strategies being implemented by teachers in the classroom.

Giddings stated, “These disparities can also be exacerbated by continued inappropriate selection of teaching materials” (p. 3). Giddings’ (1999) study combined a number of instruments including interviews, case-study techniques, and Likert-type instruments. Giddings’ study was carried out in three Australian states as part of an international project having four different phases with one focusing on “…aspects of a student’s cultural expectations and preferred classroom environment (the Multicultural Classroom Learning Environment Inventory (MCLEI)” (p. 6). The MCLEI phase of Giddings’ study focused:

> …on a possible association between scores on the science reasoning / inquiry skills test, cultural and attitude items and identified characteristics of the home learning environment (e.g. resources available at home, time spent by students on science & school work, language spoken at home, etc). (p. 7)

How does the inability of students to make a connection between school and home affect their academic achievement? Giddings (1999) used “… a simple correlation analysis…” to examine association between“… each of the MCLEI scales and students’ attitudes and between each of the raw scores on the reasoning / inquiry items” (p. 7). Giddings’ research indicated that when a student sees little congruence between his/her culture and the school’s approach to science education, the student will have a lower achievement than students who can see a connection between their home culture and the school culture.

Reasons for the disparity in achievement between different cultures could be due to many elementary teachers being inadequately prepared to address the learning needs of culturally diverse students. Many of these elementary teachers are also insufficiently trained in science concepts. These two shortcomings make it difficult for these teachers to present science content in a way that students with cultural differences can understand (Lee, Luykx, Buxton, & Shaver, 2006). Kellow and Jones examine “stereotype threat” as another possible explanation of the differences in achievement when focusing on the culture of the students (2008). First studied in 1995, “stereotype threat” proposed the difference in academic performance on standardized tests between nonminority and minority students may be due, in part, to test anxiety caused by the knowledge of negative stereotypes related with their culture. There are a number of probable causes of the “stereotype threat” which include achievement goal orientation, perceptions of ability and expectancy for success, and anxiety. The basic idea behind this theory is that a student’s perception of how he/she is expected to perform according to perceived cultural norms can have a negative influence on how the student ultimately performs (Kellow & Jones, 2008). The reasons for the underperformance of minorities in science education presented by Lee et al. and Kellow and Jones, could be amplified by limiting the exposure of minority groups to science at the elementary level. Another proposed cause of the difference in achievement between White and minority groups is the disparity in resources needed to provide equity in schools (Darling-Hammond, 2007). Lewis et al. support the assertion by Darling-Hammond in the statement that “The national urban mathematics and reading results of fourth- and eighth grade students suggest that a lack of resources may be one of a number of issues to affect learners, some of which have far-reaching and systemic implications for the test score gap” (2008, p. 131). A lack of highly qualified and/or licensed teachers is another problem faced by schools that serve high minority enrollments (Lewis et al., 2008 and Darling-Hammond, 2007).

Standardized test scores and academic performance in the classroom are not the only measures of student success where race is involved. There is a greater risk for students of color and English-language learners in dropping out of school, which may have also had an impact on the achievement gap. Since these two groups have historically performed below average on high stakes tests; having a high number of students dropping out can result in a lower achievement gap on standardized tests than would be measured if those students remained a part of the school population (Causey-Bush, 2005). For a more accurate measure of AYP, states and the federal government should be required to include students who have dropped out of school as non-proficient on their state assessments data, and all home school students should be assessed as well. In the absence of the dropout rate being included in the state or federal assessment data, this study evaluated the difference in achievement based on currently available data.

Achievement Gap in Science Based on Socioeconomic Status

Harris (2007) indicated that inequity in educational outcomes, based on income, is still a problem even with the goals of NCLB. "Although many state constitutions explicitly require thorough and efficient systems of schooling for all students, states fail much more often to provide for children of the poor than for children of the affluent" (Howley, C., Howley, A., & Pendarvis, 1995, p. 119). Children from low SES homes "…often come to school with less background knowledge and fewer family supports" (Payne, 2008, p. 48). The continued struggle to resolve the gaps in academic success between the economically privileged and the economically disadvantaged is one factor that led to the revision of the Elementary and Secondary Education Act (ESEA) to the current version called No Child Left Behind (NCLB), which had bipartisan support of Congress and President George W. Bush (Marx & Harris, 2006). To have an impact on closing the achievement gap between students from low income households and their more advantaged counterparts, we need to understand what influence SES has on student performance. Howley et al. discussed three areas that have been shown to result in discrepancies in academic achievement based on SES: a lack of adequate facilities in low income neighborhoods, inappropriate curriculum and instruction for students from low income households and the impact of remediation, and an inadequate access to further education (1995). Payne (2008) suggests nine areas that can impact the education of students living in poverty including whether educators: 1) treat these students with respect, 2) make an effort to include these students in the learning process, 3) provide these students with the tools they need to speak in a more formal way, 4) know what resources these students have or do not have access to, 5) insure these students understand the hidden rules of schools, 6) provide interventions and monitors the progress of these students, 7) work to translate the concrete to the abstract, 8) help these students understand how to ask questions, and 9) make an effort to build relationships with the parents of children living in poverty. Peter Tuerk identified a negative correlation between the number of students from low SES homes in a school and the number of highly qualified teachers in the classrooms. Another area identified as a reason for below average academic performance of low SES students is the suggestion that students from low socioeconomic status homes have little to no support in their education (Giddings, 1999). Giddings also points to the inability of low SES families to provide additional educational materials at home, which can also have a negative impact on a student's ability to achieve. Giddings indicated a "… a low (0.21) but significant positive correlation…" between access to technology and student achievement in science (1999, p. 9). Parents with a low socioeconomic status have limited resources to provide technology for their children, which place them at a disadvantage (Giddings, 1999). Payne (2008) provides more insight by stating that, "School success as it's currently defined requires a huge amount of resources that schools don't necessarily provide. Teachers need to be aware that many students identified as at 'at risk' lack these outside resources" (p. 49). Clearly socioeconomic status affects a parent's ability to financially support their child's education (Lareau, 1987). Lareau conducted a study of family-school relationships between a White, working class and middle-class communities. From this study, Lareau indicated that working-class parents are less likely to read to their children or monitor their children's homework as often as middle class parents do. He indicates there is a common goal between working and middle-class families for the success of their children; however, working-class parents rely solely on teachers for their child's education while middle-class parents take a more active role. Harris (2007) discusses research that points to other possible causes for these differences:

> For example, poor nutrition and illness cause disadvantaged students to miss school more often and to be less prepared to learn when they attend than other students (Brooks-Gunn and Duncan 1997). Within the home, low-income parents have relationships with their children that are, emotionally and physically, less healthy (Duncan and Brooks-Ginn 2000), due in part to economic pressures that induce parent-child conflicts (Conger et al. 1997). (p. 369)

However, Harris clarifies that "many parents living in poverty successfully navigate and avoid these potential problems, while some high-income parents do not, but the general patterns described here are strong" (2007, p. 369). Lareau suggests, nonetheless, that this difference in parental involvement is that many working-class parents emphasize "… kinship and promote independence between the spheres of family life and school" (Lareau, 1987, p. 82). Payne indicates "the actions and attitudes that help a student learn and thrive in a low-income community often clash with those that help one get ahead in school" (2008, p. 50). Joel Dworin and Randy Boomer (2008) raise questions about Payne's assumptions in her most recent book, *A Framework for Understanding Poverty,* and claim she is viewing the students from low SES households from a deficits point of view. Dworin and Boomer state that:

> Educators must care, know, and think about the social class and poverty as part of their work. Material struggles for order, safety, and well being occupy the attention of teachers in their daily work for variety of reasons. Poor households are more vulnerable to many kinds of harm – failing and unstable health, loss of housing, lack of predictability, shortage of food, exposure to crime, infant mortality and failure to thrive in early childhood, substance abuse, arrest and incarceration, and all emotional relational consequences that can accompany such vulnerability (Kozal, 1991, Rainwater & Smeeding, 1995). These are material conditions of life with enormous impact on a household and student's capacity to take advantage of schooling. (2008, p. 117)

No matter what the cause or causes are for the educational inequities based on SES, "children living in poverty need additional help to succeed in school" (Brown, 2007, p. 144). The question the researcher examined in this study was: does NCLB meet its goal in decreasing the achievement gap between children from low-income homes and the affluent?

Summary

This chapter discusses four main issues addressed in this research including: decrease in instructional time for science, education reform, educational change, and achievement gap between subgroups of student populations. To review these four areas: (1) The decrease in instructional time portion of the chapter presented research that indicates a decrease in the amount of time for instruction in content areas other than math and reading since the implementation of NCLB. (2) The education reform section of this chapter provided a history of the federal government's role in educational reform from the 1960s to the most recent reform NCLB. (3) In the area of educational change, the researcher provided information on four models of change including the Diffusion of Innovations Model, Conditions of Change Model, Concerns-Based-Adoption Model, and the New Meaning of Educational Change. (4) When discussing the achievement gap between subgroups, the researcher examined three subgroups that have had a history of performing below their peers. These subgroups include gender, race, and socioeconomic status specifically females compared to males, minorities compared to Whites, and children from low-income households and their affluent counterparts.

CHAPTER 3 - Methods

Chapter three describes the manner used to complete this study. The first section of this chapter restates the research questions and sub questions examined by this research. The second section provides the theoretical framework for the research. The third section discusses the design of the research methods. Data collection and instrumentation are discussed in fourth section of this chapter. The final section of this chapter discusses the protection of human subjects used in this research study.

Restatement of Research Questions

Research Question 1: In what way, if any, has NCLB influenced instructional changes in elementary science education?

a) Have administrators required teachers to decrease the amount of time on science instruction since the implementation of NCLB? If so, why did they require teachers to make these changes? If not, why?
b) Do elementary educators feel they needed to make changes in the amount of time for science instruction since NCLB has been enacted? If so, why did they feel they needed to make these changes? If not, why?
c) How does the current amount of time spent on science education compare to the time spent on science education before NCLB?
d) How has NCLB influenced how teachers prioritize their school and personal budgets for school supplies and /or professional development?

Research Question 2: Has NCLB had an impact on the achievement gap in reading, science or mathematics disaggregated by gender, race, or SES?

a) Has the achievement gap disaggregated by gender changed since the implementation of NCLB?

b) Has the achievement gap disaggregated by race changed since the implementation of NCLB?

c) Has the achievement gap disaggregated by socioeconomic status changed since the implementation of NCLB?

Theoretical Framework

As indicated in section 2.2 (Federal Education Reform), involvement of the federal government in public education issues has continued to grow culminating in 2002 with the passage of No Child Left Behind (NCLB). The theoretical framework for research question number one deals with how the mandated change inherent in NCLB has been implemented at the classroom level. Although research indicates (Hall, Wallace, & Dossett, 1973: Rogers, 1995, Ely, 1999; and Fullan, 2001) a number of different change models which can be used to implement a change like NCLB. The researcher sees the New Meaning of Educational Change presented by Fullan (2001) as a synthesis of the other models of change preceding its introduction. The researcher proposes that Fullan's (2001) New Meaning of Educational Change may be useful in explaining why the changes set forth in NCLB may or may not be effective for the following reasons:

1. Fullan's stated that "single-factor theories of change are doomed to failure" (2001, p. 93) and the researcher identifies accountability based

on student test scores in reading and math as the main single-factor driving NCLB;

2. The need for agents to implement the change at all levels; and
3. "Schools are more likely to implement superficial changes in content, objectives, and structure than changes in culture, role behavior, and conceptions of teaching" (Fullan, 2001, p. 64).

Research question two addresses the NCLB goal of decreasing the achievement gap of disaggregated subgroups (e.g., race, gender, and socioeconomic status). As discussed in the Achievement Gap section of Chapter 2, there has been a long history of lower performance by certain student subgroups. This section also provides information that indicates a number of complex reasons for why a difference in academic achievement between these disaggregated subgroups is lower compared to their specific counterparts. The researcher sees the issues faced by these subgroups as too complex a problem for NCLB to successfully address. A question examined by this study was has the achievement gap closed for any of these subgroups in the areas of math and language arts? The researcher also examines what the decreases, if any, in the achievement gap had on the instructional time for science education at the elementary level.

Design

To address the first research question, the researcher employed a survey methodology using a web-based instrument. The criteria used for selecting participants for this survey included: 1) they had to be K – 6 teachers and 2) they had to be employed within one of the five states included in this study.

To address the second research question, the researcher collected and interpreted results made available from the National Assessment of Educational Progress (NAEP). The criteria for selecting the results from the NAEP included: (1) they had to be for the years of 2002 through 2008 and (2) they had to include the results for each of the subgroups included in this study. The subgroups selected for this research included gender (male and female), race (White, African-Americans, and Hispanic-Americans), and socioeconomic status (free lunch and those who pay full price for lunch). The selection of African-American and Hispanic-American groups was based on the historical disparity on the NAEP identified between these two minority groups and their white counterparts.

Data Collection and Instrumentation Research Question One

Data for research question one were collected through a voluntary response, online survey. The need to develop a survey for this research was necessary due to a lack of an existing survey designed to collect the data required to answer research Question 1; hence, the researcher developed a survey instrument (see Appendix A) and included the same main research questions and sub-questions used in a related pilot study. The instrument included demographic and closed-ended questions, with open-ended follow-up questions based on the respondents' answer to the closed-ended questions. A pilot study was done in the fall of 2007 with the instrument being initially distributed to K – 6 educators (n = 475) via a Kansas State Department of Education science listserv and the Kansas Association of Teachers of Science listserv. E-mail reminders were also sent five days before the survey end date to enhance the response rate. The rate of response in this pilot study was 34.5 percent. The data collected in this pilot study were published in the Journal of Elementary Science Education (JESE), a peer reviewed journal (Griffith and Scharmann, 2008). The results of the pilot study were used to evaluate the value of the survey questions to the current research effort. Adjustments were made, by removing questions that did not provide information beneficial to this research. Content validity was used to evaluate the survey instrument. “Content validity is the degree to which a test measures an intended content area” (Gay & Airasian, 2003, p. 136). According to Gay and Airasian (2003) to properly measure content validity, researchers must perform both item and sampling validity. Item validity is used to determine how relevant “…the test items are in measuring the intended content area” (Gay & Airasian, 2003, p. 136). The item validity was completed using an item validity table (Table 3.1) to identify the instrument questions that are related to each of the research questions and sub-questions. This table was reviewed by three master teachers who all found these questions related to the identified research questions. Sampling validity addresses “…how well the test samples the total content area being tested (Gay & Airasian, 2003, p. 136). The sampling validity was addressed by the responses provided by three reviewers of the original survey instrument (Appendix A). These three reviewers indicated that the items addressed the complete picture to be sampled; however, there were data collected in this instrument that were not identified in the research questions and needed to be removed. The questions they identified as needing to be removed were demographic questions about the subjects and about the schools the subjects were working in.

Table 3.1: Item Validity Table

Research Question and Sub-questions:	**Related Survey Questions:**
1. In what way, if any, has NCLB influenced instructional changes in elementary science education?	14. Are you responsible for teaching the assessed indicators for science? 15. Have you ever had to give a grade for science even though you did not spend time teaching or evaluating science material? 16. If you answered yes to question 15 explain why this happened? 17. Please add any additional comments you feel are important in regards to science education in elementary school.

1a. Have administrators required teachers to decrease the amount of time on science instruction since the implementation of NCLB? If so, why did they feel they needed to make these changes? If not, why?	5. Have you ever been instructed to not teach science for any reason by a member of your administration? 6. If you answered yes to number 5, what reason was given for doing this? 7. Have you ever been instructed to decrease the time you spend teaching science by a member of your administration? 8. If you answered yes to number 7, what reason was given for doing this?
1b. Do elementary educators feel they needed to make changes in the amount of time for science instruction since NCLB has been enacted? If so, why did they feel they needed to make these changes? If not, why?	2. Has the amount of time you spend teaching science decreased since the implementation of NCLB? 3. If you answered yes to question 2, how much time did you have to remove from teaching science? 4. Why did you feel the need to decrease your instructional time for science that you indicated in question 3? 9. Do you believe you need to cut time from science education in order to spend more time with reading and math instruction? 10. Explain your answer to question 9.
1c. How does the current amount of time spent on science education compare to the time spent on science education before NCLB?	1. What is the amount of time you spend each week teaching science? 2. Has the amount of time you spend teaching science decreased since the implementation of NCLB (if yes, go to question 6; if no go to question 8)? 3. If you answered yes to question 2, how much time did you have to remove from teaching science?

1d. How has NCLB influenced how teachers prioritize their school and personal budgets for school supplies and /or professional development?	11. How does what you personally spend on science education supplies and materials compare to what you personally spend on math and reading? 12. Are you provided the same opportunity for professional development in science as you are in reading and math?

The revised instrument (Appendix B) was distributed to K – 6 educators (n=3750) via e-mail with an explanation of the purpose of the survey (Appendix C) with reminders sent at one week and two weeks. According to Dillman (2007), the uses of multiple contacts are important in increasing the response rates to email surveys. The total number of recipients was equally distributed to teachers (n=750) in each of the states of CO, KS, MO, NE, and OK. In order to prevent duplication of data, Kansas school districts that were surveyed during the collection of data for the pilot survey were not sent emails for the collection of data for this research. The reliance on volunteers as survey respondents was a factor that limited the number of responses. In addition to the limiting impact of using volunteers, research indicates that e-mail based surveys have a lower response rate of 27 percent compared to the 60 percent of traditional paper surveys (Fraze, Hardin, Brashears, Haygood, and Smith; 2003). The timing of the survey data collection was just prior to or during the state assessment in each of the states which can also contribute to a lower than normal response. Based on the reliance of volunteers, the lower response rate for an e-mail survey as indicated by Fraze et al (2003), and the time of the year the surveys were sent, the acceptable response rate for this study was set at 25 percent. In order to maintain the confidentiality of the recipients and overcome problems associated with firewalls, email were sent as blind carbon copies (BCC). By using BCC the researcher provides individualized emails to each recipient, which also prevents replies from being sent to all who received the initial email (Dillman, 2007). To enhance the response rate, reminders were e-mailed to teachers at seven and fourteen days before the survey end date.

The data for research question number one were analyzed in three ways. A chi-square goodness-of-fit test was used to determine if a significant difference existed between the numbers of responses from each state. The data from the closed-ended questions were analyzed by tabulating the raw data and determining the percentage responses to each question and then analyzed based on the demographic responses to experience and size of school district. Next the researcher analyzed the teachers' responses to closed-ended questions according to the response given to the question, "Has the amount of time you spend teaching science decreased since the implementation of No Child Left Behind?" Depending on the response to this question, respondents were directed to a specific set of closed-ended questions and/or open-ended questions.

The open-ended questions were analyzed by developing codes based on the methodology presented by Bogdan and Biklen in 1992 (In Creswell 1998). The data were examined for emergent themes with similar, overreaching ideas or concepts. The themes were further categorized into groups that were sorted based on similarities in metaphors, analogies, and concepts. Any responses that were identified as containing more than one defined theme were dissected and coded as a separate response. Themes were further organized using the connections between categories and coding was developed based on the methodology presented by Ryan and Bernard (2003). Once the themes and categories were identified, the researcher sent them to three master teachers for evaluation and coding recommendations. The definitions for the codes are provided for each question.

Data Collection and Instrumentation Research Question Two

The data analyzed for research question two were collected via the National Assessment of Educational Progress (NAEP) website (http://nces.ed.gov) which provided test results based on the demographics needed for the analysis of this question. According to the National Center of Education Statistics (NCES) the results from NAEP has been tracking student learning in a variety of content areas since 1969. The NCES (2008) provided information about the two types of NAEP assessments, which included the main NAEP and a long-term trend NAEP. According to the NCES the:

> Main NAEP does not provide scores for individual students or schools; instead, it offers results regarding subject-matter achievement, instructional experiences, and school environment for populations of students (e.g., fourth-graders) and student groups of those populations (e.g., female students, Hispanic students). NAEP results are based on school and student samples that are carefully designed to accurately represent student populations of interest. (2008)

The NAEP is a norm-referenced assessment that assesses a representative sample of students enrolled in grades 4, 8, and 12 in public and nonpublic schools. The NAEP also provides results for students as both an aggregated whole population and as disaggregated subgroups. Finally, the NAEP has a long history of its use in making research assertions. Since 2002 the Center for Education Policy (CEP) has studied the manner in which NCLB has been implemented at the federal, state and local levels. The CEP is an independent nonprofit organization that looks at both state assessment data and NAEP results in evaluating the impact of NCLB. Although state assessments are standards-referenced and directly related to state content standards, they do not provide for a direct comparison between states. In order to examine achievement in an equitable manner, the researcher chose to use NAEP results as the database for answering research question two (NCES, 2008). The researcher also chose to use results from the fourth and eighth grade levels since the focus of the study is kindergarten through sixth grade levels and NCLB has been in effect since 2002.

The selection of schools and students for the NAEP assessment is done randomly through a specific selection process. Although schools can decide not to participate in the NAEP, the NCES does not accept volunteers for participation in the NAEP. The selection process involves NCES dividing the country in approximately 1000 sampling units based on geography. These sampling units can be as large as several million to as few as 45,000. Sample selection starts based on size with the 22 largest units always being selected. The remaining schools are placed in sampling units of similar characteristics (e.g. location, populations) and selection is made randomly from these groups. When schools are selected, the next step is to select the students from each grade or age group for testing with between 30 and 150 students being tested at each site. This method of sampling provides an accurate measurement of the academic performance of the nation's students (Vanneman & White, 2000). According to the NCES (2008) Help on Assessment Samples listed under the Technical Information About NAEP Data "the typical sample size per grade and subject being assessed is 100 schools and 3000 students per state" (¶ 3).

To determine if there are differences between subgroups and over time, a t-test was used. A t-test is more appropriate for determining significance between the means of two groups than a z-test when the standard deviation (σ) is unknown. The t-test is also more appropriate because a z-test can produce a slightly larger number and a slightly smaller *p*-value than it should be which increases the chance for a Type I error (Huck, 2004). On the other hand, t-tests can provide the challenge of determining the appropriate degrees of freedom when they are used in large-scale surveys. The statistical significance of the difference in the means between subgroups on the NAEP was given at an approximate simultaneous α level of 0.05. The statistical significance of the difference in the means between testing years on the NAEP was given at an approximate simultaneous α level of 0.05. The sample size used for determining if the difference between subgroups was significantly different was set at sample size $n \geq 62$ (NCES, 2008). The minimum sample size was determined based on an $\alpha = 0.05$, a power of .80, and a medium effect for each subgroup (Huck, 2004; Howell, 2004). The medium effect size is $\gamma = .50$ based on the conventions set by Jacob Cohen in 1988 (Cohen in Howell, 2004).

Assurances for Human Subjects

To ensure the anonymity of the subjects for research question number one, the survey was completed online and did not include any information that would identify the respondents. Once the information was collected by the researcher, it was kept in a secure, locked location in the researcher's home and will be shredded and properly disposed of after three years.

The anonymity of the subjects for research question number two was protected by the researcher by the use of data that provided no identifiable information. This was achieved through the use of NAEP data that was previously analyzed by the NCES. The procedure used by NAEP to guarantee the anonymity of participants occurred in two ways. NAEP does not keep the names of the students who were sampled from the school. The other measure to ensure anonymity of the participants is how the data is reported. NAEP is only reported on the national or regional level; it is never reported by district, school, or individual students (NCES, 2008).

CHAPTER 4 - Data Analysis

Introduction

Chapter four focuses on the quantitative and qualitative data analyses in this study. According to Gay and Airasian (2003, p 586) data analysis is "A process of simplifying quantitative or qualitative data for better understanding, involving application of statistical techniques to numerical data or coding and finding patterns or themes in narrative data." The researcher's purpose in conducting this study was to identify the impact that "No Child Left Behind" (NCLB) may have had on the teaching of science at the elementary school level. This research also examined if one of the intended goals of NCLB – namely to close the achievement gap – was accomplished. The detailed review of literature in chapter two helped to guide the researcher in the development of two research questions.

The survey instrument (Appendix M) used for research question number 1 was provided online via www.surveymonkey.com and was available for a period of two months. Once the data for research question 1 were received, a chi-square goodness-of-fit test was done by the researcher to determine if there was a significant difference in the response rates from each state included in the survey. The analysis of the raw data from the closed-ended questions of the survey were reported in percentages and the open-ended questions were analyzed using codes that were developed using the methodology presented by Bogdan and Biklen in 1992 (In Creswell 1998).

The data collection for research question number 2 was done through the use of the National Center of Education Statistics (NCES) reporting of the results from the National Assessment of Educational Progress (NAEP). The NCES website provided the researcher the ability to choose a set of variables required to answer research question 2 and provide the statistical analysis of this data using a t-test to determine if any statistically significant changes were found between the means of the samples selected at an $\alpha = 0.05$.

Chapter 4 begins with the analysis of the data from the online survey instrument used to collect data for research question 1 starting with the first subsection, which provides a description of the survey instrument. The next section provides information from the sample survey followed by a Chi-square analysis section which determines the goodness of fit between the number of responses collected from each state. The researcher then addresses the quantitative data collected on the survey instrument. The quantitative data is examined in two subgroups which included teachers who indicated they cut instructional time for science and then teachers who indicated they did not cut instructional time for science. The last section of Chapter 4 dealing with research question 1 provides analysis of the data from the qualitative questions from the survey instrument.

The analysis of the NAEP data for research question 2 is the next section addressed in Chapter 4. The achievement gap based on gender is examined first for this research question, looking at the national level science scores at the fourth and eighth grade level, followed by fourth and eighth grade math by state, and then fourth and eighth grade reading by state. The achievement gap based on race is examined next for this research question looking at the national level science scores at the fourth and eighth grade level, followed by fourth and eighth grade math by state, and then fourth and eighth grade reading by state. The achievement gap based on socioeconomic status is the last section examined for this research question looking at the national level science scores at the fourth and eighth grade level, followed by fourth and eighth grade math by state, and then fourth and eighth grade reading by state. The final section of Chapter 4 is a summary of the chapter.

Changes in Data Used for Research Question 2

The researcher intended to use state level data from the fourth and eighth grade NAEP data for the content areas of science, math, and reading for each of the five states (Colorado, Kansas, Missouri, Nebraska and Oklahoma) included in this study; however, NAEP scores were only available in the content areas of reading and math for these five states. The researcher then examined the national scores for the NAEP in the content area of science which was provided for all the subgroups from the testing years of 2000 and 2005 and planned to use the national statistics. However when examining the national NAEP science data more thoroughly, the researcher found that the NAEP was not administered to all the same states in 2005 that it was administered to during the 2000 testing year. In addition, some of the states did not have reportable data for both years resulting in only 36 states having reportable data for all students and as few as 17 states for certain subgroups. The researcher decided to only use states that had reportable average scale science scores for each subgroup for both the 2000 and 2005 NAEP testing years. As a result of changing the calculation of the average scale score on the NAEP science assessment, the researcher reported science scores identified as the "adjusted national level" science data. The results from the adjusted national science data used for each of the subgroups in this research will be different from the national science data provided by the NAEP data explorer.

Research Question One: In what way, if any, has NCLB influenced instructional changes in elementary science education?

Description of the Survey Instrument: Question One

The survey instrument used for research question one (Appendix M) was a web-based survey in which the first question addressed the grade level taught and the second required respondents to identify the state in which they were teaching. The remaining questions on the survey instrument required closed-ended responses including: the amount of instructional time provided for science, had the teacher cut time for science, did the teacher believe that he/she needed to cut time for science, how much time was cut from science, did the school administrator request the teacher to either decrease the instructional time for science or not teach it at all, if the teachers were provided the same opportunity for professional development for science instruction as they receive for math or language arts, were the teachers responsible for teaching assessed indicators, and if the teacher had ever given a grade for science without instructing or assessing it. Most of the closed ended questions were followed-up with open-ended questions. There were also open-ended questions dealing with the teacher's opinion of NCLB and a section provided for additional comments at the end of the survey instrument.

Description of the Survey Sample: Question One

The link to the survey webpage was distributed by e-mail to K-6 teachers (n=750/state) in each of the states included in this research (CO, KS, NE, MO, and OK) over a period from February 15, 2009 through April 15, 2009. All of the teachers (n=3750 total for all states) were sent reminders at one week and again at two weeks. The e-mail addresses for these teachers were randomly selected from either the Department of Education for each state or from district websites through-out an individual state. An additional set of e-mail addresses for each state were stored for use to replace any e-mails that were returned undeliverable until the required number of e-mails (n=750/state) were successfully sent.

Chi-square: Question One

The number of responses obtained from each state was: Colorado (n=190), Kansas (n=265), Nebraska (n=164), Missouri (n=162), and Oklahoma (n=147). Due to the variation in the response rate, the researcher used a chi-square goodness-of-fit test to determine if there was a significant difference between the number of respondents from each state. The null hypothesis of H_o: $\mu_{CO}=\mu_{KS}=\mu_{NE}=\mu_{MO}=\mu_{OK}$ was rejected (alpha = 0.05; Chi-square = 47.61, df = 4, and p = < .0001) indicating a significant difference between the number of responses from each state. The researcher performed another chi-square test removing the results from the researcher's home state of Kansas (n=265). The null hypothesis for the second test $H_{o:}$ $\mu_{CO}=\mu_{NE}=\mu_{MO}=\mu_{OK}$ was retained (alpha = 0.05; Chi-square = 5.77, *df* = 3, and p = > 0.05). Although the number of responses from Kansas was identified as an outlier, the researcher included these results since they were taken from the researcher's home state which may have had an impact on the number of responses. Another reason for the larger sample size collected in Kansas may result from the researcher's former position as science consultant for the Kansas State Department of Education, which may have increased the response rate due to name recognition.

Data Analysis of the Quantitative Data for Research Question Number One

Dillman (2007) indicated that professionals (i.e. educators) are not as limited as a general population is in their ability to respond to web-based surveys in their workplace or home. However due to the researcher's reliance on volunteers, the lower response rate (27 percent) for an e-mail survey as indicated by Fraze et al (2003), and the time of the year the surveys were sent; the acceptable response rate for this study was set at 25 percent. The average response rate for this survey instrument was 24.7 percent which met the acceptable response rate set for this survey. The responses for the survey instrument (n=928 total all states) were analyzed and reported as a percentage of the raw data. The researcher calculated the percentage of the raw data by dividing the responses for each answer choice by the total number of responses for each question and then multiplied the result by 100. All calculations are reported by percentage of answers for each response and were rounded to one decimal place. The researcher further analyzed the responses found in Table 4.1 and found that more than half of these teachers (52.7 percent) were only teaching science for 60 minutes or less per week.

Table 4.1: Survey Question 1

1. What is the amount of time you spend each week teaching science?	
0 – 30 min	25.1%
31 – 60 min	27.6%
61 – 90 min	20.2%
91 – 120 min	13.4%
>120 min	13.8%

Question 1 provided the data on how much time was being spent teaching science at the elementary level. The responses for this question are summarized in Table 4.1. The researcher

Table 4.2: Survey Questions 3 and 4

3. Has the amount of time you spend teaching science decreased since the implementation of No Child Left Behind?	
Yes	55.3%
4. How much time did you have to remove from teaching science?	
0 – 30 min	25.6%
31 – 60 min	48.8%
61 – 90 min	17.9%
91 – 120 min	6.0%
>120 min	1.8%

Table 4.3 provides data on the percentage of teachers who cut time for instruction for science by grade level. There is no significant difference in the number of responses from grade

kindergarten through fifth grade ($\alpha = 0.05$; Chi-square = 1.6, $df = 5$, $p = .9012$); however, the number of responses from grade six is significantly lower than any other grade level ($\alpha = 0.05$; Chi-square = 49.21, $df = 6$, $p < 0.0001$). Some sixth grade teachers who received the email requesting a response to the survey replied they were not elementary teachers and only taught science. These teachers indicated they would not respond the survey because they were not elementary teachers. With some sixth grade teachers not identifying themselves as elementary teachers may explain why there was a significantly lower number of respondents at the sixth grade level.

Table 4.3: Responses to Question 3 by Grade Level

Grade	N=	Percent Who cut time for science instruction.
K	134	57.4%
1	148	60.7%
2	138	56.7%
3	129	58.2%
4	141	47.9%
5	134	45.5%
6	54	36.3%
Multiple Grades	50	34.0%
Total	928	

The responses to question 3, “Have you cut instructional time for science since the implementation of NCLB?” and the corresponding question number three, “How much time did you have to remove from teaching science?” are shown in Table 4.2. Of the 55.3 percent of teachers who indicated they decreased instructional time, almost 25 percent removed 61 minutes or more per week.

Analysis of Survey: Quantitative Responses

This section reports quantitative data from questions 6, 8, 10, 13, and 15 after they were filtered by the responses to question 3 as shown in Table 4.4. Since science was included as an annually assessed subject in NCLB starting with the 2007-2008 school year, the researcher examined if teachers who taught assessed science material indicated they cut time for science instruction. Question 15 (Appendix D) asked if the teacher was responsible for teaching the

Table 4.4: Responses to Questions 6, 8, 10, and 13 Based on the Response to Question 3

3. Has the amount of time you spend teaching science decreased since the implementation of No Child Left Behind?	
55.3% YES	44.7% NO
6. Have you ever been instructed not to teach science for any reason by a member of your administration?	6. Have you ever been instructed not to teach science for any reason by a member of your administration?
7.9% YES	3.0% YES
8. Have you ever been instructed to decrease the time you spend teaching science by a member of your administration?	8. Have you ever been instructed to decrease the time you spend teaching science by a member of your administration?
21.1% YES	8.9% YES
10. Do you believe you need to cut time from science education in order to spend more time on reading and math instruction?	10. Do you believe you need to cut time from science education in order to spend more time on reading and math instruction?
8.1% YES	33.3% YES
13. Are you provided the same opportunity for professional development in science as you are in reading and math?	13. Are you provided the same opportunity for professional development in science as you are in reading and math?
33.0% YES	44.5% YES

assessed indicators for science. Of the teachers who have cut time for science instruction, 77.5 percent were responsible for teaching the indicators that were going to be assessed in science. Of the teachers who did not cut time for science instruction (Question 15, Appendix E), 77.9 percent were responsible to teach the indicators that were going to be assessed in science which is not significantly different from 77.5 percent who indicated they were responsible for teaching assessed indicators and cut instructional time for science.

Table 4.5 summarizes the data from question 16 which asked if teachers had given a grade for science without teaching or assessing the material. Although the percentage of yes responses to this question from teachers who cut instructional time for science is larger than the

Table 4.5: Survey Question 16 (Teachers Who Decreased Instructional Time for Science)

16. Have you ever had to give a grade for science even though you did not spend time teaching or evaluating science material?		
(Cut Time for Science Instruction)	Yes	26.7%
(Did Not Cut Time for Science Instruction)	Yes	11.6%

21.8 percent who responded in the same manner in the pilot study, the difference is not significant (α = 0.05; Chi-square 0.32, $df = 1$, $p = .57$). Table 4.5 also provides the response to Question 16 for those teachers who did not cut instructional time for science. There is a significant difference (α = 0.05; Chi-square = 5.2, $df = 1$, $p = .023$) between the 11.6 percent who answered yes to question 16 in this group compared to the 26.7 percent of teachers who answered yes to the same question from the group that cut instructional time for science instruction.

Data Analysis of the Qualitative Data for Research Question Number One

The open-ended questions were analyzed by developing codes based on the methodology presented by Bogdan and Biklen in 1992 (In Creswell1998) and Ryan and Bernard (2003). The data were examined for emergent themes with similar, overreaching ideas or concepts. The themes were further categorized into groups that were sorted based on similarities in metaphors, analogies, and concepts. Responses that were identified as containing multiple themes were dissected and coded accordingly. Themes were further organized using the connections between categories and coding was developed based on the methodology presented by Ryan and Bernard (2003). Once the themes and categories were identified, the researcher sent them to three master teachers for evaluation and coding recommendations. The definitions for the codes are provided for each question.

Question 2: NCLB is an educational reform mandated by the government. What is your opinion to this type of mandate?

For this question there were five themes which include: 1) negative comments denouncing NCLB (38.4% of respondents), 2) NCLB needs to be reformed (27.5% of respondents), 3) NCLB has an unrealistic accountability system (17.1% of respondents), 4) NCLB needs to be properly funded (8.4% of the respondents), and 5) positive comments supporting NCLB (6.6% of respondents). In addition to these five main themes, there were two additional themes that each made up 2 percent of the total responses (n = 979). One of the additional themes that made up 2 percent of the responses included 22 teachers that did not know what NCLB was. The second theme making up the final 2 percent of the responses included teachers that were unsure about how they felt about the NCLB and government mandates in education.

Theme 1: "Negative comments denouncing NCLB", included a total of six different categories which include 1) I just do not like NCLB (35%), 2), detrimental to education which focus on different ways NCLB has hurt education in general (21%) 3) NCLB is unfair this can mean unfair to teachers or student groups (17%), 4) no teacher input in developing NCLB (12%), 5) NCLB is too stressful which includes stress on teachers and/or students (9%), and 6) local control which include answers that state education reform should be left to districts and states (7%).

The largest category in this theme is the group of teachers that "just do not like NCLB" and consists of 35 percent of the respondents. This category can be summed up by one statement made by most of the respondents in this category "I don't like it." The second category in this theme is the "detrimental to education" category, which includes 21 percent of the respondents in this theme. The following comments (1 through 5) are representative of the comments that were coded in the – detrimental to education category:

Response 1: "It requires us to teach more standards in less depth. If we were to focus less on mandated curriculum and more on holistic, integrated teaching our students would be gaining a better sense of the interconnections in our world. The system right now forces us to separate math from reading from science from social studies etc."

Response 2: "It seems that the more we try not to leave a child behind, the more we are leaving behind. We are not doing a service to our students by letting them pass through the grade because our stats would look "bad" to have children retained. Also, all children are not at the same level and therefore cannot have the same bar to try to meet."

Response 3: "While I understand that the concepts represented by NCLB aim to improve instruction and student performance regardless of race, gender, or special needs of the students (a really good thing), the result in my district has been a narrowing of the curriculum to focus primarily on reading and math skills. I feel that this has not been in the best interests of my students, many of which need to have a broad range of experiences and exposure to concepts so that they can build a foundation that better supports learning. This is not to say that math and reading instruction are not critical elements. But NCLB has focused instruction more narrowly to increase test scores and that has resulted in less learning for some and a focus that does not facilitate maximum gains for others."

Response 4: "I think that this type of global reform can be very harmful. It is harmful to school districts that are successful, but have to spend money on needless reforms. It is also harmful to the school that needs the reform, but need a lot of extra support that is not offered to make the sweeping changes that they need to succeed."

Response 5: "It has eliminated good teaching especially in the areas of social sciences this mandate has been ineffective because all it does is forces teachers to teach to a test."

The third category in this theme is the "NCLB is unfair" category, which includes 17 percent of the respondents in this theme. The following comments (6 through 10) are representative of the comments that were coded in the – NCLB is too stressful category:

Response 6: “I believe that the idea of serving every child is important but that it is impossible to give them the same education because they are all different and have different needs. NCLB tests the learning disabilities equally which in turn is unfair. Education should be valued not mandated.”

Response 7: “I understand the sentiment of this mandate. The idea is that we cannot lower our expectations when we teach in impoverished and ethnically diverse communities. However, in practice, testing 3rd grade children in this way is expensive and developmentally inappropriate use of tax dollars. I also feel that schools and teachers in impacted communities are unfairly targeted. Yes, we need to bring up the scores of minority children. Is NCLB the best way to do it? Probably not.”

Response 8: “I don't feel that it is appropriate. Our high kids are the ones who are being left out because our concentration is on those not on grade level.”

Response 9: “It doesn't seem to work because it doesn't fit everyone's needs.”

Response 10: “This mandate does not fairly ensure all students receive and equitable education. Students who are at or above their grade level are restrained from achieving higher levels and students who are below grade level are frustrated by our insistence that they should be able to perform at a level they are not able to achieve.”

The fourth category in this theme is the “no teacher input in the development of NCLB” category and consists of 12 percent of the respondents in this theme. This category can be summed up by a statement made by one of the respondents from this category, “Government mandated reform is usually created by a bunch of politicians who are completely removed from the realities of the classroom setting today. Most of these types of mandates are doomed from the start because of this lack of understanding of both today's student and teacher.”

The fifth category in this theme is the “NCLB is too stressful” category that includes 9 percent of the respondents in this theme. The following comments (11 through 13) are representative of the comments that were coded in the – NCLB is too stressful category:

Response 11: “I think it's important that we do our best for every child, but having the government telling us what to do doesn't always work so well. Other things get left behind - like a love of learning! And teachers tend to get burned out quicker due to the increased pressures to perform."

Response 12: "It is stressful. Good teaching is good teaching. Poor teaching is poor. Setting a standard is not going to give a poor teacher the skills needed to make change!"

Response 13: "It is a misguided attempt to bring accountability into education and is punitive to districts most needing help. I dislike the politics associated with NCLB. To prepare for state testing in March the standards, which are intended for a nine month curriculum, must all be taught by March. This puts the teachers and students in a pressured learning environment."

The final category in this theme (local control) includes 7 percent of the respondents included in the – negative comments denouncing NCLB theme. The local control category can be summed up by a single statement made by one of the respondents who states, "I feel the federal government should have far less control over schools than the local government. Different places have different needs and those can be met most effectively by those closest to the situation."

Theme 2: "NCLB needs to be reformed" consists of 27.5% of the respondents to this question. The following comments (14 through 18) are representative of the comments that were coded in the – NCLB needs to be reformed theme:

Response 14: "I believe that this reform needs its own reforming. There are many flaws in the way data is taken. The one flaw that I believe needs to be addressed immediately would be the variation in required test scores to score in the meets standard or higher category. This should be uniform throughout the states and not based upon what state the student lives. It is true and an awesome thought to have 100 percent of students fall into this category but I believe we are setting them up for failure if we do not have uniformed tests and testing standards."

Response 15: "Accountability is a good thing and very necessary. I think that all the kinks have not been worked out (such as how to account for ELL, special ed., and schools like mine located in an area of high poverty where students enter school already 1-2 years behind middle class students). However, there must be a starting place, or no progress can be made."

Response 16: "I think it is important for teachers to be accountable, but I believe that some changes need to be made to NCLB."

Response 17: "It has improved the way schools attempt to help their students succeed at a higher level, but needs improvement."

Response 18: "NCLB is great in theory. Teachers should be held accountable. However instead of focusing on test scores the focus should be on the deeper level curriculum. Underperforming schools should study their demographics and teachers should be required to meet expectations through additional training. Teachers should be treated and paid like the professionals. NCLB could be implemented with greater success if it were more supportive and less punitive.

Theme 3:"NCLB has an unrealistic accountability system" consists of 17.1% of the respondents to this question. The following comments (18 through 22) are representative of the comments that were coded in the – NCLB has an unrealistic accountability system theme:

Response 18: "NCLB is unrealistic in expecting every child to reach 100% proficiency by 2014. Statistically this is an impossible goal. Government should look for individual student growth over the years. The pressure in on the teachers like never before in order to make AYP causing a drop in teacher morale."

Response 19: "I also believe that the expectation that all children will achieve at the same level is unrealistic. It is unrealistic to believe that all children will be proficient by a certain year."

Response 20: "Nonsense...there will always be a top and a bottom-not every child is able to perform at such and such standard. How about looking at where a child started and how far they've come-doesn't that mean anything? NCLB is set up so all schools will fail. Why not say that by 2010 all kids should be prima ballerinas or hit 10 of 10 free throws??? Ridiculous!!"

Response 21: "It is unrealistic to think that children with learning disabilities will be able to accomplish the goals set by NCLB."

Response 22: "I think it is a very unfair judgment of a student's intelligence. NCLB expects all students to be on the same level of learning and that is a wonderful concept but it's not reality."

Theme 4: “NCLB needs to be properly funded” includes 8.4 percent of respondents to this question. This theme can be summed up by a statement made by one of the respondents, which states “I think that if the government is going to mandate something like education, they need to back it up financially. In other words, if NCLB is to be successful, the government needs to support schools in meeting its demands.”

Theme 5: ‘Positive comments supporting NCLB”, included statements that indicated what they felt were positive results from this government mandate. Seven percent of the respondents made comments that were identified as supportive of or positive about NCLB. The following comments (23 through 27) are representative of the comments that were coded in the – positive comments supporting NCLB theme:

Response 23: “I think this type of mandate is required to meet standards and to be certain that students are receiving the best education possible. It holds teachers and schools accountable.”

Response 24: “I think that it has been good because it reminds all of us (teachers) what our job should be. Too often many teachers become complacent in their work forgetting many children that should/need to be educated. All are entitled to an education!”

Response 25: “At first, I was a bit irritated by it, but, I have seen some wonderful improvements in student scores and our ability to reach those previously thought lost!”

Response 26: “I think it is a good way to help students that [were] overlooked by teachers and the state prior to the NCLB. I think that more students are now getting the help that they need to succeed.”

Response 27: “I think it is a very good idea. In the past we sorted and selected whom could read. Now we have a responsibility to see that all students read at some level of competency.”

Question 5: Why did you feel the need to cut time for science instruction?

For this question there was one theme which was an emphasis on improving reading and math assessment scores. Within this theme there were two main categories non-integrated instruction (97%) and integrated instruction (3%). Non-integrated instruction is defined as teaching content areas as standalone material with no cross-curricular units. Integrated instruction is defined as instruction that includes cross-curricular lesson plans which included more than one content area being taught at one time. The non-integrated category is made up of three subcategories which include: 1) teacher initiated increase in instructional time for language arts and mathematics (65%), 2) increase in instructional time for language arts and mathematics mandated at the district or administrative level (23%), and 3) time needed for assessment interventions and/or additional time to do state or local assessments (12%).

The non-integrated category was comprised by 97 percent of the respondents to question 5. Subcategory one, teacher initiated increase in instructional time for language arts and mathematics, was the largest subcategory (65%) of the non-integrated instruction. The following statements (responses 1a through 5a) are representative of the responses that were coded in the – teacher initiated increase in instructional time for language arts and mathematics subcategory:

Response 1a: “The high-stakes testing increases the pressure to ensure my students succeed on the test. I have not been in any way instructed to decrease social studies/science time by our administration; however, I feel the need to review and "teach to the test," so subjects that aren't being state-tested unfortunately get put on the back burner.”

Response 2a: “I want to help my students be prepared for the math and reading tests they have to take. I want to make sure they have the skills and the abilities to achieve success. The students stress out so I feel the more practice tests they take the more familiar they will be with the real test. If our school doesn't make AYP we will be penalized and put on an improvement plan. Teachers will be monitored more than they are now. Teaching science or keeping my job??? I have a family to support and bills to pay.”

Response 3a: “In order to hit the other subjects, like reading, writing or math b/c our scores in those areas has a great impact on us. Those scores will be published, and if we don't meet AYP it has negative implications for us. It makes the school look bad and the teachers look bad. For a struggling school with more challenges, AYP practically consumes us. Nobody wants to be marked as a school that didn't make AYP, so if something has to pushed aside to ensure that, it's going to be things like science, health, or social studies. If students have to be pulled for resource/sped, then it will be from those areas as well--we certainly wouldn't pull them from reading, writing, or math. I don't like this, but that is the way it is."

Response 4a: "As a first grade teacher, I feel that teaching reading and math is more important. In reading groups, I always try to pull in a non-fiction book so some science will be discussed. In our whole group instruction, however, there is just not much time other than just read-aloud's."

Response 5a: "We have decreased this time to allow for more time in math and reading. Our district set the time for science that we are required to devote, however, teachers "steal" from this time to give more to other subjects."

Subcategory two, increase in instructional time for language arts and mathematics mandated at the district or administrative level, was the second largest subcategory (23 percent) in the non-integrated category. The following statements (responses 6a through 10a) are representative of the responses coded in the – increase in instructional time for language arts and mathematics mandated at the district or administrative level subcategory:

Response 6a: "There is so much emphasis placed on the criterion referenced tests that we are required to take. We are only tested on reading and math so our principal has required us to spend 2 hours a day on reading and 2 hours on math, which doesn't leave a lot of extra time for other subjects."

Response 7a: "The emphases in our district (and the mandates) are reading and math. We are required to have 75 minutes of math instruction, an hour of whole group reading instruction, an hour of small group reading instruction, 20 minutes of monitored independent reading time, a story time we choose to do to help children's listening skills, spelling, writing, and penmanship time."

Response 8a: "In the state of OK, under the Reading Sufficiency laws which align with NCLB, we at third and below are restricted to reading and math teaching. They ask us to give 90 min. of instruction to both subject cores. With those chunks in place we have barely time to complete language arts, handwriting, and such. Add to that the amount of time taken out for other activities and we are very limited in instructional time to focus on science or social studies. I used to teach in units where my reading was covered during studies of science and social studies so that I could achieve all three things BUT the district I am in dissolved my ITI model of teaching in favor of an aligned curriculum in a basal series for additional benchmarking along with our testing. We also are using the DIBELS material for reading."

Response 9a: "I have a set schedule dictated by the district for math and language arts. That only leaves a short amount of time for science. I cannot integrate it into those subjects. Those times can only be used to implement the district's math and reading curriculum."

Response 10a: "Our district took away 5 hours a week in order to have tier instruction for reading and math. We used to have 7 hours a week for social studies, science and health but now it is only 2 hours per week."

Subcategory three, time needed for assessment interventions and/or additional time to do state or local assessments, was the smallest (12 percent) subcategory in the non-integration category. The following statements (responses 11a through 15a) are representative of the responses coded in the – time needed for assessment interventions and/or additional time to do state or local assessments subcategory:

Response 11a: "Time to work on test prep. In one case, we neglected science materials for two years waiting for the state to come up with science objectives. Is that teaching to the test or what?"

Response 12a: "Too much testing. I have just come back to teaching after 12 years of staying home to raise my children. All we do now is test. Do I dare say that teachers feel like we have to "teach to the test" just to survive?"

Response 13a: "The amount of testing I'm required to do in other areas necessitated it."

Response 14a: "Students not keeping up. Test prep takes up time."

Response 15a: "The increase in the time needed for reading assessment cuts into science and social studies time."

Category two, integrated instruction, only made up three percent of the total respondents to question 5. The following statements (responses 16a through 20a) are representative of the responses coded in the integrated instruction category:

Response 16a: "We have to integrate other subjects and we do a rotation to have more quality time vs. qualitative."

Response 17a: "I now have to be creative with my science units using more cross-curricular planning."

Response 18a: "I did not decrease teaching science; I just input the topic with reading and math."

Response 19a: "Reading, writing, and math is where our priority falls, because science and social studies can be implemented throughout the curriculum."

Response 20a: "I really did not have to decrease that much time. I teach Science across the curriculum."

Although the teachers in this category indicated a level of integration of science into math and reading, the main focus of the integration of science was the use of nonfiction books during language arts classes. One of the respondents stated "I have not decreased my instructional time and have integrated it into my literacy block." A statement from another respondent from the non-integrated category presented a concern that reading science is a way some teachers may use to integrate science:

> "Because 'Reading First' became the priority and science was 'left behind.' Some comments I heard was "Well, if they can't read the science books, then they are going to do poorly" While I agree, I agree to a point. Text books are NOT the only source of science education."

The statement that textbooks are not the only source of science is supported by the National Research Council (NRC) statement that, "Teaching all of science using only one method would be ineffective, and it would probably be boring" (2000, p. 36).

Questions 7 and 9: What reason was given by your administrator for their request that you not teach science? What reason was given by administration for requesting this decrease in time for science instruction?

Due to the similarity between these questions and the responses provided to these two questions, the results were included as one data set. There was one theme in the responses to this question which is the need for their school to meet the requirements of AYP set forth in NCLB. The statements that made up this theme included two different categories: 1) the need to provide more time for reading and math instruction which included the remaining 66 percent of the respondents and 2) time needed for test preparation which included 34 percent of the respondents.

The following statements (Response 1b through 6b) are representative of the responses that were coded in the – need to provide more time for reading and math instruction category:

Response 1b: "To give more time to writing, reading, and math; which were called the 'core' subjects."

Response 2b: "Reading, writing and math are the main content areas that a child should know the best. If you have to take something out then you take science or social studies."

Response 3b: "We are required to spend a certain amount of time each day [to instruct] reading, writing, and math. This allows for very little time in other areas. This means science and social studies instruction time has to be cut."

Response 4b: "We divide our science time with social studies and English Language Development (ELD). No one really minds if the teachers teach less science whereas we are instructed by law to devote a certain amount of time to ELD."

Response 5b:"Focus more on reading instruction...which science can be incorporated into. In fact, instead of just memorizing facts, a literature-based approach to science taps into higher levels of thinking with the science material."

The following statements (Response 6b through 10b) are representative of the responses that were coded in the – time needed for test preparation category:

Response 6b: "We have math days where we rotate our students through the five fourth grade classes and review concepts that they need to know for the test. With the amount of information required now, there is literally no time for review. If a student doesn't understand a concept, you won't be on schedule to teach your standard a day if you don't move on. Students end up having a shallow understanding of many concepts rather than a deep understanding of any of them."

Response 7b: "After the beginning of the year, as we approached the CSAP Test [Colorado's state assessment] we were instructed to administer several prep tests in reading, writing, and mathematics. This focus on test preparation has made the reduction of teaching science and social studies necessary."

Response 8b: "The reason was to get more test prep in the month before the test."

Response 9b: "I was told to spend more time on the area the tests cover, so our scores would go up. Not to worry so much about the other areas."

Response 10b: "The reason was to get more test prep in the month before the test."

Question11: Explain your answer to question number 10. (Question 10: Do you believe you need to cut time from science education in order to spend more time on reading and math instruction?)

The responses to why teachers believe they need to cut science were categorized into two themes. Theme 1 – was the teacher's personal emphasis on math and language arts (58%). Theme 2 – was the external pressures placed on teachers to focus on math and language arts (42%). The first theme, the teacher's personal emphasis on math and language arts, is defined as the teacher personally feeling he/she needs to decrease science instruction in order to have more time to teach math and/or language arts. The second theme, external pressures placed on teachers to focus on math and language arts, is defined as the teacher feeling a need to decrease instructional time for science due to the pressures from building or district administration and the pressure that results from required assessments and test preparation.

Theme 1: Teacher's personal emphasis on math and language arts includes two categories: 1) math and/or language arts are more important which comprised 91.3 percent of the total responses to in this theme 2) you have to know how to read and/or do math in order to participate in science which comprised 8.7 percent of the total responses to in this theme. The math and/or language arts are more important category can include statements dealing with a lack of time in the day for science instruction, math and/or language arts must be taught first, as well as math and/or language arts are more important. The following statements (Response 1c through 5c) are representative of the responses that were coded in the – math and/or language arts are more important category:

Response1c: "Small group instruction takes a lot of time. The students are on so many levels that I have to change instruction continually. The goal is to get the kids on grade level in reading, writing, and math. As a teacher, these components are crucial for second grade."

Response 2c: "There are only so many hours in the day and when students need to be reading at grade level by third grade and come to first grade two to three levels behind ~ there's a lot of work to do. They do get some science with reading; but it is information rather than inquiry."

Response 3c: "The areas of literacy have so much weight upon them to perform, so I feel that I need to get those lessons taught daily for practice and reinforcement that if an assembly or change in schedule arises, I tend to cut from my science time during the day."

Response 4c: "More time is spent in reading and the math areas which is very vital in first grade. The children need more time to grasp the concepts often."

Response 5c: "Opportunities for the children to explore science concepts take away time that is needed to ensure the children are mastering the literacy and math skills."

The second category in this theme, you have to know how read and/or do math in order to participate in science, can include statements that the science textbooks are too hard to read or the level of science vocabulary is too high for elementary students. The following statements (Response 6c through 10c) are representative of the responses that were coded in the – you have to know how read and/or do math in order to participate in science:

Response 6c: "Learning to read seems much more important at a young age. If you can't read, you certainly won't be able to read science materials correctly at a later age."

Response 7c: "Science textbooks are sometimes challenging to read. If my students cannot read the book independently, then I have to read it to them or with them. This slows down how far we get in Science and increases the time I spend on teaching them how to read the science book rather than what's in the science book."

Response 8c: "If students can't read, how can they do science? Students must know how to read and comprehend. If I teach a science lesson that the students have to read the instructions or do math (figuring out volume, force, etc) then I spend more time on the math and reading than the actual science project."

Response 9c: "There are a lot of children who have trouble reading and comprehending in general and if they do not understand what they are reading will not understand reading in the content area of science."

Response 10c:"Virtually all learning hinges upon ability to read. The better reader a child can become the better he/she will be able to do science"

Theme 2: External pressures placed on teachers to focus on math and language arts, has two categories, which are: 1) administrative pressures which included 21.5 percent of the total responses to for theme 2 and 2) assessment preparation which included 78.5 percent of the total responses for theme 2. The assessment preparation category can include statements dealing with test preparation, remediation, and time for district assessments. The following statements (Response 11c through 15c) are representative of the responses that were coded in the – assessment preparation category:

Response 11c: "More emphasis needs to be placed on reading, math and more importantly TEST TAKING SKILLS AND STRATEGIES! The students may know the information but there are many test questions on the NCLB tests that are confusing and do not show their comprehension of the skill but the comprehension of the question."

Response 12c: "I feel that Reading, Math, and Writing skills are what NCLB seems to focus on and therefore that is where I need to spend the majority of my class time."

Response 13c: "Because of CSAP and other district/state mandated tests, we HAVE to cover those areas. I would rather do more cross-curricular teaching, but because of the way the curriculum is set up, I'm not free to teach the way I believe is best and especially now, necessary."

Response 14c: "There is such a push to meet the high standards set upon children, teachers and schools that revolve around reading and math before all other subjects that something HAS to give and unfortunately the science testing is not as 'critical' as the reading and math."

Response 15c: "Well 4th grade no longer teaches multiplication and division because "they are not tested on it. Our students in 6th grade MUST know how to multiply and divide for our TEST! Science and Social Studies bye-bye!"

The administrative pressure category can include statements dealing with demands placed on teachers either directly or indirectly by administrators at any level in their district. The following statements (Response 16c through 20c) are representative of the responses that were coded in the – administrative pressures category:

Response 16c: "We are given the 'viable' curriculum in reading and math. We must use it for instruction. That limits the amount of cross curricular activities you can do."

Response 17c: "We have been given a pie chart on how much time to spend in each area. I have tried to follow that even though it took away science and social studies time."

Response 18c: "We had to cut time from somewhere in order to allow the amount of time for reading and math instruction that district administrators ordered."

Response 19c: "I didn't have a choice; there isn't enough time in our schedule. I also have to meet the district expectations for time to teach reading and math."

Response 20c: “The administration requires a certain amount of time be spent on a daily basis teaching reading, writing, and math. This leaves little time for science and social studies. We have to alternate days that science and social studies are taught. We cannot teach both these areas on a daily basis.”

Question17: Explain your answer to question number 16. (Question16: Have you ever had to give a grade for science even though you did not spend time teaching or evaluating science material?)

The responses to question 17 were provided as an explanation for why the respondent stated they had given a grade for science without teaching or assessing science material. The answers given were divided into two themes. Theme one was identified by the researcher as a grade was required. Theme one is defined as any response that indicated a grade was required but they had not covered any science content at the time grades were due. Sixty-eight percent of the respondents to this question were identified in this theme. The following statements (Response 1d through 5d) are representative of the responses that were coded in the – a grade was required theme:

Response 1d: ”It was required on the reporting form. Data rules, even if it has no meaning.”

Response 2d: “There is a grade card with a place for a science grade that must be filled in.”

Response 3d: “It was a parental expectation, and therefore a mandate from the principal.”

Response 4d: “It was expected, but I gave all the kids equal grades because of fair treatment.”

Response 5d: “The administrator said that there would be no blanks on anyone's grade card.”

Theme two was identified by the researcher as grades were given based on limited exposure to science. Theme two has three categories which include: 1) grades were based on limited exposure to actual science instruction which is defined as any grade given on an inadequate amount of exposure to science material as stated by the respondent (18%), 2) citizenship grade was given which is defined as any grade given based solely on a student watching or listening during any science related material and/or based on the students behavior (9%), 3) grades were based on limited reading of science related material which is defined as the reading of any science textbook or nonfiction reading that includes some science content (5%).

Category one consisted of 18 percent of the responses to question 17. The following statements (Response 1d through 5d) are representative of the responses that were coded in the – grades were based on limited exposure to actual science instruction category:

Response 1d: "We may have touched on topics but the curriculum was not given the amount of time I felt it deserved."

Response 2d: "I didn't have the time to fully teach it the way I would have wanted, so we sped through the lesson to give the kids a grade."

Response 3d: "I did teach some science, but not to the extent that I felt comfortable recording a grade to reflect students' mastery of concepts."

Response 4d: "While I did not spend the proper amount of time I did condense the lesson so I did have something to grade."

Response 5d: "We had discussed or squeezed in a lab or video with notes and discussion, and I needed a grade."

Category two consisted of 9 percent of the responses to question 17. The following statements (Response 11d through 15d) are representative of the responses that coded in the – citizenship grade category:

Response 11d: "I give grades based on class participation. At the primary level, I don't feel a "letter grade" is appropriate since most of our activities are group activities. The grades show up on report cards as letter grades."

Response 12d: "We give satisfactory, needs improvement, and unsatisfactory letter grades for science and social studies. The grade is placed for participation in class more than knowledge of material. It is not a core area for elementary at my level."

Response 13d: "Our progress reports are not really adequately set up to evaluate the students. Science and Social Studies grades are effort grades."

Response 14d: "In first grade it is just a participation grade, because they are not graded on any specific skills at our level."

Response 15d: "We gave an overall behavior/participation grade."

Category three consisted of 5 percent of the responses to question 17. The following statements (Response 16d through 20d) are representative of the responses that were coded in the – grades were based on limited reading of science related material category:

Response 16d: "I usually coupled science with reading to create science grades, although I wasn't teaching traditional science curriculum it was related."

Response 17d: "We covered concepts briefly and got most of it through reading lessons."

Response 18d: "We touched on science standards in our core reading program."

Response 19d: "We use the E S U grading scale for science. Even though I did not explicitly teach science, concepts were discussed during reading."

Response 20d: "It was assessed through the students writing and not actual hands-on time to manipulate the science materials."

Question18: Please add any additional comments you feel are important in regards to science education in elementary school.

The answers to question 18 were coded into two different themes. The responses found in theme one were coded as there is a need for a strong science education. Theme one included 64 percent of the responses to this question and included two categories identified as: 1) science is important to the future of students and society (44%) and 2) more help and resources are needed to properly teach science (23%). Category one consisted of 44 percent of the total responses to question 18. The following statements (Response 1e through 5e) are representative of the responses that were coded in the – science is important to the future of students and society category:

Response 1e: "I completely understand the importance in teaching students to read and write well. Furthermore, I believe that a working knowledge of mathematics is crucial in today's world. Mathematics is, after all, the language of science. However, by neglecting the teaching of science we deprive students the most essential element of academic success, giving students a sense of wonder about their world. We fail to teach students to question the world around them, to use reason and deduction to discover the amazing existence in which they live. It is through science that we teach students to become thinkers and not just robots that can memorize and regurgitate information. If our nation is to be on the cutting edge of discovery and innovation it will be through students that can broaden our knowledge of the world around us. Discovery consists, 'not in seeing what no one else has seen, but in thinking what no one else has thought.'"

Response 2e: "I believe science should receive a higher level of importance at the elementary level. It is brushed off to the side. Kids are missing out on so much when they do not get science. When they move away from elementary school, they are lost in the area of science. This causes them to become frustrated and not want to pursue a career in science. Our country needs to develop a love for science in kids. If we want to be competitive with other countries, we need a lot of amazing scientist."

Response 3e: I think that in order to solve problems such as the energy crisis, kids need to have critical thinking skills and be allowed the freedom to explore through science based activities!"

Response 4e: "I think it is important for kids in elementary school to have science instruction for thinking and problem solving skills. It is also a great motivator for students because of their high level of interest."

Response 5e: "We are returning to the days before Sputnik in regards to science education at the lower levels and that will impact us."

Category two consisted of 23 percent of the total responses to question 18. The following statements (Response 6e through 10e) are representative of the responses that were coded in the – more help and resources are needed to properly teach science:

Response 6e: "Even though I don't feel very capable of teaching science I would like to see a bigger emphasis put on this area. It would be great if our school would employ a science expert that could travel from grade level to grade level to teach the teachers how to successfully teach a science lesson. On occasion this expert could come into the classroom to model lessons and experiments."

Response 7e: "It is hard to do the lab-type activities in elementary classrooms where we do not have counter space, storage space, sinks, or adequate electrical outlets. We've been instructed to do more demonstrations than student experiments, but not surprisingly, students are not terribly engaged in demonstrations."

Response 8e: "I think having a science lab would be amazing and having a qualified science teacher come once a week or month like a traveling art teacher does, etc. would be a HUGE benefit to students and to teachers. Teachers could model again what they saw in the lab and go back to classrooms to do follow up."

Response 9e: "We need more emphasis on science!!!!! That includes professional development as well as money to buy the necessary supplies!"

Response 10e: "It is embarrassing and ridiculous that we spend as little time and resource on science. Why not combine science and literacy. Instead, our district spends thousands on a literacy curriculum that teaches skills in isolation and themes that don't build upon one another, when it could invest in a high-quality science/literacy curriculum."

Theme 2: An emphasis on assessments and curriculum related to NCLB made up 33 percent of the responses to this question and included two categories which were identified as 1) a focus on state assessments and 2) other content areas (reading and math) are more important. The researcher identified many of the responses in both these categories very similar to the responses provided to questions 7, 9 and 11 so samples of these responses are not included for this theme.

Research Question Two: Has NCLB had an impact on the achievement gap in reading, science or mathematics disaggregated by gender, race, or Socioeconomic Status (SES)?

The researcher first evaluated the data from the NAEP results in science to determine if a significant difference in achievement existed in any of the subgroups for each of the content areas of reading, math, and science. The data for research question two provides information on the achievement gap between the subgroups of gender, race, and socioeconomic status (SES). The data were then examined for any change that may have occurred between any identified gaps since the implementation of “No Child Left Behind” (NCLB) in order to evaluate the null hypothesis for research question number two. State level data were available for each of the states of Colorado, Kansas, Missouri, Nebraska, and Oklahoma for the areas of reading and mathematics. The data for science were not available at the state level so the researcher evaluated the scores for each of the subgroups using national level science data. The adjusted national level data were calculated using only data from states that were tested in both 2000 and 2005 NAEP testing years. The data were based on average scale scores in each content area and were collected from the National Assessment of Educational Progress (NAEP) Data Explorer provided by the National Center for Education Statistics (NCES) website (Retrieved May 31, 2009).

Achievement Gap - Gender

Achievement Gap in Science Disaggregated by Gender

The adjusted national level data provided in Table 4.6 indicate a significant difference in

Table 4.6: Achievement Gap Disaggregated by Gender: Grade 4 Science

Adjusted National Level Data					
	Testing Year	**Average Scale Score**	**Difference Between Average Scale Scores**	**Standard Error**	**P-value**
Male	2005	152.17	3.41	(0.27)	*P* = 0.0001
Female	2005	148.76			
Male	2000	150.76	3.96	(0.39)	*P* = 0.0001
Female	2000	146.80			
Change in Achievement Gap			-0.55		*P* = 0.2445

the level of achievement between fourth grade males and females in the area of science for both the 2000 and 2005 testing years. The table also provides data showing the difference in the achievement gap disaggregated by gender between the average scale scores from testing done in 2000 and the 2005 testing year. The difference in the achievement gap between 2000 and 2005 is not significant thus the null hypothesis is retained indicating no sustained significant difference in achievement gap between males and females on the NAEP at the fourth grade level in the content area of science.

Table 4.7: Achievement Gap Disaggregated by Gender: Grade 8 Science

Adjusted National Level					
	Testing Year	**Average Scale Score**	**Difference Between Average Scale Scores**	**Standard Error**	**P-value**
Male Female	2005 2005	150.51 148.06	2.45	(0.28)	*P* = 0.0001
Male Female	2000 2000	150.64 146.10	4.54	(0.36)	*P* = 0.0001
Change in Achievement Gap			-2.09		*P* = 0.1731

Table 4.7 shows adjusted national level data for the level of achievement between eighth grade males and females in the area of science during the 2000 and 2005 testing years. The data indicates a significant difference during both the 2000 and 2005 testing years at an $\alpha = 0.05$. Table 4.7 also provides data showing the difference in the achievement gap disaggregated by gender between the average scale scores from testing done in 2000 and the 2005 testing year. Since the difference in the achievement gap between males and females on the NAEP at the eighth grade level in the content area of science between the 2000 and 2005 testing years was not significant, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained for the subgroup of gender at the eighth grade level in the content area of science at an $\alpha = 0.05$ with $p > 0.05$.

Achievement Gap in Math Disaggregated by Gender

Fourth grade NAEP data were available in the content area of math disaggregated by gender for the tested years of 2000, 2003, 2005, and 2007 for the states of Kansas, Missouri, Nebraska, and Oklahoma. NAEP data for fourth grade math disaggregated by gender were available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2000 did not meet the reporting standards required for NAEP. Table 4.8 provides an analysis of the change in the achievement gap between males and females from each of the states of Kansas, Missouri, Nebraska, and Oklahoma for the years 2003, 2005, and 2007 as they related to the testing year 2000, which was the tested year prior to the implementation of NCLB. Table 4.8 also provides an analysis for the state of Colorado; however, the achievement gap between males and females for the years of 2000, 2005, and 2007 were compared the year 2003 due to a lack of data for 2000.

An analysis of the achievement gap based on gender in the area of math is provided in can also be found in Table 4.8 for each of the states surveyed for this study. The data for the state of Colorado for the year of 2000 did not meet the reporting standards set for NAEP reporting. For the testing year of 2003, Colorado males did score significantly higher than their female counterparts on the NAEP in the area of math at fourth grade level. The data from

Table 4.8: Achievement Gap Disaggregated by Gender: Grade 4 Math

Colorado: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	242 239	(1.3) (1.1)	3	*P* = 0.1030
Male Female	2005 2005	241 238	(1.3) (1.2)	3	*P* = 0.0843
Male Female	2003 2003	237 233	(1.2) (1.1)	4	*P* = 0.0247
Male Female	2000 2000	‡ ‡	‡ ‡	‡	*P* = ‡
Change in Achievement Gap Between 2003 and 2007 Testing Years				-1	*P* = 0.7216

Kansas: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	249 247	(1.0) (1.0)	2	*P* = 0.1798
Male Female	2005 2005	247 245	(1.0) (1.2)	2	*P* = 0.1270
Male Female	2003 2003	244 240	(1.2) (1.1)	4	*P* = 0.0230
Male Female	2000 2000	233 231	(1.6) (2.0)	2	*P* = 0.3864
Change in Achievement Gap Between 2000 and 2007 Testing Years				0	*P* = 0.9117

Missouri: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	240 239	(1.1) (1.0)	1	*P* = 0.2011
Male Female	2005 2005	237 233	(1.1) (0.9)	4	*P* = 0.0249
Male Female	2003 2003	235 235	(1.1) (1.0)	0	*P* = 0.8592
Male Female	2000 2000	228 228	(1.5) (1.1)	0	*P* = 0.7670
Change in Achievement Gap Between 2000 and 2007 Testing Years				1	*P* = 0.5710

Nebraska: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	240 236	(1.2) (1.3)	4	*P* = 0.0221
Male Female	2005 2005	239 236	(0.9) (1.1)	3	*P* = 0.0293
Male Female	2003 2003	238 235	(0.9) (1.1)	3	*P* = 0.0332
Male Female	2000 2000	225 225	(2.4) (1.9)	0	*P* = 0.9401
Change in Achievement Gap Between 2000 and 2007 Testing Years				4	*P* = 0.2713

Oklahoma: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	238 236	(0.9) (1.1)	2	*P* = 0.0790
Male Female	2005 2005	235 233	(1.1) (1.0)	2	*P* = 0.0688
Male Female	2003 2003	230 228	(1.1) (1.2)	2	*P* = 0.1356
Male Female	2000 2000	225 223	(1.3) (1.2)	2	*P* = 0.3495
Change in Achievement Gap Between 2000 and 2007 Testing Years				0	*P* = 0.7155

Colorado for the years of 2005 and 2007 does not show a significant difference in achievement between males and females in the area of math at fourth grade level at an $\alpha = 0.05$. The data for the state of Kansas indicates only one year, 2003 Kansas males scored significantly higher than females on the NAEP in the content area of fourth grade math. The data for the state of Missouri indicates a statistically significant difference in achievement between males and females on the NAEP in the content area of fourth grade math during the 2005 NAEP testing year. The analysis of the scores from the state of Nebraska for the 2000 testing year did not indicate a significant difference in achievement between males and females on the NAEP in the content area of fourth grade math. A significant difference was indicated between Nebraska males and females on the NAEP in the content area of fourth grade math for the testing years of 2003, 2005, and 2007. The data for the state of Oklahoma indicates no significant difference in achievement between males and females on the NAEP in the content area of fourth grade math for any of the testing years.

Table 4.8 shows no significant change in the achievement gap between males and females at the fourth grade level in the content area of math for any of the states included in this research. As a result of no significant change in the achievement gap being found, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained for the subgroup of gender at the fourth grade level in the content area of math at an $\alpha = 0.05$.

Eighth grade NAEP data were available in the content area of math disaggregated by gender for the tested years of 2000, 2003, 2005, and 2007 for the states of Kansas, Missouri, Nebraska, and Oklahoma. NAEP data for eighth grade math disaggregated by gender were available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2000 did not meet the reporting standards set for NAEP.

Table 4.9: Achievement Gap Disaggregated by Gender: Grade 8 Math

	Testing Year	Average Scale Score	Standard Error	Difference Between Average Scale Scores	P-value
Colorado: 8th Grade Math					
Male	2007	287	(1.2)	1	$P = 0.4463$
Female	2007	286	(1.1)		
Male	2005	281	(1.6)	0	$P = 0.9970$
Female	2005	281	(1.3)		
Male	2003	284	(1.4)	1	$P = 0.7389$
Female	2003	283	(1.2)		
Male	2000	‡	‡	‡	$P =$ ‡
Female	2000	‡	‡		
Change in Achievement Gap Between 2003 and 2007 Testing Years				1	$P = 0.7929$
Kansas: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male	2007	291	(1.3)	2	$P = 0.5093$
Female	2007	289	(1.2)		
Male	2005	285	(1.3)	2	$P = 0.5437$
Female	2005	283	(1.4)		
Male	2003	284	(1.5)	0	$P = 0.5970$
Female	2003	284	(1.4)		
Male	2000	283	(2.2)	0	$P = 0.8910$
Female	2000	283	(1.5)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				2	$P = 0.6285$
Missouri: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male	2007	282	(1.2)	3	$P = 0.1274$
Female	2007	279	(1.2)		
Male	2005	278	(1.6)	3	$P = 0.1276$
Female	2005	275	(1.4)		
Male	2003	280	(1.2)	2	$P = 0.1651$
Female	2003	278	(1.4)		
Male	2000	272	(1.7)	2	$P = 0.5395$
Female	2000	270	(1.6)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				1	$P = 0.6859$
Nebraska: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male	2007	285	(1.1)	3	$P = 0.1320$
Female	2007	282	(1.3)		
Male	2005	285	(1.1)	2	$P = 0.1135$
Female	2005	283	(1.4)		
Male	2003	284	(1.3)	3	$P = 0.0677$
Female	2003	281	(1.0)		
Male	2000	282	(1.5)	5	$P = 0.0272$
Female	2000	277	(1.6)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				-2	$P = 0.4129$

Oklahoma: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	277 273	(1.2) (1.1)	4	*P* = 0.0163
Male Female	2005 2005	272 271	(1.3) (1.1)	1	*P* = 0.8245
Male Female	2003 2003	272 272	(1.4) (1.2)	0	*P* = 0.7230
Male Female	2000 2000	271 269	(1.7) (1.4)	2	*P* = 0.4581
Change in Achievement Gap Between 2000 and 2007 Testing Years				2	*P* = 0.3894

An analysis of the achievement gap based on gender in the area of math at the eighth grade level is provided in Table 4.9 for the state of Colorado, Kansas, and Missouri indicates no significant difference in achievement between males and females on the NAEP in the content area of eighth grade math for any of the testing years at an $\alpha = 0.05$. The data for the state of Nebraska for testing year 2000 indicates a significant difference in achievement between males and females on the NAEP in the content area of eighth grade math. The data for the state of Oklahoma indicates a significant difference in achievement between males and females on the NAEP in the content area of eighth grade math only during the 2007 testing year.

Table 4.9 also provides an analysis of the change in achievement gap between males and females each of the states of Kansas, Missouri, Nebraska, and Oklahoma for the years 2003, 2005, and 2007 as they relate to the year 2000 which was the tested year prior to the implementation of NCLB. Table 4.9 also provides an analysis for the state of Colorado; however, the achievement gap between males and females for the years of 2000, 2005, and 2007 were compared to the year 2003 due to a lack of data for 2000. The data in Table 4.9 shows no sustained significant change in the achievement gap between males and females at the eighth grade level in the content area of math for any of the states included in this research. As a result of no sustained significant change in the achievement gap being found, the null hypothesis that no significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained with $\alpha = 0.05$ and $p > 0.05$ for the subgroup of gender at the eighth grade level in the content area of math.

Achievement Gap in Reading Disaggregated by Gender

Fourth grade NAEP data were available in the content area of reading disaggregated by gender for the tested years of 2002, 2003, 2005, and 2007 for the states of Kansas, Missouri, Nebraska, and Oklahoma. NAEP data for fourth grade reading disaggregated by gender were also available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2002 did not meet the reporting standards set for NAEP.

The analysis of the achievement disaggregated by gender in the area of fourth grade reading is provided in Table 4.10 for the states of Colorado, Kansas, Missouri, Nebraska, and Oklahoma. As shown in Table 4.10, the achievement gap between males and females is statistically significant for all testing years examined for each state included in this research with males scoring lower than their female counterparts. Table 4.10 also provides analysis of the change in the achievement gap between males and females in each of the states of Kansas, Missouri, Nebraska, and Oklahoma for the years2003, 2005, and 2007 as they relate to the testing year of 2002 which was the year NCLB was first implemented. Table 4.10 provides analysis of the change in the achievement gap between males and females for the state of Colorado; however, the achievement gap between males and females for the years of 2002, 2005, and 2007 were compared to the year 2003 due to a lack of data for 2002. As indicated in Table 4.10, no sustained significant change in the achievement gap was found between males and females at the fourth grade level in the content area of reading for any of the states included in this research. As a result of no sustained significant change in the achievement gap being found, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level

Table 4.10: Achievement Gap Disaggregated by Gender: Grade 4 Reading

Colorado: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	221 226	(1.2) (1.4)	-5	*P* = 0.0103
Male Female	2005 2005	221 227	(1.4) (1.5)	-6	*P* = 0.0037
Male Female	2003 2003	220 227	(1.5) (1.3)	-7	*P* = 0.0017
Male Female	2002 2002	‡ ‡	‡ ‡	‡	*P* = ‡
Change in Achievement Gap Between 2003 and 2007 Testing Years				**2**	***P* = 0.4989**
Kansas: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	221 228	(1.3) (1.4)	-7	*P* = 0.0009
Male Female	2005 2005	218 223	(1.2) (1.5)	-5	*P* = 0.0078
Male Female	2003 2003	216 224	(1.5) (1.3)	-8	*P* = 0.0001
Male Female	2002 2002	218 226	(1.6) (1.7)	-8	*P* = 0.0028
Change in Achievement Gap Between 2002 and 2007 Testing Years				**1**	***P* = 0.8033**
Missouri: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	216 225	(1.3) (1.3)	-9	*P* = 0.0000
Male Female	2005 2005	218 224	(1.4) (1.1)	-6	*P* = 0.0025
Male Female	2003 2003	219 226	(1.5) (1.4)	-7	*P* = 0.0007
Male Female	2002 2002	216 224	(1.5) (1.4)	-8	*P* = 0.0002
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-2**	***P* = 0.7608**
Nebraska: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	221 225	(1.5) (1.4)	-4	*P* = 0.0321
Male Female	2005 2005	219 224	(1.2) (1.4)	-5	*P* = 0.0232
Male Female	2003 2003	218 223	(1.3) (1.3)	-5	*P* = 0.0048
Male Female	2002 2002	218 225	(1.9) (1.8)	-7	*P* = 0.0122
Change in Achievement Gap Between 2002 and 2007 Testing Years				**1**	***P* = 0.5345**

Oklahoma: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	214 220	(1.2) (1.4)	-6	*P* = 0.0076
Male Female	2005 2005	211 217	(1.3) (1.2)	-6	*P* = 0.0005
Male Female	2003 2003	210 217	(1.5) (1.5)	-7	*P* = 0.0020
Male Female	2002 2002	210 217	(1.4) (1.4)	-7	*P* = 0.0005
Change in Achievement Gap Between 2002 and 2007 Testing Years				**1**	***P* = 0.5156**

since the implementation of NCLB is retained with α = 0.05 and for the subgroup of gender at the fourth grade level in the content area of reading.

Eighth grade NAEP data were available in the content area of reading disaggregated by gender for the tested years of 2002, 2003, 2005, and 2007 for the states of Kansas, Missouri, Nebraska, and Oklahoma. NAEP data for eighth grade reading disaggregated by gender were

Table 4.11: Achievement Gap Disaggregated by Gender: Grade 8 Reading

Colorado: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	262 271	(1.1) (1.4)	-9	*P* = 0.0000
Male Female	2005 2005	268 261	(1.3) (1.3)	7	*P* = 0.0000
Male Female	2003 2003	262 274	(1.5) (1.5)	-12	*P* = 0.0000
Male Female	2002 2002	‡ ‡	‡ ‡	‡	*P* = ‡
Change in Achievement Gap Between 2003 and 2007 Testing Years				**3**	***P* = 0.3717**
Kansas: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	263 272	(1.0) (1.0)	-9	*P* = 0.0000
Male Female	2005 2005	262 271	(1.2) (1.3)	-9	*P* = 0.0000
Male Female	2003 2003	260 272	(1.9) (1.3)	-12	*P* = 0.0000
Male Female	2002 2002	265 274	(1.7) (1.4)	-9	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**0**	***P* = 0.8285**

Missouri: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	259 268	(1.3) (1.1)	-9	*P* = 0.0000
Male Female	2005 2005	260 270	(1.3) (1.2)	-10	*P* = 0.0000
Male Female	2003 2003	263 271	(1.2) (1.3)	-8	*P* = 0.0000
Male Female	2002 2002	265 271	(1.2) (1.2)	-6	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-3**	***P* = 0.2066**
Nebraska: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	262 272	(1.2) (1.2)	-10	*P* = 0.0000
Male Female	2005 2005	261 274	(1.0) (1.3)	-13	*P* = 0.0000
Male Female	2003 2003	261 271	(1.1) (1.1)	-10	*P* = 0.0000
Male Female	2002 2002	267 274	(1.0) (1.3)	-7	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-3**	***P* = 0.2039**
Oklahoma: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Male Female	2007 2007	255 264	(1.1) (0.9)	-9	*P* = 0.0000
Male Female	2005 2005	254 265	(1.3) (1.2)	-11	*P* = 0.0000
Male Female	2003 2003	256 268	(1.2) (1.2)	-12	*P* = 0.0000
Male Female	2002 2002	257 267	(1.1) (1.2)	-10	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**1**	***P* = 0.5319**

available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2002 did not meet the reporting standards set for NAEP. The researcher began this data analysis with the 2002 testing year 2002 since it was the year NCLB was first implemented.

The analysis of the achievement disaggregated by gender in the area of eighth grade reading is provided in 4.11 for the states of Colorado, Kansas, Missouri, Nebraska, and

Oklahoma. The achievement gap between males and females in the area of eighth grade reading is statistically significant for all testing years and states included in this study.

Table 4.11 also provides an analysis of the change in the achievement gap between males and females each of the states of Kansas, Missouri, Nebraska, and Oklahoma for the years 2003, 2005, and 2007 as they relate to the year 2002 which was the year NCLB was first implemented. Table 4.11 also provides an analysis for the state of Colorado; however, the achievement gap between males and females for the years of 2005 and 2007 were compared the year 2003 due to a lack of data for 2002. With no statistically significant difference indicated in the achievement gap 2002 and testing year 2007 for the states of Kansas, Missouri, Nebraska, and Oklahoma and 2003 and 2007 for the state of Colorado; no sustained statistically significant change was found. As a result of no sustained significant change in the achievement gap being found for any of the tested states, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained at an $\alpha = 0.05$ and $p > 0.05$ for the subgroup of gender at the eighth grade level in the content area of reading.

Achievement Gap – Race

Achievement Gap in Science Disaggregated by Race

The adjusted national level NAEP data provided in Table 4.12 indicates a significant difference in the level of achievement disaggregated by race in the area of science for the 2000 and 2005 testing years at the fourth grade level. The achievement gap between White and African-American and White and Hispanic-American fourth grade students was significant at an $\alpha = 0.05$ for both tested years with Whites scoring higher on the average scale score than both minority groups. The achievement gap between African-American and Hispanic-American was

Table 4.12: Change in Achievement Gap Disaggregated by Race: Grade 4 Science

Adjusted National Level Data					
	Testing Year	**Average Scale Score**	**Difference Between Average Scale Scores**	**Standard Error**	**P-value**
White	2005	160.41	30.85	(1.33)	*P* = 0.0001
African-Americans	2005	129.56			
White	2000	159.16	32.62	(0.39)	*P* = 0.0001
African-Americans	2000	126.54			
Change in Achievement Gap			-1.77		*P* = 0.2076
	Testing Year	**Average Scale Score**	**Difference Between Average Scale Scores**	**Standard Error**	**P-value**
White	2005	160.41	26.39	(1.52)	*P* = 0.0001
Hispanic-Americans	2005	134.02			
White	2000	159.16	31.54	(3.05)	*P* = 0.0001
Hispanic-Americans	2000	127.62			
Change in Achievement Gap			-5.15		*P* = 0.2698
	Testing Year	**Average Scale Score**	**Difference Between Average Scale Scores**	**Standard Error**	**P-value**
African-Americans	2005	129.56	-4.46	(1.60)	*P* = 0.0001
Hispanic-Americans	2005	134.02			
African-Americans	2000	126.54	-1.08	(2.48)	*P* = 0.6704
Hispanic-Americans	2000	127.62			
Change in Achievement Gap			-3.38		*P* = 0.2612

only significant for the 2007 testing year with Hispanic-American scoring higher than African-American students. Table 4.12 also provides data showing the change in the achievement gap disaggregated by race at the fourth grade level between the average scale science scores from testing done in 2000 and the 2005 testing year. As shown in Table 4.12 the difference in the achievement gap between White and African-American, White and Hispanic-American, and African-American and Hispanic-American fourth grade students was not significantly different from the 2000 to 2005 testing years. As a result of no sustained significant change in the achievement gap between White and African-American, White and Hispanic-American or African-American and Hispanic-American students from the 2000 to 2005 testing years, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained at an α = 0.05 between these three categories from the subgroup of race at the fourth grade level in the content area of science.

Table 4.13: Achievement Disaggregated by Race: Grade 8 Science

Adjusted National Level Data					
	Testing Year	**Average Scale Score**	**Difference Between Average Scale Scores**	**Standard Error**	**P-value**
White African-Americans	2005 2005	159.59 125.24	34.35	(1.05)	*P* = 0.0001
White African-Americans	2000 2000	157.68 124.21	33.47	(2.47)	*P* = 0.0001
Change in Achievement Gap			0.88		*P* = 0.7741
	Testing Year	**Average Scale Score**	**Difference Between Average Scale Scores**	**Standard Error**	**P-value**
White Hispanic-Americans	2005 2005	159.59 130.12	29.47	(1.52)	*P* = 0.0001
White Hispanic-Americans	2000 2000	157.68 125.94	31.74	(3.08)	*P* = 0.0001
Change in Achievement Gap			-2.27		*P* = 0.5766
	Testing Year	**Average Scale Score**	**Difference Between Average Scale Scores**	**Standard Error**	**P-value**
African-Americans Hispanic-Americans	2005 2005	125.24 130.12	-4.88	(3.67)	*P* = 0.1968
African-Americans Hispanic-Americans	2000 2000	124.21 125.94	-1.73	(2.06)	*P* = 0.4171
Change in Achievement Gap			-3.15		*P* = 0.5322

The adjusted national level data provided in Table 4.13 indicates a significant difference in the level of achievement disaggregated by race in the area of science for the 2000 and 2005 testing years at the eighth grade level. The achievement gap between White and African-American and White and Hispanic-American eighth grade students was significant with α = 0.05 and $p < 0.05$ for both tested years with Whites scoring higher on the average scale score than both minority groups. There was no statistically significant difference in achievement between African-American and Hispanic-American students was identified for either testing year. Table

4.13 also provides data showing the difference in the achievement gap disaggregated by race at the eighth grade level between the average scale science scores from testing done in 2000 and the 2005 testing year.   No statistically significant change was identified in the achievement gap between any of the subgroups

As a result of no sustained significant change in the achievement gap from 2000 and 2005, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained with $\alpha = 0.05$ and $p > 0.05$ between the categories of White and African-American and White and Hispanic-American students from the subgroup of race at the eighth grade level in the content area of science.

Achievement Gap in Math Disaggregated by Race

Fourth grade NAEP data were available in the content area of math disaggregated by race for the tested years of 2000, 2003, 2005, and 2007 for the states of Kansas, Nebraska, and Oklahoma for the three member categories for this subgroup (White, African-American, and Hispanic-American students). NAEP data for fourth grade math disaggregated by race were also available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2000 did not meet the reporting standards set for NAEP. NAEP data for fourth grade math disaggregated by race were also available for the state of Missouri for a comparison between White and African-American students for the tested years of 2000, 2003, 2005, and 2007. Data for the Hispanic-American were only available for the tested years of 2003, 2005, and 2007 because the data for 2000 did not meet the reporting standards set for NAEP.

Figure F.1 (Appendix F) provides an analysis of the achievement gap between White and African-American students, White and Hispanic-American and African-American and Hispanic-American students. The achievement gap between White and African-American students for all five states was significant at an $\alpha = 0.05$ and $p < 0.05$ for each year data were available for fourth grade math. The difference in achievement between White and African-American students ranged from a difference of 22 to a difference of 37 (Average Difference between the Average Scale Scores = 27.1) with White students scoring higher than their African-American counterparts. The analysis of the achievement gap between White and Hispanic-American students for all five states was significant with $\alpha = 0.05$ and $p < 0.05$ for each year data were available for fourth grade math. The difference in achievement between White and Hispanic-American students ranged from a difference of 11 to a difference of 26 (Average Difference between the Average Scale Scores = 20.1) with White students scoring higher than their Hispanic-American counterparts. The difference in achievement between African-American and Hispanic-American students ranged from a difference of 0 to a difference of 16 (Average Difference between the Average Scale Scores = 6.7) with Hispanic-American students scoring the same or higher than African-American students. The difference in achievement between African-American and Hispanic-American students was significant at an $\alpha = 0.05$ for Kansas in 2003, Missouri in 2003 and 2007 and Nebraska in 2005.

Figure F.1 also provides an analysis of the achievement gap between White and African-American, students from each of the states of Kansas, Missouri, Nebraska, and Oklahoma for the years 2003, 2005, and 2007 as they relate to the testing year of 2000 which was the last year tested prior to the implementation of NCLB. Figure F.1 also provides an analysis for the state of Colorado; however, the achievement gap between White, African-American, and Hispanic-

American students for the years of 2005 and 2007 were compared to the 2003 testing year due to a lack of data for 2000. The analysis of the achievement gap between Whites and African-American students and African-American and Hispanic-American students for the state of Missouri for the years of 2005 and 2007 were compared to the 2003 testing year due to a lack of data for Hispanic-American students from the 2000 testing year. The analysis of the change in the achievement gap between White and African-American students and White and Hispanic-American students for the states of Colorado, Kansas, Nebraska, and Oklahoma showed no sustained significant change in the achievement gap at an $\alpha = 0.05$ and $p > 0.05$ between any of the categories for any of the years data were available. As a result of no sustained significant change in the achievement gap being found for this subgroup in any of the tested states, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained with $\alpha = 0.05$ and $p > 0.05$ for the subgroup of race at the fourth grade level in the content area of math. The change in the achievement gap between African-American and Hispanic-American students is also included in Figure F.1. A statistically significant change was identified for the state of Oklahoma with African-American students' scores improving between the 2002 and 2009 testing years. No statistically significant change in the achievement gap between African-American and Hispanic-American students was identified for the other states in this research.

Eighth grade NAEP data were available in the content area of math disaggregated by race for the tested years of 2000, 2003, 2005, and 2007 for the states of Kansas, Nebraska, and Oklahoma for the three member categories for this subgroup (White, African-American, and Hispanic-American students). NAEP data for eighth grade math disaggregated by race were also available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2000 did not meet the reporting standards set for NAEP. NAEP data for eighth grade math disaggregated by race were also available for the state of Missouri for a comparison between White and African-American students for the tested years of 2000, 2003, 2005, and 2007. Data for the state of Missouri for the Hispanic-American students were only available for the tested year of 2007 because the data for 2000, 2003, and 2005 did not meet the reporting standards set for NAEP.

Figure G.1 (Appendix G) provides an analysis of the achievement gap between White and African-American students, White and Hispanic-American students, and African-American and Hispanic-American students. The achievement gap between White and African-American students for all five states was significant at an $\alpha = 0.05$ and $p < 0.05$ for each year data were available for eighth grade math. The difference in achievement between White and African-American students ranged from a difference of 22 to a difference of 51 (Average Difference between the Average Scale Scores = 35) with White students scoring higher than their African-American counterparts. The analysis of the achievement gap between White and Hispanic-American students for the all five states was significant with $\alpha = 0.05$ and $p < 0.05$ each year data were available for eighth grade math. The difference in achievement between White and Hispanic-American students ranged from a difference of 21 to a difference of 43 (Avg. Diff. = 28) with White students scoring higher than their Hispanic-American counterparts. The analysis of the achievement gap between African-American and Hispanic-American students for the all five states was significant at an $\alpha = 0.05$ and $p < 0.05$ for Colorado in 2007 with African-American students scoring higher, Kansas in 2003, Missouri in 2007, Nebraska in 2005 and 2007, and Oklahoma in 2000 with Hispanic-American students scoring higher for these four states. The difference in achievement between White and Hispanic-American students ranged from a difference of 2 to a difference of 21 (Average Difference between the Average Scale Scores = 9.9).

Figure G.1 also provides an analysis of the change in achievement gap in eighth grade math between White, African-American, and Hispanic-American students from each of the states of Kansas, Nebraska, and Oklahoma for the years 2003, 2005, and 2007 as they relate to the testing year of 2000 which was the year NCLB was first implemented. Figure G.1 also provides an analysis for the state of Colorado; however, the achievement gap between White, African-American, and Hispanic-American students for the years of 2005 and 2007 were compared the year 2003 due to a lack of data for 2000. Data from the state of Missouri were not available for an analysis of the difference in the achievement gap between Hispanic-American students and the other two members of this subgroup because only the 2007 testing year provided enough data to meet the reporting standards set for NAEP. Sufficient data were available for the state of Missouri for an analysis of the achievement gap between White and African-American students for the years 2003, 2005, and 2007 as they relate to the year testing year of 2000.

The analysis between White and African-American students for the states of Kansas, Missouri, and Oklahoma shows no significant change in the achievement gap at an $\alpha = 0.05$ and $p > 0.05$ between the years data were available. The analysis of the achievement gap between White and African-American students from the state of Colorado indicated a significant decrease in the achievement gap from testing year 2000 to 2007 (Difference between the Average Scale Scores = 13; $p = 0.0018$). The analysis of the achievement gap between White and African-American students from the state of Nebraska indicated a significant increase in the achievement gap from testing year 2000 to 2007 (Difference between the Average Scale Scores = 13; p =

0.0017). The analysis of the achievement gap between White and Hispanic-American students for the states of Colorado, Kansas, Nebraska and Oklahoma shows no significant change at an $\alpha = 0.05$ and $p > 0.05$ for any of the years data were available.

No significant change in the achievement gap between White and African-American students from the states of Kansas, Missouri, and Oklahoma was identified which indicates no sustained significant change in the achievement gap between these two categories of this subgroup with $\alpha = 0.05$ and $p > 0.05$. No significant change in the achievement gap between White and Hispanic-American students from the states of Colorado, Kansas, Nebraska, and Oklahoma was identified which indicates no sustained significant change in the achievement gap between these two categories of this subgroup with $\alpha = 0.05$ and $p > 0.05$. No significant change in the achievement gap between African-American and Hispanic-American students from the state of Kansas was identified. A significant decrease in the achievement between African-American and Hispanic-American students was identified for the states of Colorado and Oklahoma while a significant decrease in the achievement gap was found for the state of Nebraska between these two groups.

Since no sustained significant change was present between White and African-American students from the states of Kansas, Missouri, and Oklahoma; the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained at an $\alpha = 0.05$ and $p > 0.05$ for the states of Kansas, Missouri, and Oklahoma between White and African-American students at the eighth grade level in the content area of math. Since a significant decrease was identified between White and African-American students and Hispanic-American students from the state of Colorado between the testing years 2003 and

2007; the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is rejected with α = 0.05 and $p < 0.05$ for the state of Colorado. Since a significant decrease was identified between African-American students and Hispanic-American students from the state of Oklahoma between the testing years 2000 and 2007; the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is rejected with α = 0.05 and $p < 0.05$ for the state of Oklahoma at the eighth grade level in the content area of math. Since a significant increase was identified between White and African-American and African-American and Hispanic-American students from the state of Nebraska between the testing years 2000 and 2007; the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is rejected with α = 0.05 and $p < 0.05$ for the state of Nebraska between White and African-American students at the eighth grade level in the content area of math.

Achievement Gap in Reading Disaggregated by Race

Fourth grade NAEP data were available in the content area of reading disaggregated by race for the tested years of 2002, 2003, 2005, and 2007 for the states of Kansas, Nebraska, and Oklahoma for the three member categories for this subgroup (White, African-American, and Hispanic-American students). NAEP data for fourth grade reading disaggregated by race were also available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2002 did not meet the reporting standards set for the NAEP. NAEP data for fourth grade reading disaggregated by race were also available for the state of Missouri for a comparison between White and African-American students for the tested years of 2002, 2003, 2005, and 2007. Data for the Hispanic-American students from Missouri were only available for the tested years of 2003, 2005, and 2007 because the data for 2002 did not meet the reporting standards set for NAEP.

Figure H.1 (Appendix H) provides an analysis of the achievement gap between White and African-American students, White and Hispanic-American students, and African-American and Hispanic-American students. The achievement gap between White and African-American students for all five states was significant with $\alpha = 0.05$ and $p < 0.05$ for each year data were available for fourth grade reading. The difference in achievement between White and African-American students ranged from a difference of 17 to a difference of 36 (Average Difference between the Average Scale Scores = 25.5) with White students scoring higher than their African-American counterparts. The analysis of the achievement gap between White and Hispanic-American students for the states of Colorado, Kansas, Nebraska, and Oklahoma was significant with $\alpha = 0.05$ and $p < 0.05$ each year data were available for fourth grade reading. There was no significant difference in achievement in fourth grade reading between White and Hispanic-American students from Missouri during the 2003 testing year ($\alpha = 0.05$; $p > 0.05$); however, in the 2005 and 2007 a significant difference ($\alpha = 0.05$; $p < 0.05$) was found between White and Hispanic-American students. The difference in achievement between White and Hispanic-American students ranged from a difference of 9 to a difference of 30 (Average Difference between the Average Scale Scores = 21.4) with White students scoring higher than their Hispanic-American counterparts. A statistically significant difference in achievement between African-American and Hispanic-American students was identified in Kansas for testing year

2003, Missouri for testing years 2003 and 2007, and Nebraska for testing year 2005 with Hispanic-American students scoring higher than African-American students in each state. No other statistically significant difference was identified for any state in the other testing years examined in this research.

Figure H.2 (Appendix H) provides an analysis of the change in the achievement gap between White, African-American, and Hispanic-American students from each of the states of Kansas, Nebraska, and Oklahoma for the years 2003, 2005, and 2007 as they relate to the year testing year of 2002 which was the year NCLB was first implemented. The analysis of the achievement gap between White, African-American, and Hispanic-American students for the years of 2002, 2005, and 2007 were compared to the 2003 testing year for the states of Colorado and Missouri due to the lack of a complete data set from these two states for testing year 2002. The analysis between White and African-American students, White and Hispanic-American students, and African-American and Hispanic-American students for the states of Colorado, Kansas, and Missouri had no significant change in the achievement gap with $\alpha = 0.05$ and $p > 0.05$ for any of the years data were available. The analysis of the achievement gap between White and African-American students from the state of Nebraska indicated a statistically significant change between testing years 2002 and 2007 (Difference between the Average Scale Scores = 19; $p = 0.0114$). Since there was a statistically significant increase in the achievement gap identified in the state of Nebraska, the researcher considered this a sustained significant change in the area of fourth grade reading with African-Americans falling further behind their White counterparts. The achievement gap between White and African-American students in the state of Oklahoma did show a significant decrease (Difference between the Average Scale Scores = 13; $p = 0.0076$) and a significant decrease in the achievement gap between African-American and Hispanic-American students (Difference between the Average Scale Scores = 15; p = 0.0254). Since there was a statistically significant decrease in the achievement gap identified in the state of Oklahoma, the researcher considered this a sustained significant decrease in the achievement gap between White and African-American students and African-American and Hispanic-American students in the area of fourth grade reading. The change in the achievement gap between White and Hispanic-American students for the states of Nebraska and Oklahoma did not have a significant change in the achievement gap for any of the years data were available with $\alpha = 0.05$ and $p > 0.05$.

As a result of no sustained significant change in the achievement gap being found for this subgroup in the states of Colorado, Kansas, and Missouri; the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained with $\alpha = 0.05$ and $p > 0.05$ for the subgroup of race at the fourth grade level in the content area of reading for these three states. The states of Nebraska and Oklahoma showed no sustained significant change in the achievement gap between White and Hispanic-American students resulting in the retention of the null hypothesis, that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained with $\alpha = 0.05$ and $p > 0.05$ between White and Hispanic-American students in the area of fourth grade reading for these two states. Since the achievement gap between White and African-American students from the state of Nebraska sustained a significant increase from 2002 through 2007, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is rejected at an $\alpha = 0.05$ and $p < 0.05$ between White and African-American students from the state of Nebraska in eighth grade reading. Since the achievement gap between White and African-American students and African-American and Hispanic-American students from the state of Oklahoma sustained a significant decrease from 2002 through 2007, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is rejected at an $\alpha = 0.05$ and $p < 0.05$ between White and African-American students from the state of Oklahoma in eighth grade reading.

Eighth grade NAEP data were available in the content area of reading disaggregated by race for the tested years of 2002, 2003, 2005, and 2007 for the states of Kansas, Nebraska, and Oklahoma for the three member categories for this subgroup (White, African-American, and Hispanic-American students). NAEP data for eighth grade reading disaggregated by race were also available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2002 did not meet the NAEP reporting standards. NAEP data for eighth grade math disaggregated by race were also available for the state of Missouri for a comparison between White and African-American students for the tested years of 2002, 2003, 2005, and 2007. Data for the Hispanic-American students from Missouri were only available for the tested years of 2005 and 2007 because the data for 2002 and 2003 did not meet the reporting standards set for NAEP.

Figure I.1 (Appendix I) provides an analysis of the achievement between White and African-American students, White and Hispanic-American students, and African-American and Hispanic-American students. The achievement gap between White and African-American students for all five states was significant with $\alpha = 0.05$ and $p < 0.05$ for each year data were available for eighth grade. The difference in achievement between White and African-American students ranged from a difference of 19 to a difference of 32 (Average Difference between the Average Scale Scores = 26.4) with White students scoring higher than their African-American counterparts. The analysis of the achievement gap between White and Hispanic-American students for the states of Colorado, Kansas, Nebraska, and Oklahoma was significant with $\alpha = 0.05$ and $p < 0.05$ each year data were available for eighth grade reading. There was no significant difference ($\alpha = 0.05$; $p > 0.05$) in achievement between White and Hispanic-American students from Missouri during the 2005 testing year but a significant difference was identified between these two categories of this subgroup during the 2007 testing year at an $\alpha = 0.05$ and $p < 0.05$. The difference in achievement between White and Hispanic-American students ranged from a difference of 12 (Missouri 2005 with no significant difference $p > 0.05$) to a difference of 30 (Average Difference between the Average Scale Scores = 22.4) with White students scoring higher than their Hispanic-American counterparts. A statistically significant difference in achievement between African-American and Hispanic-American students was identified in Kansas for testing year 2003, Missouri for testing year 2005, and Nebraska for testing year 2007 with Hispanic-American students scoring higher than African-American students in each state. No other statistically significant difference was identified for any state in the other testing years examined in this research.

Figure I.1 also provides an analysis in the change of the achievement gap between White, African-American, and Hispanic-American students from each of the states of Kansas, Nebraska, and Oklahoma for the years 2003, 2005, and 2007 as they relate to the year testing year of 2002 which was the first year NCLB was implemented. Figure I.1 also provides an analysis for the state of Colorado; however, the achievement gap between White, African-American, and Hispanic-American students for the years of 2005 and 2007 were compared to the year 2003 due to a lack of data for 2002. Data for the state of Missouri were only available for a comparison between White and African-American for the years 2003, 2005, and 2007 as they relate to the year testing year of 2002. The comparison between White and Hispanic-American students and African-American and Hispanic-American students was only available between the testing years of 2005 and 2007 due to a lack of data for the 2002 and 2003 testing years so analysis of the change in the achievement gap was not done for these two categories.

The analysis between White and African-American students and White and Hispanic-American students for the states of Colorado, Kansas, Missouri, Nebraska, and Oklahoma had no sustained significant change in the achievement gap between any of the categories for any of the years data were available at an $\alpha = 0.05$ and $p > 0.05$. The analysis between African-American and Hispanic-American students for the states of Colorado, Kansas, Nebraska, and Oklahoma had no sustained significant change in the achievement gap between any of the categories for any of the years data were available at an $\alpha = 0.05$ and $p > 0.05$. As a result of no sustained significant change in the achievement gap being found for this subgroup in the states of Colorado, Kansas, Missouri, Nebraska, and Oklahoma; the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained with $\alpha = 0.05$ and $p > 0.05$ for the subgroup of race at the eighth grade level in the content area of reading for all five states.

Achievement Gap – Socioeconomic Status (SES)

Achievement Gap in Science Disaggregated by SES

The adjusted national level data provided in Table 4.14 indicates a significant difference in the level of achievement disaggregated by socioeconomic status (SES) in the area of science for the 2000 and 2005 testing years at the fourth grade level. As seen in Table 4.14, the achievement gap was significant at an $\alpha = 0.05$ and $p < 0.05$ for both testing years with students not eligible for free lunches scoring higher on the average scale score than students who were eligible for free lunches. The analysis of the change in the achievement gap in fourth grade science at the adjusted national level between the 2000 to 2005 testing years is also provided in Table 4.14. The change in the achievement gap is not significantly different between the testing 2000 and 2005 testing years (Difference between the Average Scale Scores = -2.07; $p = 0.1314$).

Table 4.14: Achievement Gap Disaggregated by SES: Grade 4 Science

Adjusted National Level Data					
	Testing Year	**Average Scale Score**	**Difference Between Average Scale Scores**	**Standard Error**	**P-value**
Not Eligible	2005	161.08	23.17	(1.48)	*P* = 0.0001
Eligible	2005	137.91			
Not Eligible	2000	159.81	25.24	(1.08)	*P* = 0.0001
Eligible	2000	134.57			
Change in Achievement Gap			-2.07		*P* = 0.1314

As a result of no sustained significant change in the achievement gap in science at the fourth grade level from 2000 to 2005 results in the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB being retained at an $\alpha = 0.05$ and $p > 0.05$ for the subgroup of SES at the fourth grade level in the content area of science at the adjusted national level

The adjusted national level data provided in Table 4.15 indicates a significant difference in the level of achievement disaggregated by SES in the area of science for the 2000 and 2005 testing years at the eighth grade level. As seen in Table 4.15, the achievement gap was significant with $\alpha = 0.05$ and $p < 0.05$ for both testing years with students not eligible for free

Table 4.15: Achievement Gap Disaggregated by SES: Grade 8 Science

Adjusted National Level Data					
	Testing Year	**Average Scale Score**	**Difference Between Average Scale Scores**	**Standard Error**	**P-value**
Not Eligible	2005	158.31	23.92	(0.96)	*P* = 0.0001
Eligible	2005	134.39			
Not Eligible	2000	156.94	25.33	(1.08)	*P* = 0.0001
Eligible	2000	131.61			
Change in Achievement Gap			-1.41		*P* = 0.3194

lunches scoring higher on the average scale score than students who were eligible for free lunches. The analysis of the change in the achievement gap in eighth grade science at the adjusted national level between the 2000 to 2005 testing years is also provided in Figure Table 4.15. As a result of no sustained significant change in the achievement gap in science at the eighth grade from 2000 to 2005 results in the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB being retained with $\alpha = 0.05$ and $p > 0.05$ for the subgroup of SES at the eighth grade level in the content area of science at the adjusted national level.

Achievement Gap in Math Disaggregated by SES

Fourth grade NAEP data were available in the content area of math disaggregated by socioeconomic status (SES) for the tested years of 2000, 2003, 2005, and 2007 for the states of Kansas, Missouri, Nebraska, and Oklahoma. NAEP data for fourth grade math disaggregated by

SES were also available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2000 did not meet the reporting standards set for NAEP.

Table 4.16 provides an analysis of the achievement gap between students who were eligible for free lunches (eligible) and students who were not eligible (non-eligible) for free lunches. The achievement gap between eligible and non-eligible students was significant at an α = 0.05 and $p < 0.05$ for all states in the study and each year data were available for fourth grade math. Table 4.16 also provides an analysis in the change of the achievement gap between eligible and non-eligible students from Kansas, Missouri, Nebraska, and Oklahoma for the years 2003, 2005, and 2007 as they relate to the year testing year of 2000 which was the last year tested prior to the year NCLB was first implemented. Table 4.16 provides an analysis for the state of Colorado; however, the achievement gap between eligible and non-eligible students for the years of 2005 and 2007 were compared to the 2003 testing year due to a lack of data for 2000. The analysis of the change in the achievement gap between eligible and non-eligible students for the states of Colorado, Kansas, Missouri, Nebraska, and Oklahoma had no sustained significant change in the achievement gap with α = 0.05 and $p > 0.05$ in fourth grade math for any of the years data were available. As a result of no sustained significant change in the

Table 4.16: Achievement Gap Disaggregated by SES: Grade 4 Math

Colorado: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	251 225	(1.3) (0.9)	26	*P* = 0.1030
Not-Eligible Eligible	2005 2005	248 224	(1.4) (1.1)	24	*P* = 0.0843
Not-Eligible Eligible	2003 2003	243 219	(1.7) (1.1)	24	*P* = 0.0247
Not-Eligible Eligible	2000 2000	‡ ‡	‡ ‡	‡	*P* = ‡
Change in Achievement Gap Between 2003 and 2007 Testing Years				2	*P* = 0.5280

Kansas: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	255 237	(1.2) (0.8)	18	*P* = 0.0000
Not-Eligible Eligible	2005 2005	254 235	(0.8) (1.1)	19	*P* = 0.0000
Not-Eligible Eligible	2003 2003	249 231	(0.9) (1.1)	18	*P* = 0.0000
Not-Eligible Eligible	2000 2000	240 218	(2.8) (1.2)	22	*P* = 0.0000
Change in Achievement Gap Between 2000 and 2007 Testing Years				-4	*P* = 0.2644
Missouri: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	247 228	(1.0) (1.1)	19	*P* = 0.0000
Not-Eligible Eligible	2005 2005	243 225	(1.0) (1.1)	18	*P* = 0.0000
Not-Eligible Eligible	2003 2003	243 224	(1.0) (1.1)	19	*P* = 0.0000
Not-Eligible Eligible	2000 2000	236 213	(1.7) (1.2)	23	*P* = 0.0000
Change in Achievement Gap Between 2000 and 2007 Testing Years				-4	*P* = 0.1301
Nebraska: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	246 225	(1.6) (0.9)	21	*P* = 0.0000
Not-Eligible Eligible	2005 2005	246 225	(1.1) (1.0)	21	*P* = 0.0000
Not-Eligible Eligible	2003 2003	244 222	(1.2) (0.9)	22	*P* = 0.0000
Not-Eligible Eligible	2000 2000	235 210	(2.2) (1.7)	25	*P* = 0.0000
Change in Achievement Gap Between 2000 and 2007 Testing Years				-4	*P* = 0.3122
Oklahoma: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	245 230	(0.9) (0.8)	15	*P* = 0.0000
Not-Eligible Eligible	2005 2005	243 227	(1.0) (1.3)	16	*P* = 0.0000
Not-Eligible Eligible	2003 2003	239 223	(1.3) (1.0)	16	*P* = 0.0000
Not-Eligible Eligible	2000 2000	233 215	(1.4) (1.0)	18	*P* = 0.0000
Change in Achievement Gap Between 2000 and 2007 Testing Years				-3	*P* = 0.3018

achievement gap being found for this subgroup in any of the tested states, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained with $\alpha = 0.05$ and $p > 0.05$ for the subgroup of SES at the fourth grade level in the content area of math.

Eighth grade NAEP data were available in the content area of math disaggregated by SES for the tested years of 2000, 2003, 2005, and 2007 for the states of Kansas, Missouri, Nebraska, and Oklahoma. NAEP data for eighth grade math disaggregated by SES were also available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2000 did not meet the reporting standards set for NAEP. Table 4.17 provides an analysis of the achievement between eligible and non-eligible students. The achievement gap between eligible and non-eligible students for all five states was significant with $\alpha = 0.05$ and $p < 0.05$ for each year data were available for eighth grade math.

Table 4.17 also provides an analysis in the change of the achievement gap between eligible and non-eligible students from Kansas, Missouri, Nebraska, and Oklahoma for the years 2003, 2005, and 2007 as they relate to the year testing year of 2000 which was the last year tested prior to the year NCLB was first implemented. Table 4.17 provides an analysis for the

Table 4.17: Achievement Gap Disaggregated by SES: Grade 8 Math

Colorado: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible	2007	296	(1.1)	29	*P = 0.0000*
Eligible	2007	267	(1.2)		
Not-Eligible	2005	290	(1.1)	29	*P = 0.0000*
Eligible	2005	261	(2.1)		
Not-Eligible	2003	292	(1.4)	30	*P = 0.0000*
Eligible	2003	262	(1.2)		
Not-Eligible	2000	‡	-	‡	*P = ‡*
Eligible	2000	‡	-		
Change in Achievement Gap Between 2003 and 2007 Testing Years				**-1**	***P = 0.5168***

Kansas: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	299 275	(1.0) (1.5)	24	*P = 0.0000*
Not-Eligible Eligible	2005 2005	293 270	(1.1) (1.6)	23	*P = 0.0000*
Not-Eligible Eligible	2003 2003	291 270	(1.3) (1.9)	21	*P = 0.0000*
Not-Eligible Eligible	2000 2000	289 265	(4.4) (1.8)	24	*P = 0.0001*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**0**	***P = 0.8798***
Missouri: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	290 266	(1.2) (1.0)	24	*P = 0.0000*
Not-Eligible Eligible	2005 2005	286 262	(1.5) (1.5)	24	*P = 0.0000*
Not-Eligible Eligible	2003 2003	286 263	(1.8) (1.1)	23	*P = 0.0000*
Not-Eligible Eligible	2000 2000	279 250	(2.6) (1.2)	29	*P = 0.0000*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-5**	***P = 0.1852***
Nebraska: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	293 265	(1.0) (1.6)	28	*P = 0.0000*
Not-Eligible Eligible	2005 2005	291 268	(1.1) (1.3)	23	*P = 0.0000*
Not-Eligible Eligible	2003 2003	290 265	(1.1) (1.3)	25	*P = 0.0000*
Not-Eligible Eligible	2000 2000	287 260	(1.3) (2.1)	27	*P = 0.0000*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**1**	***P = 0.8630***
Oklahoma: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	285 264	(1.2) (1.2)	21	*P = 0.0000*
Not-Eligible Eligible	2005 2005	283 260	(1.2) (1.1)	23	*P = 0.0000*
Not-Eligible Eligible	2003 2003	282 260	(1.1) (1.5)	22	*P = 0.0000*
Not-Eligible Eligible	2000 2000	277 258	(1.2) (1.8)	19	*P = 0.0000*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**2**	***P = 0.6040***

state of Colorado; however, the achievement gap between eligible and non-eligible students for the years of 2005 and 2007 were compared to the 2003 testing year due to a lack of data for

2000. The analysis of the change in the achievement gap between eligible and non-eligible students for the states of Colorado, Kansas, Missouri, Nebraska, and Oklahoma had no sustained significant change in the achievement gap at an $\alpha = 0.05$ and $p > 0.05$ in eighth grade math for any of the years data were available. As a result of no sustained significant change in the achievement gap being found for this subgroup in any of the tested states, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained with $\alpha = 0.05$ and $p > 0.05$ for the subgroup of SES at the eighth grade level in the content area of math.

Achievement Gap in Reading Disaggregated by SES

Fourth grade NAEP data were available in the content area of reading disaggregated by socioeconomic status (SES) for the tested years of 2002, 2003, 2005, and 2007 for the states of Kansas, Missouri, Nebraska, and Oklahoma. NAEP data for fourth grade reading disaggregated

Table 4.18: Achievement Gap Disaggregated by SES: Grade 4 Reading

Colorado: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	235 206	(1.1) (1.4)	29	*P* = 0.0000
Not-Eligible Eligible	2005 2005	232 208	(1.1) (1.6)	24	*P* = 0.0000
Not-Eligible Eligible	2003 2003	231 207	(1.4) (1.5)	24	*P* = 0.0000
Not-Eligible Eligible	2002 2002	‡ ‡	‡ ‡	‡	*P* = ‡
Change in Achievement Gap Between 2003 and 2007 Testing Years				**5**	***P* = 0.5280**
Kansas: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	233 212	(1.0) (1.6)	21	*P* = 0.0000
Not-Eligible Eligible	2005 2005	230 208	(1.4) (1.6)	22	*P* = 0.0000
Not-Eligible Eligible	2003 2003	230 206	(1.4) (1.3)	24	*P* = 0.0000
Not-Eligible Eligible	2002 2002	230 211	(1.8) (1.4)	19	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**2**	***P* = 0.2644**

Missouri: 4th Grade Reading					
	Testing Year	Average Scale Score	Standard Error	Difference Between Average Scale Scores	P-value
Not-Eligible Eligible	2007 2007	230 208	(1.4) (1.3)	22	*P* = 0.0000
Not-Eligible Eligible	2005 2005	231 209	(1.1) (1.4)	22	*P* = 0.0000
Not-Eligible Eligible	2003 2003	232 208	(1.2) (1.6)	24	*P* = 0.0000
Not-Eligible Eligible	2002 2002	231 205	(1.1) (1.8)	26	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-4**	***P* = 0.1301**

Nebraska: 4th Grade Reading					
	Testing Year	Average Scale Score	Standard Error	Difference Between Average Scale Scores	P-value
Not-Eligible Eligible	2007 2007	232 208	(1.0) (2.0)	24	*P* = 0.0000
Not-Eligible Eligible	2005 2005	232 205	(1.5) (1.3)	27	*P* = 0.0000
Not-Eligible Eligible	2003 2003	229 207	(1.3) (1.6)	22	*P* = 0.0000
Not-Eligible Eligible	2002 2002	230 209	(1.8) (2.0)	21	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**3**	***P* = 0.3122**

Oklahoma: 4th Grade Reading					
	Testing Year	Average Scale Score	Standard Error	Difference Between Average Scale Scores	P-value
Not-Eligible Eligible	2007 2007	227 209	(1.0) (1.1)	18	*P* = 0.0000
Not-Eligible Eligible	2005 2005	225 205	(1.4) (1.2)	20	*P* = 0.0000
Not-Eligible Eligible	2003 2003	227 204	(1.1) (1.6)	23	*P* = 0.0000
Not-Eligible Eligible	2002 2002	227 203	(1.0) (1.3)	24	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-6**	***P* = 0.3018**

by SES were also available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2002 did not meet the reporting standards set for NAEP. Table 4.18 provides an analysis of the achievement gap between students who were eligible for free lunches (eligible) and students who were not eligible (non-eligible) for free lunches. The achievement gap between eligible and non-eligible students was significant at an $\alpha = 0.05$ for all states and each year data were available for fourth grade reading.

Table 4.18 also provides an analysis in the change of the achievement gap between eligible and non-eligible students from Kansas, Missouri, Nebraska, and Oklahoma for testing year 2007 related to the year testing year of 2002 which was the year NCLB was first implemented. Table 4.18 provides an analysis for the state of Colorado; however, the achievement gap between eligible and non-eligible students for the 2007 testing year was compared to the 2003 testing year due to a lack of data for 2002. The analysis of the change in the achievement gap between eligible and non-eligible students for the states of Colorado, Kansas, Missouri, and Nebraska had no sustained significant change in the achievement gap at an $\alpha = 0.05$ in fourth grade reading for any of the years data were available. As a result of no sustained significant change in the achievement gap being found for this subgroup in the states of Colorado, Kansas, Missouri, and Nebraska; the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained at an $\alpha = 0.05$ and $p > 0.05$ for the subgroup of SES at the fourth grade level in the content area of reading for these four states. Oklahoma did have a small but statistically significant decrease in the achievement gap in fourth grade reading between testing year 2002 and testing year 2007 which the researcher considers a sustained significant change. As a result of the sustained significant change in the achievement gap being found for this subgroup in the state of Oklahoma; the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is rejected with $\alpha = 0.05$ and $p < 0.05$ for the subgroup of SES at the fourth grade level in the content area of reading for the state of Oklahoma.

Eighth grade NAEP data were available in the content area of reading disaggregated by SES for the tested years of 2002, 2003, 2005, and 2007 for the states of Kansas, Missouri, Nebraska, and Oklahoma. NAEP data for eighth grade reading disaggregated by SES were also available for the state of Colorado but only included the tested years of 2003, 2005, and 2007 because the data for 2002 did not meet the reporting standards set for NAEP. Table 4.19 provides an analysis of the achievement between eligible and non-eligible students in eighth grade reading. The achievement gap between eligible and non-eligible students for all five states was significant at an $\alpha = 0.05$ for each year data were available for eighth grade reading.

Table 4.19 also provides an analysis in the change of the achievement gap between eligible and non-eligible students from Kansas, Missouri, Nebraska, and Oklahoma for testing year 2007 related to testing year of 2002 which was the year NCLB was first implemented. Table 4.19 provides an analysis for the state of Colorado; however, the achievement gap between eligible and non-eligible students for testing year 2007 were compared to the 2003 testing year due to a lack of data for 2002. The analysis of the difference in the achievement gap between eligible and non-eligible students for the states of Colorado, Kansas, Missouri, and Oklahoma had no sustained significant change in the achievement gap at an $\alpha = 0.05$ in eighth grade reading for any of the years data were available for these states. As a result of no sustained statistically significant change in the achievement gap being found for this subgroup in any of the tested states of Colorado, Kansas, Missouri, and Oklahoma, the null hypothesis that no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is retained at an $\alpha = 0.05$ for the subgroup of SES at the eighth grade level in the content area of reading for these four states. The analysis of the change in the achievement gap between eligible and non-eligible students for the state of Nebraska had a statistically significant increase in the achievement gap in eighth grade reading between the years 2002 and 2007 which the researcher considers a sustained significant change. As a result of the sustained significant change in the achievement gap being found for this subgroup in the state of Nebraska; the null hypothesis that

Table 4.19: Achievement Gap Disaggregated by SES: Grade 8 Reading

	Testing Year	Average Scale Score	Standard Error	Difference Between Average Scale Scores	P-value
Colorado: 8th Grade Reading					
Not-Eligible Eligible	2007 2007	273 251	(1.1) (1.5)	22	*P* = 0.0000
Not-Eligible Eligible	2005 2005	272 248	(1.1) (1.4)	24	*P* = 0.0000
Not-Eligible Eligible	2003 2003	274 250	(1.3) (1.2)	24	*P* = 0.0000
Not-Eligible Eligible	2002 2002	‡ ‡	‡ ‡	‡	*P* = ‡
Change in Achievement Gap Between 2003 and 2007 Testing Years				**-2**	***P* = 0.3741**
Kansas: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	275 253	(0.8) (1.3)	22	*P* = 0.0000
Not-Eligible Eligible	2005 2005	275 254	(1.1) (1.4)	21	*P* = 0.0000
Not-Eligible Eligible	2003 2003	273 253	(1.3) (2.4)	20	*P* = 0.0000
Not-Eligible Eligible	2002 2002	276 251	(1.2) (2.3)	25	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-3**	***P* = 0.3204**
Missouri: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	271 252	(1.1) (1.4)	19	*P* = 0.0000
Not-Eligible Eligible	2005 2005	272 253	(1.2) (1.6)	19	*P* = 0.0000
Not-Eligible Eligible	2003 2003	273 255	(1.0) (1.7)	18	*P* = 0.0000
Not-Eligible Eligible	2002 2002	273 257	(1.3) (1.4)	16	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**3**	***P* = 0.2307**
Nebraska: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	273 254	(1.0) (1.2)	19	*P* = 0.0000
Not-Eligible Eligible	2005 2005	274 253	(1.0) (1.2)	21	*P* = 0.0000
Not-Eligible Eligible	2003 2003	273 253	(0.9) (1.4)	20	*P* = 0.0000
Not-Eligible Eligible	2002 2002	275 260	(1.0) (1.5)	15	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**4**	***P* = 0.0447**

Oklahoma: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
Not-Eligible Eligible	2007 2007	268 252	(1.0) (1.1)	16	*P* = 0.0000
Not-Eligible Eligible	2005 2005	267 252	(1.4) (1.2)	15	*P* = 0.0000
Not-Eligible Eligible	2003 2003	271 251	(1.1) (1.6)	20	*P* = 0.0000
Not-Eligible Eligible	2002 2002	270 253	(1.0) (1.3)	17	*P* = 0.0000
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-1**	***P* = 0.5832**

no sustained significant change in the achievement gap occurred for any subgroup in the content areas of reading, math, or science at the fourth or eighth grade level since the implementation of NCLB is rejected with $\alpha = 0.05$ and $p < 0.05$ for the subgroup of SES at the eighth grade level in the content area of reading for the state of Nebraska.

Summary

The manner in which the change occurred at the elementary level in response to "No Child Left Behind" (NCLB) is demonstrated in Chapter 4 using both quantitative data and qualitative collected via an online survey instrument. These data were used to evaluate how the mandates of NCLB were implemented and what impact they may have had on science education. One goal of NCLB was the narrowing of the achievement gap between subgroups and Chapter 4 provides data which first indicates if an achievement gap is present between subgroups disaggregated on gender, race, and socioeconomic status. Chapter 4 then provides data on what change in the achievement gaps may have occurred. Chapter 5 focuses on the conclusions, discussions, and recommendations from the results provided in Chapter 4.

CHAPTER 5 - Conclusions and Recommendations

Introduction

This chapter is divided into six sections. The first section, discusses the limitations of the study. The second section examines "The Initial Impact of 'No Child Left Behind' (NCLB) on Elementary Education" and includes discussions on how NCLB impacted science education in grades K-6 in a five state region of the United States. The next section, NCLB and Academic Achievement, evaluates the impact NCLB has had on student achievement in the areas of science, math, and reading. The researcher's intent is to determine if one of the goals of NCLB, decreasing the achievement gap between disaggregated subgroups, was accomplished. This section also provides a discussion concerning which change theory (as introduced in chapter 2) more accurately predicts the way NCLB was implemented. This section ends with a set of conclusions related to change and the academic achievement gap. The researcher next provides an academic cost-to-benefit analysis of how NCLB was implemented in the section labeled Implications. The intent of the Implications section is to determine what if anything was gained through NCLB compared to what if anything was given up through its implementation. The Recommendations for Further Research section is next and includes ideas and suggestions for additional research based on the information provided in the first three sections. The last section in Chapter 5 is a summary of the chapter.

Limitations of Study

There are a number of limitations to this study. First, the focus of the sample was only a five state region which was a small sample compared to the number of classrooms nationwide. However, the data can be useful to educational leaders in other regions of the United States.

Second, accurately determining the return rate was limited by school firewalls, which may have prevented emails from reaching the intended recipient without notifying the researcher of the failure of delivery. The successful return rate was also limited due to self-reporting by anonymous respondents, which restricted the effectiveness of follow-up e-mails. Other probable limitations included the ability of the survey to navigate past the e-mail filtering systems in some districts, the inability to ask follow-up questions (since the survey was anonymous), and being able to assure a representative sampling of all subgroups. Finally, with the survey being voluntary in nature, respondents may have deemed the survey as an extra burden in an already busy schedule and opted not to complete it. The limitations on the second research question included the difficulty on getting raw data to evaluate it independently and the data were collected by someone other than the researcher. Another limitation related to the second research question was the fact that the NAEP is a norm-referenced test and the state assessments are standards-referenced which does not provide a fair comparison of student achievement related to individual state standards. The lack of national standards, which could be used to develop a national standards-referenced based assessment, limited the researcher's ability to make an accurate comparison between the reported improvements of one state to the reported improvements of another.

The Initial Impact of NCLB on Elementary Science Education

In an effort to reach the goals set forth in NCLB elementary teachers from Colorado, Kansas, Missouri, Nebraska, and Oklahoma are placing science education in a deferential position compared to math and reading instruction at the kindergarten through sixth grade levels. The evidence for this change is the admission by 55.3 percent of the teachers (n=513) who responded to an online survey (Appendix M) from these five states who indicated they have reduced time for science instruction in order to have more time to focus on math and reading. Even with science being included as a tested content area in 2008, the fact that it is not included in AYP and is only required to be assessed at one grade level at the elementary, middle, and high school levels still places it as a low priority for many of the teachers surveyed. This is a concern since science is separated from other intellectual activity because it is cumulative in nature requiring individuals to build knowledge layer by layer (Shamos, 1995). The cumulative nature of science is why it is important for students to have an accumulation of knowledge and experiential interactions over a number of years. If the United States is ever going to have a citizenry that is scientifically literate, we will need to build a strong foundation at the elementary level that middle school, high school, and college instructors can build upon. With the degree of complexity inherent to science concepts, the 60 minutes per less a week spent on science instruction reported by 52.7 percent of the teachers surveyed is less than adequate. In order to deal with the accountability resulting from NCLB, elementary teachers in these five states are responding to this mandate in a way that is detrimental to science education by decreasing the amount of time they spend on science instruction.

This research also examined who is making these instructional decisions. Have administrators required teachers to make changes in science instruction since the implementation of NCLB? If so, what changes did they require teachers to make? The answer to the second question was present in the data from the first part of research question 1 – time for science instruction is being decreased. However, is this change mainly the result of administrative mandates as suggested by Linda Froschauer, President of the NSTA (2006)? It appears only a limited number of administrators are influential in directly imposing this change in the classroom with just over 20 percent of the teachers who decreased science instruction stating it was at the request of a member of their school or district administration, while only 8.9 percent of teachers who did not decrease time for science indicated a member of their administration instructed them to cut time from science instruction. Overall, just over 15 percent of the teachers in this study had been asked to decrease instructional time in science by a member of their administrative staff. Although any directive to cut instructional time for science made by a school or district administrator is viewed as unacceptable by the researcher, the statements made by Ms. Froschauer (2006) that elementary teachers are being forced by their administrators to limit time for science instruction is only accurate for a limited number of teachers in this research. The data provided here indicate that classroom teachers are the primary agents in making changes to the amount of time provided for teaching each content area. The researcher makes this assertion based on the following results: 1) the survey shows that 78.1 percent of teachers from the "cut instructional time for science" category believed they needed to cut instructional time for science in order to improve math and reading scores and 2) 61.7 percent of the teachers who "did not cut instructional time for science" did not believe they needed to cut instructional time for science in order to improve reading and/or math scores. An assertion that one cannot do science if one cannot read – so reading must be mastered before they can do science – is one reason provided by a number of teachers for why they believe they need to reduce time for science instruction. This assertion contradicts the research presented by Michael Klentschy at the 2006 NSTA national convention. Dr. Klentschy reported that inquiry science at the elementary level has been shown to increase student performance in math, reading, and writing even with at-risk students (2006). Based on these responses, the researcher proposes that the teachers who were making these changes were doing so mainly based on their individual belief system. The researcher's conclusion is supported by a study by Carla Johnson (2009) where she found that the key in changing instructional practices is based on the motivation and beliefs of the teacher.

Although teachers are identified by the researcher as the main factor directly influencing change in the classroom, other factors can indirectly influence change by impacting their belief system. This research indicates administrators play a limited role in directly influencing the decrease in instructional time for science instruction at the elementary level; however, they can play a large role in indirectly influencing this change by how they foster their teachers' beliefs about what should or should not occur in the classroom. The administrators' role is to provide adequate resources, professional development, and monitor teacher commitment to the curriculum (Fullan, 2001). A number of the teachers surveyed indicated their administration did not provide them with proper or adequate resources to teach science in a way it should and/or needs to be taught. In addition, the researcher found that 67 percent of the teachers who cut instructional time for science received less professional development for science instruction than they received for reading and math instruction. A limited amount of professional development in methods for creating or using truly integrated or thematic lessons inhibit teachers from having the professional tools to effectively include all content areas, which may be one reason teachers feel they have to cut instructional time for science. This research provides evidence that administrators have influenced their teachers' belief system indirectly by their actions in limiting resources and training for teaching science. Based on the data, the researcher feels that administrators need to play a more active and direct role as change agents in providing their teachers with the training and tools needed to effectively include instruction of all content areas everyday in classrooms. Both teachers and administrators need to join together in a common voice in order to persuade the external forces of change (i.e., state education agencies and the federal government) to develop an effective reform that they all can and will support.

NCLB is leaving science behind was a theme proposed by one of the respondents to the survey used for this research. A measure of whether this is occurring would be to look at the amount of time used for science instruction today compared to the amount prior to NCLB having been enacted. To make this determination the researcher examined the amount of time removed from science instruction since NCLB was implemented. The data indicates that 25.6 percent of the teachers who cut time from science removed between 31 and 60 minutes per week with another 48.8 percent cutting between 61 and 90 minutes per week. These cuts in science instruction will ultimately have a detrimental impact on student science skills as they advance to middle and high school.

Another problem identified here is the number of teachers who indicated they have given a grade for science without teaching or assessing it. Of the teachers who cut time for science instruction, 26.7 percent indicated they had given a grade for science without teaching or assessing it and 11.6 percent of the teachers who did not cut time for science instruction admitted doing this as well. Of all the teachers who responded to the survey (n=928), 19.9 percent admitted providing a grade for science without teaching or assessing it. This is a concern to the researcher because he views it as a misrepresentation of student knowledge and does not provide an accurate picture of what a child is truly capable of for his/her next teacher. As a former science teacher, the researcher understands the problems associated with starting a class or group of students at the wrong academic level. The loss of instructional time due to the need for teaching knowledge, which students should and are indicated to have mastered prior to entering his class and the re-teaching of the introductory material leaves a limited amount of time to focus on content students should have when they finish his class. Based on the culmination of this information, the researcher asserts that NCLB currently has had a negative impact on elementary science instruction in the five state region under investigation. This negative impact may become a larger problem as AYP targets for reading and math continue to increase through the year 2014 even with science assessments being required each year by NCLB starting in 2008.

NCLB and Academic Achievement Gap

Accountability as defined by NCLB includes two goals which are 1) have all students score at proficient or above in reading and math by the year 2014 and 2) have all subgroups score at proficient or above in reading and math by the year 2014 (which is intended to close the achievement gap between all subgroups).   The second focus on this research effort was to determine if the accountability goals set forth in NCLB have been successful in decreasing the achievement gap based on three specific identifiers: gender, race, and socioeconomic status (SES). The researcher also examined the content area of science in addition to reading and math since science was required by NCLB to be assessed every year starting in 2008 and recent research indicated a cut in instructional time for content areas that are not included in the AYP requirement of NCLB (CEP, 2006; Griffith & Scharmann, 2008).

Although the main focus of this research is examining the impact of NCLB on the academic achievement gap between the disaggregated subgroups of gender, race, and SES, the researcher felt it necessary to provide information on the progress made in meeting the overall goal of NCLB to have all students score at proficient or above in reading and math by 2014. The NAEP national level data for fourth grade reading is provide in Figure J1 (Appendix J) and shows a positive difference of three percent from 2002 to 2007; however, this is not a significant difference with $\alpha = .05$ and $p = .8065$. The NAEP national level data for eighth grade reading is provided in Figure J2 and shows a negative difference of two percent from 2002 to 2007; however, this is not a significant difference with an alpha = .05 and p = .8875. The NAEP national level data for fourth grade math is provided in Figure K1 (Appendix K) and shows a positive difference of 17 percent from 2000 to 2007, which is a significant difference with α = .05 and p = .0213. The NAEP national level data for eighth grade math is provided in Figure K2 and shows a positive difference of nine percent from 2000 to 2007; however, this is not a significant difference with α = .05 and p = .3961. Although there have been significant gains made by fourth grade students in math from 2000 to 2007, the researcher concludes that NCLB would not be currently on track to meet the goal to have all students score at proficient or above in both math and reading by 2014 if NAEP was used to evaluate academic progress. In the area of reading, there has been no significant improvement in the number of students scoring at proficient or above on the NAEP at either grade level.

In the three discussions to follow on gender, race, and socioeconomic status, the researcher considers identified achievement gaps where data were available for review. In order to determine if there has been a change in the achievement gap, the researcher compared the most recent test data for each of the three content areas to the test data that were collected just prior to the implementation of NCLB.

Achievement Gap Disaggregated by Gender

Researchers have indicated a significant difference in achievement between male and female students in the content areas of math and science as an ongoing problem (Bazler & Simonis, 1991; Bianchini, 1993; Sadker & Sadker, 1994; and Tobin, 1988). The current data also indicates an achievement gap between males and females in the content area of science at both the fourth and eighth grade levels; thus, this difference is still an issue. Based on state level data from the NAEP for science, males scored higher than females at both grade levels. In the content area of math at the fourth grade level during the 2007 testing year (Table 5.1), Nebraska was the only state where a significant difference was found between male and female students with males scoring at a higher level. Eighth grade math results from the 2007 testing year shows a significant difference in achievement between male and females students from the state of Oklahoma with males scoring higher. No significant difference between males and females was identified in the area of math at either grade level during the 2007 testing year for the remaining states included in this research. On the 2007 reading NAEP (Table 5.1), a significant difference was identified by the researcher between males and females at both grade levels in all states included in this research with females scoring higher in all cases. The researcher found no significant changes in the achievement gap between males and females for any content area in

Table 5.1: Achievement Gap Based on Gender from the 2007 NAEP

	2007 Testing Year		2007 Testing Year	
State	**Grade 4 Read**	**Grade 8 Read**	**Grade 4 Math**	**Grade 8 Math**
Colorado	MSL	MSL	--	--
Kansas	MSL	MSL	--	--
Missouri	MSL	MSL	--	--
Nebraska	MSL	MSL	FSL	--
Oklahoma	MSL	MSL	--	FSL

Key
FSL = Females Significantly lower MSL = Males Significantly lower
-- = No Significant Difference Between Groups

any of the states in the areas of reading and math or in science at the adjusted national level. As a result of these findings, the researcher concludes that NCLB has not significantly impacted the achievement gap related to gender that was present prior to its implementation for any content area or any grade level.

Achievement Gap Disaggregated by Race

The academic achievement of minorities and how and why it is significantly lower than their White counterparts has been studied by a number of researchers (Causey-Bush, 2005; Giddings, 1999; Johnson, 2009; Kellow & Jones, 2008; and Lee, Luykx, Buxton, & Shaver, 2006). In this section, the researcher examines the current data to see if an achievement gap still exists based on race and what if any impact NCLB has had on any identified difference between subgroups. The researcher identified a significant difference between White and African-American students and White and Hispanic-American students in reading and math at both the fourth and eighth grade levels for all five states included in this study. White students

Table 5.2: Change in Achievement Gap Based on Race since the Implementation of NCLB

State	White Students Compared to:	Between 2002 & 2007 Testing Years		Between 2000 & 2007 Testing Years	
		Grade 4 Read	**Grade 8 Read**	**Grade 4 Math**	**Grade 8 Math**
Colorado	AA	--	--	--	SD
	HA	--	--	--	--
Kansas	AA	--	--	--	--
	HA	--	--	--	--
Missouri	AA	--	--	--	--
	HA	--	--	--	--
Nebraska	AA	SI	--	--	SI
	HA	--	--	--	--
Oklahoma	AA	SD	--	--	--
	HA	--	--	--	--

Key

AA =African-American SD = Significant Decrease in Gap

HA =Hispanic-American SI = Significant Increase in Gap

-- = No Significant Change in Gap

scored significantly higher than both their African-American and Hispanic-American counterparts in both content areas during the 2007 testing year. White students also scored significantly higher than both African-American and Hispanic-Americans students on the 2005 NAEP science assessment.

As provided in Table 5.2 in the area of math, tested at the eighth grade level, a significant decrease in the achievement gap was identified between White and African-American students from Colorado. A significant increase in the achievement gap between White and African-American students from Nebraska was also identified in the area of math at the eighth grade level. In the content area of reading at the fourth grade level, a significant decrease in the achievement gap was identified between White and African-American students from Oklahoma. In the content area of reading at the fourth grade level the researcher found a significant increase in the achievement gap between White and African-American students from the state of Nebraska. No other significant change in the achievement gap was identified for the remaining states at either the fourth or eighth grade level in the content areas of math or reading between any of the subgroups. The researcher identified a significant decrease in the achievement gap between White and Hispanic-American students in the content area of science at the fourth grade level; however, no other significant changes were found for the other grade levels or subgroups. As a result of these findings, the researcher concludes that NCLB only had a very limited impact on the achievement gap based on race with two of the five significant changes resulting in an increase in the achievement gap.

Achievement Gap Disaggregated by Socioeconomic Status

Recent studies have focused on possible reasons for why and how SES impacts academic performance resulting in an achievement gap between students from low income households and their more affluent counterparts (Brown, 2007; Dworin & Boomer, 2008; Harris, 2007; and Payne, 2008). The data evaluated in this research indicates that a gap in academic achievement is a continuing problem. Results from the 2007 reading and math NAEP at both the fourth and eighth grade levels show a significant difference in achievement between students eligible for free lunches and those who are not eligible. A gap is also found in the content area of science at both the fourth and eighth grade level students at the adjusted national level during the 2005 testing year. As seen in Table 5.3 for the content area of reading at the fourth grade level, a significant decrease in the achievement gap was identified between students eligible for free lunches and those not eligible from the state of Oklahoma. In the content area of reading at the eighth grade level the researcher found a significant increase in the achievement gap between students eligible for free lunches and those not eligible from the state of Nebraska. No other significant change in the achievement gap was identified for the remaining states at either the fourth or eighth grade level in the content areas of math or reading between these subgroups or in science for students at the adjusted national level during the 2005 testing year. With one of the

Table 5.3: Change in Achievement Gap Based on SES since the Implementation of NCLB

	Between 2002 & 2007 Testing Years		Between 2000 & 2007 Testing Years	
State	**Grade 4 Read**	**Grade 8 Read**	**Grade 4 Math**	**Grade 8 Math**
Colorado	--	--	--	--
Kansas	--	--	--	--
Missouri	--	--	--	--
Nebraska	--	SI	--	--
Oklahoma	SD	--	--	--

Key

SD = Significant Decrease in Gap SI = Significant Increase in Gap

-- = No Significant Change in Gap

two significant changes increasing the achievement gap, the researcher concludes that NCLB had no significant impact on the achievement gap based on SES.

NCLB and Change Theory

The researcher examined four different theories of change including the *Diffusion of Innovation*s model (Rogers, 1995), *Conditions of Change* model (Ely, 1999), *Concerned-Based-*

Table 5.4: Fullan's Nine Factors of Change and Corresponding Representative Teacher Responses

Fullan's Nine Factors of Change (2001)	Corresponding Teacher Representative Responses
1. Need	"I think it is required to ensure that students receive the best education possible."
2. Clarity	"Government mandated reform is usually created by a bunch of politicians who are completely removed from the realities of the classroom setting today. Most of these types of mandates are doomed from the start because of this lack of understanding of both today's student and teacher."
3. Complexity	"The ideals are good, but it is impossible as it is set up as an unfunded mandate that needs money to collect the data for checking on progress."
4. Quality/Practicality	"I think to the public this reform looks and sounds good on the surface. However, the expectations are unreasonable for students who are each unique individuals. Also, the state is not fully funding the programs and resources needed to accomplish NCLB goals. NCLB does not take into consideration what teaching and learning is all about, and that it is a developmental process that each child reaches at their own pace. This mandate has greatly narrowed the curriculum in school districts, and encourages teachers to teach to the test rather than teach students how to think and learn. NCLB places more emphasis on data, rather than the actual learning taking place. I believe in the current state, this mandate is harmful to students, and in the end, we will produce students who are better test takers, but not necessarily better thinkers."
5. District	"The school district has put pressure on us to make sure that reading, writing and math are being taught for a set number of hours in the week. It allows for about 15 minutes a day for Science, social Studies and Health."
6. Community	"The reality is that the population of public education comes to us with so many 'issues' that we can make all kinds of growth progress with those kids and still not reach the expectations set by NCLB."
7. Principal	"It was a previous principal that basically told us we better focus on what is being tested by CSAP first. If that means we cut our explore (our science and social studies time), so be it. My team values explore, so we strive to retain as much as possible. I know for a while our lower grades even reduced it more."
8. Teacher	"I wish it wasn't so but with all the testing, our children need to score well in reading and math. I know they need the other subjects too, such as science and social studies but there isn't always time to do it justice."
9. Government and other agencies	"I believe we should do whatever it takes to ensure that each and every child has a chance at a great education. But, I'm not so sure the government needs to tell the educators how we are to do that."

Adoption model (Hall, Wallace, & Dossett; 1973), and the *New Meaning of Educational Change* model (Fullan, 2001). Each of these change models could have predicted how successfully the mandates set by NCLB would be implemented; however the researcher hypothesized that the delineation of the change process described in the New Meaning of Educational Change presented by Fullan (2001) would be the best lens to examine the challenges associated with the implementation of a mandated change like NCLB. The nine factors of change proposed by

Fullan (2001) are presented in Table 5.4 and are paired with corresponding statements from respondents to the survey instrument.

The researcher presented the basis for his hypothesis in three statements, which are addressed individually in this section. The first statement refers to Fullan's comment that "single-factor theories of change are doomed to failure" (2001, p. 93). Although the researcher is aware that the NCLB mandate includes a combination of involvement from federal and state governments, school and district administrators, and teachers, the apparent lack of inclusion of all parties in the planning and development of this reform has left many local educators feeling that the problems associated with it lies prominently with the federal government. A number of the elementary teachers surveyed in this research indicated that the accountability required in NCLB was the main driving force in the changes made in their classrooms and is seen as an intrusion by the federal government. Being able to have their students meet the AYP targets required by NCLB resulted in a large percentage of the surveyed teachers focusing on how to help their students improve in these two content areas even at the expense of other content areas like science, social studies, and the arts. A number of teachers also indicated they focus mainly on the assessed indicators from their state reading and math standards during their instructional time due to the pressures of meeting AYP required by this federal mandate. The researcher sees any failure of NCLB as a result of it being forced on state education agencies and local educators by one entity outside of their control. Although states have a role in this reform, many of the educators commented that reform needs to be left to the states and /or local districts. According to the researcher, a sign that NCLB is failing is the large number of students who are not receiving a complete, well rounded education in all content areas due to a number of teachers focusing mainly on assessed indicators in reading and math. An example of this lack of a complete well rounded education is the decrease in instructional time in science by 53 percent of the teachers surveyed. A number of respondents commented that they have to focus on the assessed indicators in the core content areas of reading and math for AYP. The apparent demotion of science and social studies from their status of core content areas to non-core status in the eyes of many teachers and administrators is another failure of NCLB. In addition to the impact on non-assessed content areas, 18 percent of these teachers indicated that the accountability target requiring 100 percent of students score at proficient or higher on state assessments by the year 2014 is unrealistic. Some of the comments, which captured the essence of the respondents, include "I have felt nothing but frustration towards the NCLB reform. Its expectations are unreasonable and set schools up to fail" and "I feel it is an unrealistic expectation placed not only on teachers, but children, as well." Based on these teachers' identifying NCLB as a mandate placed on them by the federal government, the researcher categorizes NCLB as a single-factor theory of change that currently has questionable results at best and predicts it is "doomed to failure" as Fullan (2001) indicated these types of initiatives tend to be if NCLB is not properly reformed. The researcher agrees with one respondent who stated, "Government mandated reform is usually created by a bunch of politicians who are completely removed from the realities of the classroom setting today. Most of these types of mandates are doomed from the start because of this lack of understanding of both today's student and teacher." The researcher sees these two statements as strong indicators of what must be addressed when NCLB is reformed. A complete and diverse group that includes nationally respected educators from all levels of education will need to be included in the reform of NCLB (or whatever the next education reform will be labeled). Including these shareholders in the decision making process will help to limit the problem of the next reform being seen as a single-factor theory of change mandated by the federal government alone.

The second statement by Fullan (2001) examined by the researcher is the need for “change agents” to implement the change at all levels. As previously indicated, NCLB is a single-factor, top down reform mandated by the federal government by which many of the teachers surveyed feel pressured. Although the federal government is seen as the single entity behind this reform, its role as a change agent is considered very limited in the actual implementation of NCLB by a number of respondents. Many of these teachers considered the lack of financial support necessary to properly implement this educational reform as what limited the federal government’s role as a change agent in this reform. One respondent stated “Government mandates are too broad, cost too much money and cause too many hardships for school districts.” Another factor limiting the federal government’s role as a change agent is the perception of a number of these teachers that “… most politicians are not versed in educational practices,” as stated by a respondent to question 2 and as a result they are not considered qualified to legislate any change in education. The role state governments’ play as change agents is also limited and is dependent on the state involved as indicated in the following response, “The problem is the way NCLB is implemented in various districts and states.” Another respondent supported the various levels that states can be change agents in stating “Testing criteria is not consistent across states. It's hard to compare proficiency.” By NCLB being a broad mandate as indicated by some of the respondents, state governments do not have adequate guidance which can limit their effectiveness as change agents. In addition to the different manner in which various states implement NCLB as a result of inadequate guidance, a lack of adequate funding for states is another issue. One respondent stated, “It is essentially an unfunded mandate that has been dumped on the states…" which the researcher feels further limits their effectiveness in being effective change agents. As discussed in the "*Initial Impact of NCLB on Elementary Science Education*" section of Chapter 5, the research indicates that administrators have only played a limited role as change agents in the implementation of NCLB. The limited roles played by the state and federal governments and school and district administrators have left teachers as the main change agents in the implementation of this mandate. Since teachers are identified as the main change agents involved with the reforms targeted by NCLB, the researcher sees this as a failure to have change agents at every level which Fullan indicates as necessary for reform to be effective (2001).

The final point of Fullan's Change theory looked at by the researcher is the statement that "Schools are more likely to implement superficial changes in content, objectives, and structure than changes in culture, role behavior, and conceptions of teaching" in response to a mandated multidimensional change (Fullan, 2001, p. 64). With over half the teachers surveyed increasing time for reading and math instruction in an effort to increase student performance (i.e. assessment scores) at the expense of other content areas, the researcher sees this as a superficial change in order to meet the external pressure to make AYP. Educators who have increased instructional time in reading and math indicated they needed the time for giving practice tests, teaching test taking skills, and having students better understand the materials on which they are going to be tested during the state assessments. The increase in time for teachers to provide more of the same type of instruction for students in reading and math is not seen as true reform of the educational system which will be needed to meet the needs of all students as mandated by NCLB. Some teachers indicated they integrated science into language arts by having their students read nonfiction books on science or having them read the science texts. Some of the teachers justified cutting science instruction to help students become better readers because they felt one cannot do science if one cannot read. The researcher responds to these two rationales in the following way: 1) just reading about science is not true integration and 2) science can be done without being able to read and can help students become better readers. Although reading is very important, there is more to science than just reading. Although the researcher can support this statement through his lifetime observations of the natural inquiry children demonstrate prior to attending school by doing science through play and peer interactions before they can even read, historically individuals such as Schwab (1962) spent entire careers promoting the transformative power of science as inquiry (which he represented as enquiry). Finally, as indicated by a study done by Klentschy (2006) student achievement in reading can be improved by teaching science through inquiry; however, this change requires additional training, more resources, buy-in by administrators, and ultimately a change in the teacher's belief system.

Conclusions Related to Change and the Academic Achievement Gap

The researcher used the results of the data related to both research questions to conclude that Fullan's (2001) *New Meaning of Educational Change* Model accurately predicts why an educational reform like NCLB has not been effective. Specifically as a result of NCLB being a single-factor theory of change: (a) there would be a need for change agents at all levels to properly implement it, and (b) the current single-factor approach results in superficial changes when the problem truly calls for a multidimensional educational reform. The researcher bases his conclusion on the following data from this research:

1. Teachers identified the federal government as the single-factor behind the NCLB mandate. A single-factor theory of change is of the type Fullan (2001) asserted

was doomed to fail. Further, NCLB seems to be failing based on the NAEP data showing both goals included as a measure of accountability are not being met.

2. The limited role the federal government has had as a change agent in the implementation of NCLB and with teachers as the predominant change agents, the need for change agents at all levels for reform to be successful as indicated by Fullan (2001) has not been met.
3. The other area that is identified by Fullan's change theory is reflected in his statement that mandated changes are more likely to result in superficial changes which are the type of changes the survey data indicates have been made. Although some attempts at more in-depth changes (i.e., integration of science into reading) were presented by a number of the respondents in this survey, their description of what changes they were making seem to be less than adequate to meet the goal of accountability set forth in NCLB.

The manner in which teachers and some administrators increased the time for reading and math is considered by the researcher to be a superficial change which does not impact student learning at the level of complexity needed to meet the accountability targets set by the mandates of NCLB. Based on the data collected from the NAEP from each of the states included in this research, NCLB has not successfully met the goal of significantly decreasing the achievement gap between disaggregated subgroups in the content areas of reading and math. In addition, the adjusted national NAEP data in the areas of reading and math support the conclusion that NCLB is not on track to meet its goal to have 100 percent of the students achieving proficient or above by 2014.

The decrease in the amount and quality of science instruction the elementary students from Colorado, Kansas, Missouri, Nebraska, and Oklahoma are receiving is too high a price to pay considering the lack of return (no significant increase in students scoring at proficient or above on the NAEP reading and math assessments) NCLB has provided. Each of these five states have improved the number of students meeting proficient or above on their individual state assessments but as many of the teachers surveyed indicated, there is a lack of consistency between state standards and assessments and most teach to their state's test. One state could have 100 percent of their total student population and each subgroup score at proficient or above on their state assessments; however, these same students may still be performing at a lower academic level than students from another state who only has 70 percent of their students scoring at proficient or above on their state assessments. It is the disparity in the state assessments that led the researcher to focus on a national assessment like NAEP. Because NAEP (norm-referenced test) data may not show a decrease in the achievement gap similar to the decrease reported by some states on their state level assessment (standards-referenced test), an accurate national measure of the success of NCLB may need to be developed in order to make more commensurate comparisons.

Implications

The need for individuals that understand science, technology, and mathematics has never been greater than it is now (Lee & Houseal, 2003). The cut in instructional time for science can only result in moving our citizens further behind other countries in the areas of science and technology. This research indicates the majority of the elementary teachers surveyed are decreasing the time needed to provide the foundation layer of knowledge in the area of science. If the trend to decrease science instruction at the elementary level continues, students will not be properly prepared for science education at the middle and high school levels and ultimately life after high school. Having students only read science related material, as a form of content integration, will negatively impact the problem solving skills they will need to have in order to be on the cutting edge in the areas of science and technology.

A continuing discrepancy between each state's content standards and standards-referenced assessments support the need for national education standards for all content areas and a national standards-referenced assessment which will hold all states and districts to the same level of academic performance is perhaps one broad implication of this research. Although teachers express a concern that NCLB has resulted in teachers teaching to the test, the researcher contends that this has been the educational model that has been in place since the early days of education when a teacher assessed if his/her students learned the material the teacher recently covered. The focus of education will need to move from this historical model of teaching to a test, to a teaching model with the goals of helping students develop problem solving skills and the ability to perform the basic skills needed to be successful beyond high school which are provided in an inquiry-based science curriculum.

Recommendations for Further Research

The researcher contends it may be prudent to study the ability of students exposed to limited amounts of science to solve problems and/or apply the math and reading skills to which they were exposed. Another study that would be beneficial might be one comparing the rigor of the content standards and assessments from each state. An examination of these documents would help to determine if the claims made by a number of teachers in this study that some states have standards and assessments that are more rigorous than other states have sufficient validity. A study of this type would help identify if any unfair comparison between states exists when measuring the success of each state in their efforts to meet the goal of 100 percent of their students scoring proficient or higher on state assessments.

Research should also be done to determine the appropriate way to assess learning for all students at the national level. This assessment should measure a child's ability to problem solve, the skills needed to be successful after graduation, as well as general content knowledge. Any national standards-referenced assessment should include these components and should provide all students the opportunity to demonstrate their knowledge in a manner that matches their individual learning style. A national standards-referenced would provide an instrument to evaluate any national level educational mandate like NCLB.

Since, according to Fullan, successful educational change or reform is multifaceted, the researcher proposes studies be completed on an educational reform that includes a 210-220 day school year, a departmentalized elementary school model, and a 15:1 student-teacher ratio and at least one certified teaching assistant in each classroom at all grade levels and in every content area. This reform model might, at minimum, require a full week of professional development for all teachers, teacher assistants, and administrators during their one-month summer recess and five additional professional development opportunities during the school year. The professional development will need to address cross-curricular instruction techniques, differentiated instruction for all grade levels and content areas, and other research-based educational practices that help teachers teach for understanding. The professional development should be tiered according to years of experience using the strategy, not necessarily the number of years of experience a teacher may have. All teachers and teaching assistants would be required to use teaming and be provided two days per month for team planning and discussion of how to address any problems, adjust curriculum as needed, implement or integrate any instructional methods identified from the professional development opportunities that support schools' goals for student achievement.

Summary

The purpose of this research was to determine if NCLB had any influence on K-6 science education in five Midwestern States by: (a) identifying any change in science instruction at the elementary level as a result of NCLB; (b) enhancing an understanding of how NCLB may or may not impact elementary science education and what role administration plays in any changes being made; (c) identifying any positive or negative effects as a result of how NCLB has been implemented at the state level; (d) if science needs to be included as a measure of a school's AYP when NCLB is reauthorized; (e) evaluating available professional development for elementary science educators; and (f) determining any negative or positive impact on the achievement gap based on gender, race, or socioeconomic status (SES).

The research shows that NCLB has had a negative influence on science education for students in grades K-6 in the five states under investigation, as indicated by the decrease in instructional time for science reported by 55.3 percent of the teachers surveyed. Based on the survey results, administrators have played a limited role in the decrease in instructional time for science at the elementary level while the teacher's individual belief system played a more dominant role in this change. A large percentage of teachers did indicate they receive less professional development in the content area of science than they receive for reading and math instruction. One possible way to overcome the disparity in instructional time between science and Math and Reading at the elementary level is to provide more professional development in the area of science instruction. There appears to be a virtual lack of any positive movement in decreasing the achievement gap that exists based on gender, race, and SES, based on the NAEP data. States and the federal government need to examine the benefit of national education standards and national standards-referenced assessments for math, reading, science and social studies as a way to overcome the disparity in the expectations between states. A national standards-referenced test would also provide an instrument to evaluate the success of changes implemented as a result of a national mandate like NCLB.

Teachers are charged with providing a high level of education for all of our students. Educational leaders in the field are also responsible for assuring this occurs in all classrooms. State and national leaders are responsible for making sure the schools are provided with the means to accomplish this daunting task. Educators at all levels need to come together in a unified way to guide reform in a manner that will be best for all of our students and work with political leaders in order make it happen.

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Appendix A - Web-Based Survey Instrument

Years teaching experience 0 – 5 6 – 10 11 – 15 16 – 20 >20

Grade you are presently teaching K 1 2 3 4 5 6

Gender Male Female

School Size 1-2A 3-4A 5-6A

1. What is the amount of time you spend each week teaching science?

   0 – 30 min 31 – 60 min 61 – 90 min 91 – 120 min >120 min

1. Has the amount of time you spend teaching science decreased since the implementation of NCLB (if yes, go to question 3; if no go to question 5)? Yes or No

2. If you answered yes to question 2, how much time did you have to remove from teaching science?

   0 – 30 min 31 – 60 min 61 – 90 min 91 – 120 min >120 min

3. Why did you feel the need to decrease your instructional time for science that you indicated in question 3?

4. Have you ever been instructed to not teach science for any reason by a member of your administration? Yes or No

5. If you answered yes to number 5, what reason was given for doing this?

6. Have you ever been instructed to decrease the time you spend teaching science by a member of your administration? Yes or No

7. If you answered yes to number 7, what reason was given for doing this?

8. Do you believe you need to cut time from science education in order to spend more time with reading and math instruction? Yes or No

9. Explain your answer to question 9.

10. Compared to the funding your school spends on reading and math, what percentage of funding does your school provide for science?
    a. < 25% of what is spent on reading and math
    b. 26 – 50% of what is spent on reading and math
    c. 51 – 75% of what is spent on reading and math
    d. 76 – 99% of what is spent on reading and math
    e. Equal to reading and math

11. How does what you personally spend on science education supplies and materials compare to what you personally spend on math and reading?

12. Are you provided the same opportunity for professional development in science as you are in reading and math? Yes or No

13. Are you responsible for teaching the assessed indicators for science? Yes or No

14. Do you feel confident to teach science concepts for the grade you teach? Yes or No

15. Explain you answer to question 15?

16. Have you ever had to give a grade for science even though you did not spend time teaching or evaluating science material? Yes or No

17. If you answered yes to question 17 explain why this happened.

18. Please add any additional comments your feel are important in regards to science education in elementary school.

Appendix B - Web-Based Survey Instrument Revised

Grade you are presently teaching: K 1 2 3 4 5 6

State: CO KS MO NE OK

1. What is the amount of time you spend each week teaching science?

   0 – 30 min 31 – 60 min 61 – 90 min 91 – 120 min >120 min

2. NCLB is an educational reform mandated by the government. What is your opinion of this type of mandate?

3. Has the amount of time you spend teaching science decreased since the implementation of NCLB (if yes, go to question 4; if no go to question 6)? Yes or No

4. If you answered yes to question three, how much time did you have to remove from teaching science?

   0 – 30 min 31 – 60 min 61 – 90 min 91 – 120 min >120 min

5. Why did you feel the need to decrease your instructional time for science that you indicated in question 4?

6. Have you ever been instructed to not teach science for any reason by a member of your administration? Yes or No

7. What reason was given by your administrator for their request that you not teach science?

8. Have you ever been instructed to decrease the time you spend teaching science by a member of your administration? Yes or No

9. What reason was given by administration for requesting this decrease in time for science instruction?

10. Do you believe you need to cut time from science education in order to spend more time on reading and math instruction? Yes or No

11. Explain your answer to question 10.

12. How does what you personally spend on science education supplies and materials compare to what you personally spend on math and reading?

    Less More Same N/A

13. Are you provided the same opportunity for professional development in science as you are in reading and math? Yes or No

14. How long has your state been assessing science?

15. Are you responsible for teaching the assessed indicators for science? Yes or No

16. Have you ever had to give a grade for science even though you did not spend time teaching or evaluating science material? Yes or No

17. If you answered yes to question 16 explain why this happened?

18. Please add any additional comments you feel are important in regards to science education in elementary school.

Appendix C - E-mail Sent With a Link to the Survey Instrument

Graduate student request for assistance

Hi,

My name is George Griffith Supt. of Northern Valley schools in Almena KS. I am working on my Ph. D. and need input from elementary teachers for my dissertation. The link below will direct you to the online survey with questions about NCLB and elementary science education. The survey should not take more than 10 minutes to complete. I hope you will be able to assist me with this and be assured you responses will remain anonymous. I would like to thank you in advance for your assistance.

http://www.surveymonkey.com/s.aspx?sm=DI_2b10HfLQg9QiNAr_2fCqIyw_3d_3d

Respectfully

George Griffith

Superintendent, Northern Valley USD#212

PO Box 217

Almena KS 67622

Appendix D - Research Question Number One: Tables of Quantitative Data From Teachers Who Decreased Instructional Time for Science.

Figure D.1: Questions 6, 8, 10, 13, and 15 Decrease in Science Instructional Time

6. Have you ever been instructed not to teach science for any reason by a member of your administration?	
Yes	7.9%
8. Have you ever been instructed to decrease the time you spend teaching science by a member of your administration?	
Yes	21.1%
10. Do you believe you need to cut time from science education in order to spend more time on reading and math instruction?	
Yes	78.1%
13. Are you provided the same opportunity for professional development in science as you are in reading and math?	
Yes	33.0%
15. Are you responsible for teaching the assessed indicators for science?	
Yes	77.5%

Appendix E - Research Question Number One: Table of Quantitative Data From Teachers Who Did Not Decrease Instructional Time for Science.

Figure E.1: Questions 6, 8, 10, 13, and 15 No Decrease in Science Instructional Time

6. Have you ever been instructed not to teach science for any reason by a member of your administration?	
Yes	3.0%
8. Have you ever been instructed to decrease the time you spend teaching science by a member of your administration?	
Yes	8.9%
10. Do you believe you need to cut time from science education in order to spend more time on reading and math instruction?	
Yes	33.3%
13. Are you provided the same opportunity for professional development in science as you are in reading and math?	
Yes	44.5%
15. Are you responsible for teaching the assessed indicators for science?	
Yes	77.9%

Appendix F - Fourth Grade Math Achievement Gap: Analysis by State 2000 to 2007

Figure F.1: Achievement Gap Disaggregated by Race / Race: Grade 4 Math

Colorado: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	249	(1.1)	25	
African-American	2007	224	(2.2)		*P = 0.0000*
White	2005	247	(1.1)	25	
African-American	2005	222	(2.7)		*P = 0.0000*
White	2003	243	(0.9)	26	
African-American	2003	217	(2.4)		*P = 0.0000*
White	2000	‡	-	‡	
African-American	2000	‡	-		*P = ‡*
Change in Achievement Gap Between 2003 and 2007 Testing Years				**-1**	***P = 0.7895***
Kansas: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	252	(0.7)	26	*P = 0.0000*
African-American	2007	226	(2.1)		
White	2005	249	(1.1)	21	*P = 0.0000*
African-American	2005	228	(1.8)		
White	2003	246	(1.0)	29	*P = 0.0000*
African-American	2003	217	(1.5)		
White	2000	237	(1.2)	29	*P = 0.0000*
African-American	2000	208	(3.6)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-3**	***P = 0.5030***
Missouri: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	245	(0.9)		
African-American	2007	218	(1.7)	27	*P = 0.0000*
White	2005	240	(0.7)		
African-American	2005	215	(1.7)	25	*P = 0.0000*
White	2003	240	(0.9)		
African-American	2003	216	(1.3)	24	*P = 0.0000*
White	2000	233	(1.1)		
African-American	2000	202	(2.8)	31	*P = 0.0000*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-4**	***P = 0.2732***
Nebraska: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	244	(0.8)	33	*P = 0.0000*
African-American	2007	211	2.5		
White	2005	244	(0.9)	33	*P = 0.0000*
African-American	2005	211	(3.3)		
White	2003	241	(0.8)	30	*P = 0.0000*
African-American	2003	211	(1.8)		
White	2000	230	(1.5)	37	*P = 0.0004*
African-American	2000	193	(5.7)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-4**	***P = 0.5087***

Oklahoma: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	242	(0.9)		
African-American	2007	220	(1.5)	22	*P = 0.0000*
White	2005	240	1.0		
African-American	2005	217	(1.8)	23	*P = 0.0000*
White	2003	235	(1.0)		
African-American	2003	211	(2.0)	24	*P = 0.0000*
White	2000	229	(1.1)		
African-American	2000	205	(3.0)	24	*P = 0.0000*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-2**	***P = 0.5396***

Colorado: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	249	(1.1)	25	*P = 0.0000*
Hispanic-American	2007	224	(2.2)		
White	2005	247	(1.0)	24	*P = 0.0000*
Hispanic-American	2005	223	(2.7)		
White	2003	243	(0.9)	26	*P = 0.0000*
Hispanic-American	2003	217	(2.4)		
White	2000	‡	-	‡	*P = ‡*
Hispanic-American	2000	‡	-		
Change in Achievement Gap Between 2003 and 2007 Testing Years				**-1**	***P = 0.6554***

Kansas: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	252	(0.7)	18	*P = 0.0000*
Hispanic-American	2007	234	(2.0)		
White	2005	249	(1.1)	15	*P = 0.0000*
Hispanic-American	2005	234	(1.8)		
White	2003	246	(1.0)	16	*P = 0.0000*
Hispanic-American	2003	230	(1.5)		
White	2000	237	(1.2)	24	*P = 0.0132*
Hispanic-American	2000	213	(6.3)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-6**	***P = 0.4239***

Missouri: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	245	(0.9)	11	*P = 0.0312*
Hispanic-American	2007	234	(4.2)		
White	2005	240	(0.7)	19	*P = 0.0001*
Hispanic-American	2005	221	(3.0)		
White	2003	240	(1.0)	20	*P = 0.0000*
Hispanic-American	2003	220	(2.1)		
White	2000	‡	-	‡	*P = ‡*
Hispanic-American	2000	‡	-		
Change in Achievement Gap Between 2003 and 2007 Testing Years				**-9**	***P = 0.1287***

Nebraska: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White Hispanic-American	2007 2007	244 220	(0.8) (2.4)	24	*P = 0.0000*
White Hispanic-American	2005 2005	244 219	(0.9) (1.4)	25	*P = 0.0000*
White Hispanic-American	2003 2003	241 213	(0.8) (2.1)	28	*P = 0.0000*
White Hispanic-American	2000 2000	230 205	(1.5) (3.1)	25	*P = 0.0000*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-1**	***P = 0.7190***

Oklahoma: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White Hispanic-American	2007 2007	242 227	(0.9) (2.1)	15	*P = 0.0000*
White Hispanic-American	2005 2005	240 226	(1.0) (1.5)	14	*P = 0.0000*
White Hispanic-American	2003 2003	235 220	(1.0) (2.3)	15	*P = 0.0000*
White Hispanic-American	2000 2000	229 211	(1.1) (2.1)	18	*P = 0.0000*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-3**	***P = 0.2938***

Colorado: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	224 224	(2.1) (1.7)	0	*P = 0.8944*
African-American Hispanic-American	2005 2005	222 223	(2.7) (1.7)	-1	*P = 0.9320*
African-American Hispanic-American	2003 2003	217 217	(2.4) (1.8)	0	*P = 0.9858*
African-American Hispanic-American	2000 2000	‡ ‡	- -	‡	*P = ‡*
Change in Achievement Gap Between 2003 and 2007 Testing Years				**0**	***P = 0.9387***

Kansas: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	226 234	(2.1) (2.0)	-8	*P = 0.0110*
African-American Hispanic-American	2005 2005	228 234	(1.8) (1.8)	-6	*P = 0.0358*
African-American Hispanic-American	2003 2003	217 230	(1.5) (1.5)	-13	*P = 0.0000*
African-American Hispanic-American	2000 2000	208 213	(3.6) (6.3)	-5	*P = 0.5043*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-3**	***P = 0.7303***

Missouri: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American	2007	218	(1.7)	-16	*P = 0.0052*
Hispanic-American	2007	234	(4.2)		
African-American	2005	215	(1.7)	-6	*P = 0.1001*
Hispanic-American	2005	221	(3.0)		
African-American	2003	216	(1.3)	-4	*P = 0.4139*
Hispanic-American	2003	220	(2.1)		
African-American	2000	‡	‡	‡	*P = ‡*
Hispanic-American	2000	‡	‡		
Change in Achievement Gap Between 2003 and 2007 Testing Years				**-12**	***P = 0.0612***
Nebraska: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American	2007	211	(2.5)	-9	*P = 0.0127*
Hispanic-American	2007	220	(2.4)		
African-American	2005	211	(3.3)	-8	*P = 0.0447*
Hispanic-American	2005	219	(1.4)		
African-American	2003	211	(1.8)	-2	*P = 0.4618*
Hispanic-American	2003	213	(2.1)		
African-American	2000	193	(5.7)	-12	*P = 0.0859*
Hispanic-American	2000	205	(3.1)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**3**	***P = 0.6980***
Oklahoma: 4th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American	2007	220	(1.5)	-7	*P = 0.0116*
Hispanic-American	2007	227	(2.1)		
African-American	2005	217	(1.8)	-9	*P = 0.0002*
Hispanic-American	2005	226	(1.5)		
African-American	2003	211	(2.0)	-9	*P = 0.0102*
Hispanic-American	2003	220	(2.3)		
African-American	2000	205	(3.0)	-6	*P = 0.1287*
Hispanic-American	2000	211	(2.1)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-1**	***P = 0.7895***

Appendix G - Eighth Grade Math Achievement Gap: Analysis by State 2000 to 2007

Figure G.1: Achievement Gap Disaggregated by Race: Grade 8 Math

Colorado: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	296	(1.1)	24	*P = 0.0000*
African-American	2007	272	(2.1)		
White	2005	292	(1.1)	36	*P = 0.0000*
African-American	2005	256	(3.1)		
White	2003	292	(1.2)	37	*P = 0.0000*
African-American	2003	255	(2.9)		
White	2000	‡	-	‡	*P = ‡*
African-American	2000	‡	-		
Change in Achievement Gap Between 2003 and 2007 Testing Years				**-13**	***P = 0.0018***
Kansas: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	295	(1.0)	28	*P = 0.0000*
African-American	2007	267	(3.0)		
White	2005	289	(1.0)	33	*P = 0.0000*
African-American	2005	256	(4.4)		
White	2003	290	(1.2)	38	*P = 0.0000*
African-American	2003	252	(3.5)		
White	2000	287	(1.5)	42	*P = 0.0000*
African-American	2000	245	(10.9)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-14**	***P = 0.2374***
Missouri: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	288	(0.9)	35	*P = 0.0000*
African-American	2007	253	(2.0)		
White	2005	284	(1.3)	37	*P = 0.0000*
African-American	2005	247	(1.9)		
White	2003	284	(1.0)	34	*P = 0.0000*
African-American	2003	250	(2.1)		
White	2000	277	(1.1)	39	*P = 0.0000*
African-American	2000	238	(4.0)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-4**	***P = 0.2969***

Nebraska: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	291	(1.0)	51	*P = 0.0000*
African-American	2007	240	(2.8)		
White	2005	289	(1.1)	46	*P = 0.0000*
African-American	2005	243	(2.3)		
White	2003	287	(1.0)	40	*P = 0.0000*
African-American	2003	247	(8.6)		
White	2000	285	(1.1)	38	*P = 0.0000*
African-American	2000	247	(3.4)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**13**	***P = 0.0071***
Oklahoma: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	280	(0.9)	22	*P = 0.0000*
African-American	2007	258	(2.5)		
White	2005	278	(1.1)	29	*P = 0.0000*
African-American	2005	249	(2.3)		
White	2003	278	(1.0)	29	*P = 0.0000*
African-American	2003	249	(3.4)		
White	2000	274	(1.3)	29	*P = 0.0000*
African-American	2000	245	(4.7)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-7**	***P = 0.2217***
Colorado: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	296	(1.1)	32	*P = 0.0000*
Hispanic-American	2007	264	(1.3)		
White	2005	292	(1.1)	32	*P = 0.0000*
Hispanic-American	2005	260	(1.9)		
White	2003	292	(1.2)	33	*P = 0.0000*
Hispanic-American	2003	259	(1.9)		
White	2000	‡	-	‡	*P = ‡*
Hispanic-American	2000	‡	-		
Change in Achievement Gap Between 2003 and 2007 Testing Years				**-1**	***P = 0.7502***
Kansas: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	295	(1.0)	26	*P = 0.0000*
Hispanic-American	2007	269	(2.8)		
White	2005	289	(1.0)	23	*P = 0.0000*
Hispanic-American	2005	266	(2.5)		
White	2003	290	(1.2)	27	*P = 0.0000*
Hispanic-American	2003	263	(2.6)		
White	2000	287	(1.5)	25	*P = 0.0000*
Hispanic-American	2000	262	(3.8)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**1**	***P = 0.6788***

Missouri: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	288	(0.9)	18	*P = 0.0000*
Hispanic-American	2007	270	(2.8)		
White	2005	‡	‡	‡	
Hispanic-American	2005	‡	‡		
White	2003	‡	‡	‡	
Hispanic-American	2003	‡	‡		
White	2000	‡	‡	‡	
Hispanic-American	2000	‡	‡		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**‡**	
Nebraska: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	291	(1.0)	30	*P = 0.0000*
Hispanic-American	2007	261	(2.2)		
White	2005	289	(1.1)	28	*P = 0.0000*
Hispanic-American	2005	261	(2.2)		
White	2003	287	(1.0)	32	*P = 0.0000*
Hispanic-American	2003	255	(3.0)		
White	2000	285	(1.1)	43	*P = 0.0000*
Hispanic-American	2000	242	(6.5)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-13**	***P = 0.0755***
Oklahoma: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	280	(0.9)	21	*P = 0.0000*
Hispanic-American	2007	259	(2.4)		
White	2005	278	(1.1)	21	*P = 0.0000*
Hispanic-American	2005	257	(3.7)		
White	2003	278	(1.0)	20	*P = 0.0000*
Hispanic-American	2003	258	(3.0)		
White	2000	274	(1.3)	14	*P = 0.0000*
Hispanic-American	2000	260	(3.7)		
Change in Achievement Gap Between 2000 and 2007 Testing Years				**7**	***P = 0.1020***
Colorado: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American	2007	272	(2.1)	8	*P = 0.0022*
Hispanic-American	2007	264	(1.3)		
African-American	2005	256	(3.1)	-4	*P = 0.2458*
Hispanic-American	2005	260	(1.9)		
African-American	2003	255	(2.8)	-4	*P = 0.2138*
Hispanic-American	2003	259	(1.9)		
African-American	2000	‡	-	‡	*P = ‡*
Hispanic-American	2000	‡	-		
Change in Achievement Gap Between 2003 and 2007 Testing Years				**12**	***P = 0.0059***

Kansas: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	267 269	(3.0) (2.8)	-2	*P = 0.6754*
African-American Hispanic-American	2005 2005	256 266	(4.4) (2.5)	-10	*P = 0.0810*
African-American Hispanic-American	2003 2003	252 263	(3.5) (2.6)	-11	*P = 0.0113*
African-American Hispanic-American	2000 2000	245 262	(10.9) (3.8)	-17	*P = 0.1457*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**15**	***P = 0.6788***

Missouri: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	253 270	(2.0) (2.8)	-17	*P = 0.0000*
African-American Hispanic-American	2005 2005	‡ ‡	‡ ‡	‡	
African-American Hispanic-American	2003 2003	‡ ‡	‡ ‡	‡	
African-American Hispanic-American	2000 2000	‡ ‡	‡ ‡	‡	
Change in Achievement Gap Between 2000 and 2007 Testing Years				**‡**	

Nebraska: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	240 261	(2.8) (2.2)	-21	*P = 0.0000*
African-American Hispanic-American	2005 2005	243 261	(2.3) (2.2)	-18	*P = 0.0000*
African-American Hispanic-American	2003 2003	247 255	(8.6) (3.0)	-8	*P = 0.1023*
African-American Hispanic-American	2000 2000	247 242	(3.4) (6.5)	5	*P = 0.4787*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**-26**	***P = 0.0030***

Oklahoma: 8th Grade Math					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	258 259	(2.5) (2.4)	-1	*P = 0.8374*
African-American Hispanic-American	2005 2005	249 257	(2.3) (3.7)	-8	*P = 0.0686*
African-American Hispanic-American	2003 2003	249 258	(3.4) (3.0)	-9	*P = 0.0739*
African-American Hispanic-American	2000 2000	245 260	(4.7) (3.7)	-15	*P = 0.0148*
Change in Achievement Gap Between 2000 and 2007 Testing Years				**14**	***P = 0.0382***

Appendix H - Fourth Grade Reading Achievement Gap: Analysis by State 2002 to 2007

Figure H.1: Achievement Gap Disaggregated by Race: Grade 4 Reading

Colorado: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White African-American	2007 2007	234 210	(1.0) (3.2)	24	*P = 0.0000*
White African-American	2005 2005	232 207	(1.2) (3.0)	25	*P = 0.0000*
White African-American	2003 2003	232 208	(1.2) (2.6)	24	*P = 0.0000*
White African-American	2002 2002	‡ ‡	- -	‡	*P = ‡*
Change in Achievement Gap Between 2003 and 2007 Testing Years				**0**	***P = 0.9257***
Kansas: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White African-American	2007 2007	229 208	(1.1) (2.6)	21	*P = 0.0000*
White African-American	2005 2005	225 196	(1.3) (2.5)	29	*P = 0.0000*
White African-American	2003 2003	225 197	(1.3) (2.9)	28	*P = 0.0000*
White African-American	2002 2002	226 206	(1.6) (3.0)	20	*P = 0.0000*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**1**	***P = 0.7764***
Missouri: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White African-American	2007 2007	226 200	(1.2) (2.1)	26	*P = 0.0000*
White African-American	2005 2005	226 200	(0.9) (2.6)	26	*P = 0.0000*
White African-American	2003 2003	227 203	(1.3) (1.7)	24	*P = 0.0000*
White African-American	2002 2002	226 197	(1.4) (3.6)	29	*P = 0.0000*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-3**	***P = 0.3929***

Nebraska: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White African-American	2007 2007	230 194	(0.9) (3.7)	36	*P = 0.0000*
White African-American	2005 2005	228 194	(1.2) (2.4)	34	*P = 0.0000*
White African-American	2003 2003	225 203	(1.1) (2.9)	22	*P = 0.0000*
White African-American	2002 2002	226 209	(1.6) (4.9)	17	*P = 0.0000*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**19**	***P = 0.0114***
Oklahoma: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White African-American	2007 2007	223 204	(1.1) (2.2)	19	*P = 0.0000*
White African-American	2005 2005	219 197	(1.3) (2.8)	22	*P = 0.0000*
White African-American	2003 2003	220 195	(1.3) (2.5)	25	*P = 0.0000*
White African-American	2002 2002	220 188	(1.0) (3.7)	32	*P = 0.0000*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-13**	***P = 0.0076***
Colorado: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White Hispanic-American	2007 2007	234 204	(1.0) (1.7)	30	*P = 0.0000*
White Hispanic-American	2005 2005	232 206	(1.2) (1.6)	26	*P = 0.0000*
White Hispanic-American	2003 2003	232 205	(1.2) (1.6)	27	*P = 0.0000*
White Hispanic-American	2002 2002	‡ ‡	- -	‡	*P = ‡*
Change in Achievement Gap Between 2003 and 2007 Testing Years				**3**	***P = 0.2710***
Kansas: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White Hispanic-American	2007 2007	229 209	(1.1) (2.4)	20	*P = 0.0000*
White Hispanic-American	2005 2005	225 203	(1.3) (2.8)	22	*P = 0.0000*
White Hispanic-American	2003 2003	225 207	(1.3) (2.5)	18	*P = 0.0000*
White Hispanic-American	2002 2002	226 205	(1.6) (2.5)	21	*P = 0.0000*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-1**	***P = 0.8836***

Missouri: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White Hispanic-American	2007 2007	226 213	(1.2) (4.1)	13	*P = 0.0035*
White Hispanic-American	2005 2005	226 210	(0.9) (4.8)	16	*P = 0.0026*
White Hispanic-American	2003 2003	227 218	(1.3) (4.2)	9	*P = 0.0689*
White Hispanic-American	2002 2002	‡ ‡	‡ ‡	‡	*P = ‡*
Change in Achievement Gap Between 2003 and 2007 Testing Years				**4**	***P = 0.4247***
Nebraska: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White Hispanic-American	2007 2007	230 203	(0.9) (2.8)	27	*P = 0.0000*
White Hispanic-American	2005 2005	228 202	(1.2) (2.5)	26	*P = 0.0000*
White Hispanic-American	2003 2003	225 202	(1.1) (2.7)	23	*P = 0.0000*
White Hispanic-American	2002 2002	226 203	(1.6) (3.9)	23	*P = 0.0000*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**4**	***P = 0.4117***
Oklahoma: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White Hispanic-American	2007 2007	223 198	(1.0) (2.8)	25	*P = 0.0000*
White Hispanic-American	2005 2005	219 204	(1.2) (2.4)	15	*P = 0.0000*
White Hispanic-American	2003 2003	220 200	(1.1) (2.8)	20	*P = 0.0000*
White Hispanic-American	2002 2002	223 197	(1.0) (3.0)	26	*P = 0.0000*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-1**	***P = 0.6915***
Colorado: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	210 204	(3.2) (1.7)	6	*P = 0.1084*
African-American Hispanic-American	2005 2005	207 206	(3.0) (1.6)	1	*P = 0.6830*
African-American Hispanic-American	2003 2003	208 205	(2.6) (1.6)	3	*P = 0.2770*
African-American Hispanic-American	2002 2002	‡ ‡	- -	‡	*P = ‡*
Change in Achievement Gap Between 2003 and 2007 Testing Years				**3**	***P = 0.5690***

Kansas: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	208 209	(2.6) (2.4)	-1	*P = 0.7288*
African-American Hispanic-American	2005 2005	196 203	(2.5) (2.8)	-7	*P = 0.0679*
African-American Hispanic-American	2003 2003	197 207	(2.9) (2.5)	-10	*P = 0.0114*
African-American Hispanic-American	2002 2002	206 205	(3.0) (2.5)	1	*P = 0.8773*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-2**	***P = 0.7279***
Missouri: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	200 213	(2.1) (4.1)	-13	*P = 0.0101*
African-American Hispanic-American	2005 2005	200 210	(2.6) (4.8)	-10	*P = 0.0880*
African-American Hispanic-American	2003 2003	203 218	(1.7) (4.2)	-15	*P = 0048*
African-American Hispanic-American	2002 2002	‡ ‡	‡ ‡	‡	*P = ‡*
Change in Achievement Gap Between 2005 and 2007 Testing Years				**2**	***P = 0.7363***
Nebraska: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	194 203	(3.7) (2.8)	-9	*P = 0.0768*
African-American Hispanic-American	2005 2005	194 202	(2.4) (2.5)	-8	*P = 0.0226*
African-American Hispanic-American	2003 2003	203 202	(2.9) (2.7)	1	*P = 0.6722*
African-American Hispanic-American	2002 2002	209 203	(4.9) (3.9)	6	*P = 0.3856*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-15**	***P = 0.0754***
Oklahoma: 4th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American Hispanic-American	2007 2007	204 198	(2.2) (3.9)	6	*P = 0.2359*
African-American Hispanic-American	2005 2005	197 204	(2.8) (3.2)	-7	*P = 0.1122*
African-American Hispanic-American	2003 2003	195 200	(2.5) (3.0)	-5	*P = 0.2821*
African-American Hispanic-American	2002 2002	188 197	(3.7) (2.8)	-9	*P = 0.0507*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**15**	***P = 0.0254***

Appendix I - Eighth Grade Reading Achievement Gap: Analysis by State 2002 to 2007

Figure I.1: Achievement Gap Disaggregated by Race Grade 8 Reading

Colorado: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	275	(1.2)	23	*P = 0.0000*
African-American	2007	252	(3.2)		
White	2005	273	(1.0)	19	*P = 0.0002*
African-American	2005	254	(3.9)		
White	2003	275	(1.4)	26	*P = 0.0000*
African-American	2003	249	(3.2)		
White	2002	‡	-	‡	*P = ‡*
African-American	2002	‡	-		
Change in Achievement Gap Between 2003 and 2007 Testing Years				**-3**	***P = 0.4289***
Kansas: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	272	(0.9)	26	*P = 0.0000*
African-American	2007	246	(3.1)		
White	2005	271	(1.0)	24	*P = 0.0000*
African-American	2005	247	(2.2)		
White	2003	271	(1.4)	28	*P = 0.0000*
African-American	2003	243	(3.1)		
White	2002	273	(1.3)	29	*P = 0.0000*
African-American	2002	244	(3.0)		
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-3**	***P = 0.5909***
Missouri: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	270	(1.0)	28	*P = 0.0000*
African-American	2007	242	(2.2)		
White	2005	270	(1.1)	28	*P = 0.0000*
African-American	2005	242	(1.8)		
White	2003	272	(1.0)	29	*P = 0.0000*
African-American	2003	243	(1.8)		
White	2002	271	(1.0)	21	*P = 0.0000*
African-American	2002	250	(2.3)		
Change in Achievement Gap Between 2002 and 2007 Testing Years				**7**	***P = 0.0950***

	Testing Year	Average Scale Score	Standard Error	Difference Between Average Scale Scores	P-value
Nebraska: 8th Grade Reading					
White	2007	271	(1.0)	28	*P = 0.0000*
African-American	2007	243	(3.2)		
White	2005	271	(0.9)	28	*P = 0.0000*
African-American	2005	243	(2.5)		
White	2003	271	(0.9)	32	*P = 0.0000*
African-American	2003	239	(3.1)		
White	2002	273	(0.9)	27	*P = 0.0000*
African-American	2002	246	(3.2)		
Change in Achievement Gap Between 2002 and 2007 Testing Years				**1**	***P = 0.7937***
Oklahoma: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	266	(1.0)	23	*P = 0.0000*
African-American	2007	243	(2.7)		
White	2005	265	(1.2)	22	*P = 0.0000*
African-American	2005	243	(2.7)		
White	2003	267	(1.1)	27	*P = 0.0000*
African-American	2003	240	(4.0)		
White	2002	268	(1.0)	30	*P = 0.0000*
African-American	2002	238	(3.0)		
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-7**	***P = 0.1086***
Colorado: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	275	(1.2)	26	*P = 0.0000*
Hispanic-American	2007	249	(1.9)		
White	2005	273	(1.0)	26	*P = 0.0000*
Hispanic-American	2005	247	(1.9)		
White	2003	275	(1.4)	28	*P = 0.0000*
Hispanic-American	2003	247	(2.1)		
White	2002	‡	-	‡	*P = ‡*
Hispanic-American	2002	‡	-		
Change in Achievement Gap Between 2003 and 2007 Testing Years				**-2**	***P = 0.5429***
Kansas: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	272	(0.9)	24	*P = 0.0000*
Hispanic-American	2007	248	(3.4)		
White	2005	271	(1.0)	22	*P = 0.0000*
Hispanic-American	2005	249	(2.6)		
White	2003	271	(1.4)	26	*P = 0.0000*
Hispanic-American	2003	245	(3.8)		
White	2002	273	(1.3)	20	*P = 0.0002*
Hispanic-American	2002	253	(4.2)		
Change in Achievement Gap Between 2002 and 2007 Testing Years				**4**	***P = 0.5090***

Missouri: 8th Grade Reading						
	Testing Year	Average Scale Score	Standard Error	Difference Between Average Scale Scores	P-value
White	2007	270	(0.9)	22	*P = 0.0009*
Hispanic-American	2007	248	(2.0)		
White	2005	270	(1.3)	12	*P = 0.0628*
Hispanic-American	2005	258	(1.9)		
White	2003	‡	(1.0)	‡	*P = ‡*
Hispanic-American	2003	‡	(2.1)		
White	2002	‡	(1.1)	‡	*P = ‡*
Hispanic-American	2002	‡	(4.0)		
Change in Achievement Gap Between 2005 and 2007 Testing Years				**10**	***P = 0.2969***
Nebraska: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	271	(1.0)	16	*P = 0.0000*
Hispanic-American	2007	255	(2.5)		
White	2005	271	(0.9)	26	*P = 0.0000*
Hispanic-American	2005	245	(2.0)		
White	2003	271	(0.9)	30	*P = 0.0000*
Hispanic-American	2003	241	(3.1)		
White	2002	273	(0.9)	22	*P = 0.0000*
Hispanic-American	2002	251	(2.8)		
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-6**	***P = 0.1296***
Oklahoma: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
White	2007	266	(1.0)	25	*P = 0.0000*
Hispanic-American	2007	241	(2.8)		
White	2005	265	(1.2)	18	*P = 0.0000*
Hispanic-American	2005	247	(2.4)		
White	2003	267	(1.1)	17	*P = 0.0000*
Hispanic-American	2003	250	(2.8)		
White	2002	268	(1.0)	17	*P = 0.0000*
Hispanic-American	2002	251	(3.0)		
Change in Achievement Gap Between 2002 and 2007 Testing Years				**8**	***P = 0.0678***
Colorado: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American	2007	252	(3.2)	3	*P = 0.4265*
Hispanic-American	2007	249	(1.9)		
African-American	2005	254	(3.9)	7	*P = 0.0894*
Hispanic-American	2005	247	(1.9)		
African-American	2003	249	(3.2)	2	*P = 0.7563*
Hispanic-American	2003	247	(2.1)		
African-American	2002	‡	-	‡	*P = ‡*
Hispanic-American	2002	‡	-		
Change in Achievement Gap Between 2003 and 2007 Testing Years				**1**	***P = 0.7371***

Kansas: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American	2007	246	(3.1)	-2	*P = 0.6754*
Hispanic-American	2007	248	(3.4)		
African-American	2005	247	(2.2)	-2	*P = 0.0810*
Hispanic-American	2005	249	(2.6)		
African-American	2003	243	(3.1)	-2	*P = 0.0113*
Hispanic-American	2003	245	(3.8)		
African-American	2002	244	(3.0)	-9	*P = 0.1457*
Hispanic-American	2002	253	(4.2)		
Change in Achievement Gap Between 2002 and 2007 Testing Years				**7**	***P = 0.3715***
Missouri: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American	2007	242	(2.2)	-6	*P = 0.3151*
Hispanic-American	2007	248	(5.2)		
African-American	2005	242	(1.8)	-16	*P = 0.0238*
Hispanic-American	2005	258	(6.0)		
African-American	2003	‡	‡	‡	*P = ‡*
Hispanic-American	2003	‡	‡		
African-American	2002	‡	‡	‡	*P = ‡*
Hispanic-American	2002	‡	‡		
Change in Achievement Gap Between 2005 and 2007 Testing Years				**10**	***P = 0.2584***
Nebraska: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American	2007	243	(3.2)	-12	*P = 0.0042*
Hispanic-American	2007	255	(2.5)		
African-American	2005	243	(2.5)	-2	*P = 0.5018*
Hispanic-American	2005	245	(2.0)		
African-American	2003	239	(3.1)	-2	*P = 0.7064*
Hispanic-American	2003	241	(3.1)		
African-American	2002	246	(3.2)	-5	*P = 0.2785*
Hispanic-American	2002	251	(2.8)		
Change in Achievement Gap Between 2002 and 2007 Testing Years				**-7**	***P = 0.2137***
Oklahoma: 8th Grade Reading					
	Testing Year	**Average Scale Score**	**Standard Error**	**Difference Between Average Scale Scores**	**P-value**
African-American	2007	243	(2.5)	2	
Hispanic-American	2007	241	(2.4)		*P = 0.8374*
African-American	2005	243	(2.3)	-4	
Hispanic-American	2005	247	(3.7)		*P = 0.0686*
African-American	2003	240	(3.4)	-10	
Hispanic-American	2003	250	(3.0)		*P = 0.0739*
African-American	2002	238	(4.7)	-13	
Hispanic-American	2002	251	(3.7)		*P = 0.0148*
Change in Achievement Gap Between 2002 and 2007 Testing Years				**15**	***P = 0.0105***

Appendix J - National Reading: Scores at Proficient and Above

Figure J.1: Scoring Proficient and Above on 4th Grade Reading; 2002 Compared to 2007

Adjusted National Level 4th Grade Reading			
Year		Percent Proficient or Above	
2002		36%	
2007		39%	
Chi-square Analysis			
α =.05	Chi-sq = 0.06	*df* = 1	*p* = .8065

Figure J.2: Scoring Proficient and Above on 8th Grade Reading; 2002 Compared to 2007

Adjusted National Level 8th Grade Reading			
Year		Percent Proficient or Above	
2002		33%	
2007		31%	
Chi-square Analysis			
α =.05	Chi-sq = 0.02	*df* = 1	*p* = .8875

Appendix K - National M: Scores at Proficient and Above

Figure K.1: Scoring Proficient and Above on 4th Grade Math; 2000 Compared to 2007

Adjusted National Level 4th Grade Math			
	Year	Percent Proficient or Above	
	2000	22%	
	2007	39%	
Chi-square Analysis			
α =.05	Chi-sq = 5.3	*df* = 1	*p* = .0213

Figure K.2: Scoring Proficient and Above on 8th Grade Math; 2000 Compared to 2007

Adjusted National Level 8th Grade Math			
	Year	Percent Proficient or Above	
	2000	30%	
	2007	39%	
Chi-square Analysis			
α =.05	Chi-sq = 0.72	*df* = 1	*p* = .3961

Appendix L - National Science: Scores at Proficient and Above

Figure L.1: Scoring Proficient and Above on 4th Grade Science; 2000 Compared to 2005

Adjusted National Level 4th Grade Science	
Year	Percent Proficient or Above
2000	29%
2005	29%
Chi-square Analysis	
Was not performed because there is of no difference in values.	

Figure L.2: Scoring Proficient and Above on 8th Grade Science; 2000 Compared to 2005

Adjusted National Level 8th Grade Science			
Year	Percent Proficient or Above		
2000	33%		
2005	30%		
Chi-square Analysis			
α =.05	Chi-sq = 0.06	*df* = 1	*p* = .8065

Appendix M - Screen Shots of Online Survey

Page #1

1. Untitled Page

1. What grade(s) do you presently teach?

☐ K ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

2. What state do you teach in?

○ CO ○ KS ○ OK ○ MO ○ NE

3. NCLB is an educational reform mandated by the government. What is your opinion of this type of mandate?

4. In your opinion, what impact do you believe NCLB has had on science education?

5. What is the amount of time you spend each week teaching science?

○ 0 – 30 min ○ 31 – 60 min ○ 61 – 90 min ○ 91 – 120 min ○ >120 min

6. Has the amount of time you spend teaching science decreased since the implementation of No Child Left Behind?

○ Yes

○ No

Page #2

2. Yes decreasing time due to NCLB

7. How much time did you have to remove from teaching science?

- 0 – 30 min
- 31 – 60 min
- 61 – 90 min
- 91 – 120 min
- >120 min

8. Why did you feel the need to decrease your instructional time for science?

9. Have you ever been instructed to decrease the time you spend teaching science by a member of your administration?

- Yes
- No

Page #3

3. yes admin decrease science

10. What reason was given by administration for requesting this decrease in time for science instruction?

11. Have you ever been instructed not to teach science for any reason by a member of your administration?

- Yes
- No

Page #4

4. no decrease by admin

12. Have you ever been instructed not to teach science for any reason by a member of your administration?

- [ ] Yes
- [ ] No

Page #5

5. yes admin no science

13. What reason was given by the administration for requesting that you not teach science?

14. Do you believe you need to cut time from science education in order to spend more time on reading and math instruction?

- [ ] Yes
- [ ] No

Page #6

6. No admin no science

15. Do you believe you need to cut time from science education in order to spend more time on reading and math instruction?

- [ ] Yes
- [ ] No

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7. No decrease in time due to NCLB

16. Have you ever been instructed to decrease the time you spend teaching science by a member of your administration?

- [ ] Yes
- [ ] No

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8. Believes it needed to cut science for math and reading

17. Explain why you believe you need to cut time from science education.

18. How does what you personally spend on science education supplies and materials compare to what you personally spend on math and reading?

19. Are you provided the same opportunity for professional development in science as you are in reading and math?

- Yes
- No

20. Are you responsible for teaching the assessed indicators for science?

- Yes
- No

21. Explain why you feel or don't feel confident to teach science concepts.

22. Have you ever had to give a grade for science even though you did not spend time teaching or evaluating science material?

- Yes
- No

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9. no need to cut science

23. How does what you personally spend on science education supplies and materials compare to what you personally spend on math and reading?

24. Are you provided the same opportunity for professional development in science as you are in reading and math?

- Yes
- No

25. Are you responsible for teaching the assessed indicators for science?

- Yes
- No

26. Explain why you feel or don't feel confident to teach science concepts.

27. Have you ever had to give a grade for science even though you did not spend time teaching or evaluating science material?

- Yes
- No

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10. grade for science but did not teach it

28. Why did you give a grade for science even though you did not spend time teaching or evaluating science material?

29. Please add any additional comments you feel are important in regards to science education in elementary school.

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11. no to grade without teaching it

30. Please add any additional comments you feel are important in regards to science education in elementary school.