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The Perceived Impact of No Child Left Behind on Third- through Fifth-Grade Elementary Science Classrooms.

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by

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ABSTRACT

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The purpose of this study was to describe the perceived impact of *No Child Left Behind* on elementary science classrooms in 3 Northeast Tennessee school districts. Quantitative descriptive methodology was used to document how *No Child Left Behind* impacts instructional methodology, professional development, administrative support, materials and resources, and assessment in 3rd through 5th grades.

Data were collected using a survey developed by the researcher. The survey consisted of a demographic section, 28 statements, and 2 open-ended questions. The 51 participants included elementary-school science teachers in 8 schools in 3 upper East Tennessee school districts.

Data analysis was based on the following demographics: differing levels of teaching experience, *No Child Left Behind* school status, and small and large schools. Findings included: The 3 greatest concerns of the impact of the *No Child Left Behind* Act were the pressures felt by teachers to increase test scores, the manner in which it impacted at-risk or disadvantaged students, and the lack of inservice, specifically for science. Findings also revealed that low-scoring schools or grades were receiving extra assistance and teachers reported they feel that their school or district fosters and supports change. An analysis of the open-ended questions

emphasized the stress teachers reported feeling along with the loss of science instruction time to math and language arts.

DEDICATION

I wish to dedicate this dissertation to the following:

To my mom and dad, Ruth and Hobert Kinsler, who always supported and believed in me and who, throughout my life, have been my greatest teachers in how a person should walk through this world;

to the Morristown Cohort, whose members have provided inspiration, guidance, and support;

to my friends, who, at a moments notice, edited, encouraged, and most of all listened; and

to my late grandmothers Ida Grace Kinsler and Emma McPherson who inspired me to take chances and to stand for what I believe in.

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CONTENTS

Chapter Page

Chapter Page

LIST OF TABLES

Table Page

CHAPTER 1

INTRODUCTION

Walt Whitman once said, “Science is a limitless voyage of joyous exploration” (as cited in Shubin, 2004, p. 56). Science--a journey through time and space, science--a thorough examination of what is known and what is not known, science--fun, spontaneous, inventive, and exciting. Whitman’s thought was expressed many years ago, but it captured the essence of science education. Today, however, with school systems, politicians, parents, and the media focused on concepts such as accountability, systemic reform, standards-based learning, and average yearly progress, are students failing to experience the essence of science?

The most comprehensive education law to be passed in history, the *No Child Left Behind* Act, is making an impact on science education by requiring states and school systems to test students in math, language arts, and eventually science in grades three through eight and at least once in high school (Tennessee Department of Education, 2003). Specifically, in science, it calls for states to staff highly-qualified teachers by the end of the 2005-2006 school year, to establish science standards in kindergarten through 12th grade by 2005, and to test students once a year in each of the following grade spans: 3 through 5, 6 through 9, and 10 through 12 in 2007-2008 (Education Commission of the States, 2003). The state of Tennessee has already met many of these mandates. Science standards are in place for kindergarten through 12th grade. High school students are tested through Gateway Biology, and the *Terra Nova* currently tests students in grades three, five, and eight.

Three years have gone by since *No Child Left Behind* became law, and many states, specifically the state of Tennessee, are on board and meeting the testing guidelines; nevertheless, the question now needs to be asked: With these new testing requirements and standards in place,

how has this focus on accountability impacted science literacy for all children, specifically elementary school children?

Background to the Problem

Late in the 19th century, science became a component of school curriculum in part at the urging of scientists such as Thomas Huxley, Herbert Spencer, and Charles Eliot because it provided an inductive way of thinking by allowing students to carry out independent inquiries and investigations as opposed to the deductive reasoning provided by the education mode of the day (DeBoer, 1991). Dewey, in 1910, (as cited in Rudolph, 2003) added his anxiety about science educators who wanted science to be "so much ready-made knowledge, so much subject matter of fact and law" (p. 69).

By the late 1950s, the interest in scientific literacy and its role in society increased with the Soviet Union's launching of the satellite Sputnik in 1957. At this point, science education began to mobilize to produce scientists and to focus on national security concerns (DeBoer, 2000; Yager, 2000). Even with this monumental push toward a change in the direction of science education, other opinions existed. DeBoer (2000) pointed out that the Rockefeller Brothers Fund, because of the movement into the technological age in 1958, proposed that scientific literacy should provide a broad understanding of science whether one wanted to become a scientist or not.

As time moved from the late 1950s to the 1990s, the central question of science education revolved around whether science education was about content or science-based social issues. Kromhout and Good (1983) proposed the question:

> Is the purpose of science education to increase our nation's economic position in the world and would that lead to the loss of "any real understanding of the structural integrity of science" and add to the impression that "the basics do not get taught"? (p. 649)

In the 1990s, science education reform resulted from the suggestion that the United States had not prepared its young people to live in a world where science and technology plays such a

broad part as had many other countries (DeBoer, 2000). Documents such as the American Association for the Advancement of Science (1993) Project 2061's *Science for All Americans*, the National Research Council's (1996) *National Science Education Standards,* and the National Science Resources Center's (1997) *Science for All Children* have led to standards-based reform in an effort to assure that all children achieve scientific literacy. These groups suggested that this type of reform could happen by (a) focusing on national, state, and local science education; (b) identifying content benchmarks that should be mastered by particular grade levels; (c) calling for changes in how educators think about teaching, professional development, and assessment in science education; and (d) incorporating current research on how children learn science (American Association for the Advancement of Science; National Research Council; National Science Resources Center).

In 1620, Francis Bacon wrote, "The ideal of human service is the ultimate goal of scientism effort" (as cited in Hurd, 2000, p. 285). Today, scientific literacy is minimally defined by the scientific educational community as "the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" (National Research Council, 1996, p. 22).

With the passage of *No Child Left Behind* and its accountability measures, the question could be asked: "Is scientific literacy by all American children being achieved?" The purpose of this study was to identify and describe how *No Child Left Behind* is a part of this preservation through its impact on professional development, instructional methodology, assessment, materials and resources, and administrative support in elementary science classrooms. The participants included elementary-school science teachers in grades three through five in eight Northeast Tennessee schools.

Significance of the Study

With the passage of *No Child Left Behind* in 2002, little research has been completed or accumulated to identify its impact on science education. Many data have been made available to school systems and the public on test scores and whether or not a school has been designated to be on a "list"; however, it is up to the educational community to determine if *No Child Left Behind* is moving science education "towards viable solutions and sound practices" (Huber & Moore, 2000, p. 12). Now is the time for local educators, government officials, and teachers to study the foundation that *No Child Left Behind* has provided and to make adjustments, deletions, and additions to make scientific literacy distinctly attainable for all children.

Also, with the concern placed on American students' standing in the international community and how this will affect America's position in the global workforce, another issue surrounding *No Child Left Behind* becomes significant. According to the *Trends in International Mathematics and Science Study* (TIMSS & PIRLS International Study Center, 2003), between 1999 and 2003, fourth-grade science students in 9 of 15 countries showed an improvement in test scores; however, the United States was one of the countries that failed to improve. In 1995, fourth graders in the United States scored 542 on TIMSS. In 2003, their scores fell 6 points to 536 (TIMSS & PIRLS International Study Center). Even though this drop may seem insignificant, now is the time to determine what impact (if any) *No Child Left Behind* has had on this decline. Again, it is important to determine what adjustments, additions, and revisions are needed to make all American children scientifically literate.

The purpose of this study was to identify the perceived impact of the *No Child Left Behind* Act on science literacy in elementary education by examining the differences in professional development, assessment, instructional methodology, materials and resources, and administrative support among teachers with differing levels of experience and between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools, and small and large schools. *No Child Left Behind* on-track schools are those listed as in good standing by the Tennessee

Department of Education (2003) and *No Child Left Behind* off-track schools are those designated as either targeted or high priority.

Research Questions and Hypotheses

Creswell (2003) suggested that quantitative researchers "use research questions and hypotheses to shape and specifically focus the purpose of the study" (p.108). The research questions should be "interrogative statements or questions" that the researcher seeks to answer (p. 108). Based on Creswell's suggestions, I developed the following research questions to shape and focus the study:

1. Is there a difference in the perceived impact of the *No Child Left Behind Act* among teachers with differing levels of experience on professional development, instructional methodology, administrative support, assessment, and resources and materials?
2. Is there a difference in the perceived impact of the *No Child Left Behind Act* between *No Child Left Behind* on-track schools and *No Child Left Behind* off-track schools on professional development, instructional methodology, administrative support, assessment, and resources and materials?
3. Is there a difference in the perceived impact of the *No Child Left Behind Act* between small and large schools on professional development, instructional methodology, administrative support, assessment, and resources and materials?

From the research questions, the following hypotheses were developed:

$Ho1_1$: There is no significant difference in the perceived impact of *No Child Left Behind* on professional development among teachers with differing levels of experience.

$Ho1_2$: There is no significant difference in the perceived impact of *No Child Left Behind* on instructional methodology among teachers with differing levels of experience.

$Ho1_3$: There is no significant difference in the perceived impact of *No Child Left Behind* in administrative support among teachers with differing levels of experience.

$Ho1_4$: There is no significant difference in the perceived impact of *No Child Left Behind* on resources and materials among teachers with differing levels of experience.

$Ho1_5$: There is no significant difference in the perceived impact of *No Child Left Behind* on assessment among teachers with differing levels of experience.

$Ho2_1$: There is no significant difference in the perceived impact of *No Child Left Behind* on professional development between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools.

$Ho2_2$: There is no significant difference in the perceived impact of *No Child Left Behind* on instructional methodology between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools.

$Ho2_3$: There is no significant difference in the perceived impact of *No Child Left Behind* in administrative support between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools.

$Ho2_4$: There is no significant difference in the perceived impact of *No Child Left Behind* on resources and materials between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools.

$Ho2_5$: There is no significant difference in the perceived impact of *No Child Left Behind* on assessment between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools.

$Ho3_1$: There is no significant difference in the perceived impact of *No Child Left Behind* on professional development between small and large schools.

$Ho3_2$: There is no significant difference in the perceived impact of *No Child Left Behind* on instructional methodology between small and large schools.

$Ho3_3$: There is no significant difference in the perceived impact of *No Child Left Behind* in administrative support between small and large schools.

$Ho3_4$: There is no significant difference in the perceived impact of *No Child Left Behind* on resources and materials between small and large schools.

$Ho3_5$: There is no significant difference in the perceived impact of *No Child Left Behind* on assessment between small and large schools.

Definitions of Terms

Inquiry-centered science: According to the National Science Resources Center (1997), this is a strategy used in science education that allows students to "learn to ask questions, experiment, develop theories, and communicate their ideas" (p. 1).

Adequate Yearly Progress (AYP): Adequate Yearly Progress is a measure of a school or school system's ability to meet required federal benchmarks with specific performance standards from year to year (Tennessee Department of Education, 2004a).

Standards-based: This is an outline of what students need to know, understand, and be able to do to be scientifically literate at different grade levels while allowing for diverse students' learning abilities, interests, and contexts (National Research Council, 1996).

High priority school/school system: A high priority school/school system is one that has missed the same federal benchmark for more than 1 consecutive year. There are five different levels of high priority schools/systems: School Improvement 1, School Improvement 2, Corrective Action, Restructuring 1, and Restructuring 2. School Improvement 1 refers to schools that have not met federal benchmarks for 2 consecutive years. At this stage, students attending Title 1 schools are eligible for school choice. School Improvement 2 refers to schools that have not met federal benchmarks for 3 consecutive years. The state, school district, and staff develop a school improvement plan defining ways to use additional resources to improve student performance. Students may receive supplemental educational services such as tutoring free.

Corrective Action refers to schools that have not met federal benchmarks for 4 years. The school is put on probation and the state may remove school staff, decrease local control, and increase the school year or day. Restructuring 1 refers to schools that have not met federal benchmarks for 5 years. A restructuring of the school or district plan must be made that provide options such as conversion to a charter school, staff replacement, outside management control, or management with a contracting university. Restructuring 2 refers to schools that have not met federal benchmarks for 6 years. The State Department of Education implements the plan developed in Restructuring 1 (Tennessee Department of Education, 2004a).

Title I school: A school with at least 50% poverty level of students who receive funding under Title I of the Elementary and Secondary Act to improve the academic achievement of children of low-income families (National Center for Education Statistics, 2000).

Targeted school: A targeted school/school system is one that missed a federal benchmark in at least one area for the 1st year. There are no sanctions/penalties for target schools/systems. The Department of Education offers technical assistance to help keep target schools/systems from becoming high priority schools/systems (Tennessee Department of Education, 2004a).

On-track schools: A school or system designated by the Tennessee Department of Education (2004a) as in good standing.

Off-track schools: A school or system designated by the Tennessee Department of Education (2004a) as either targeted or high priority.

Small school: A school with fewer than 400 students.

Large school: A school with 400 or more students.

Normal Curve Equivalent (NCE): A "mapping of percentile data into corresponding points in a normal distribution"(Tennessee Department of Education, 2004a, n. p.).

Criterion-Referenced Tests (CRT): Tests that are a measure of an individual student's performance on predetermined standards. These standards are created from established state curriculum (Tennessee Department of Education, 2004a).

Value-Added: An assessment developed to demonstrate schools' influence on students' performance by measuring student growth within a grade and subject (Tennessee Department of Education, 2004a).

Limitations and Delimitations

The *No Child Left Behind* Act of 2001 was signed into law in January of 2002 and has focused on math and language arts as components of school accountability; therefore, this has allowed a small timeframe in which teachers can make judgments on its impact in their classrooms. Furthermore, in 2007-2008, science will become one of the principal accountability components of *No Child Left Behind* and school systems may be in various stages of readiness for this phase of *No Child Left Behind*. Administering the survey at the beginning of the school year after the TCAP had been given and before results had been received might lead to limitations of the data and the use of a purposeful sample further limited the scope of the study. Therefore, the results should not be generalized beyond the sample of this study.

The survey instrument was developed by the researcher and was distributed to eight Northeast Tennessee schools in three different school districts. Elementary-school teachers in grades three through five completed the five-part survey.

Overview of the Study

This study is organized and presented in five chapters. Chapter 1 includes an introduction, background to the problem, significance of the study, research questions and hypotheses, and definitions of terms, limitations, and delimitations. Chapter 2 includes a review of the literature pertaining to the *No Child Left Behind* Act and scientific literacy. The literature review addresses several aspects of scientific literacy including: (a) inquiry-centered learning, (b) constructivism, (c), assessment, and (d) political and societal role. Chapter 3 consists of methodology and procedures for the study, research design, participants, data collection, data

analysis, and means to ensure validity and reliability of the study. Chapter 4 presents the results of data analysis. Chapter 5 provides a discussion of the findings, conclusions, recommendations for further research, and recommendations to improve practice.

CHAPTER 2

REVIEW OF LITERATURE

The purpose this study was to examine the perceived impact of the *No Child Left Behind* Act on the elementary-school science classroom. This chapter provides a history of scientific literacy, accountability, and the *No Child Left Behind* Act in order to provide an understanding of present policy development and its impact on education at the elementary level. In addition, current theories, instructional methods, and pedagogy related to an effective elementary science classroom through the review of constructivism, science inquiry, standards-based reform, professional development, and assessments are presented.

Scientific Literacy

Primarily, scientists were the leading instigators in science becoming part of the curriculum in schools in the United States and Europe during the 19th century. According to DeBoer (1991), Michael Faraday, Herbert Spencer, Charles Lyell, Thomas Huxley, John Tyndall, and Charles Elliot were just a few of the more notable promoters. Their promotion of science consisted of trying to present the utility of science along with its place in a world that considered the humanities the most noble and worthy of the educational process. These men deemed that science provided the highest level of intellectual training, that of induction, a process of drawing conclusions by observing the natural world rather than deduction that was the key component in most formal educational aspects of the time. Induction or the inductive process would be learned by students in the laboratory where they would have freedom to carry out independent investigations and inquires. The idea was that this freedom and independence would then create adults who were more willing and able to participate in a democratic society (DeBoer, 2000).

Dewey, in 1910, (as cited in Rudolph, 2003) was against educators who wanted to impart science as "so much ready-made knowledge, so much subject matter of fact and law" (p. 69). Students early in the 20th century were expected to learn a predetermined body of scientific information or scientific facts and laws; however, Dewey's instrumental theory of knowledge proposed that this type of information became relevant only when components of the learning included inquiry (Shook, 2000). According to Dewey, in 1916**,** "Atoms, molecules, chemical formulae, [and] the mathematical propositions in the study of physics represent instruments for the carrying on of science" (as cited in Rudolph, p. 69). Students must understand the technical knowledge of science both as a product and as an instrument of scientifically conducted research. Students must understand it is both the means and the end and it is an end without finality. Dewey, 1916, (as cited in Rudolph) stated:

> As in the case of other tools, their significance can be learned only by use. We cannot procure understanding of their meaning by pointing to things, but only by pointing to their work when they are employed as part of the technique of knowledge. (p. 69)

According to Dewey, 1910, (as cited in Rudolph), the crucial goal of science education could be measured in the scope in which society was guided in all things by scientific thinking or the scientific method. Rudolph noted that Dewey pointed out civilization depended on "the widening spread and deepening hold of the scientific habit of mind" and the course of education was "to discover how to mature and make effective this scientific habit" (p. 71).

As reported by DeBoer (2000), the Commission on the Reorganization of Secondary Education of the National Education Association issued the *Cardinal Principles of Secondary Education* report and a related report, *Reorganization of Science in Secondary Schools* was also issued by NEA's science committee early in the 20th century. DeBoer (2000) noted that these reports were also influenced by men such as Dewey and proposed that science education should be applicable to contemporary life and that all members of society should understand the world around them so that each individual could be a valuable member of society.

Related to these reports was the Public Education Association's appointment of a committee in 1932 to study existing problems of science education (Hurd, 2000). After 5 years of proceedings were finished, the committee developed a framework built around "(a) personal living, (b) immediate personal-social relationships, (c) social-civics, and (d) economic relationships for general science education" (Hurd, p. 290).

According to DeBoer (2000), social relevance continued as a theme of science education in the middle to late 1940s as presented by the National Society for the Study of Education's *Science Education in American Schools* and the *Harvard Committee on General Education* reports. Both reports indicated a link between human progress and science; yet, this linkage was tempered with the events of World War II, in that science can be a destructive force in society (DeBoer, 2000). DeBoer (2000) stated that not only should the individual, positive, reform, and societal building components of science be understood but the public needed the skills and understanding to make judgments about the risks associated with science. DeBoer (2000) cited the National Society for the Study of Education as saying in 1947 that science education was "for all pupils for their own and society's benefits and only incidentally involves concern for the welfare or future of science" (p. 585).

From the launch of Sputnik in 1957 and up to the 1970s, science education focused on the identification of central concepts, major theories, and unifying themes. In other words, students should learn science in the same manner that scientists discovered and explained their world. According to Saul (2004) and Yager (2000), there was no room for students' individuality, views, or ownership. The Soviet Union's launch of Sputnik lead to the enactment of the National Defense Education Act in 1958 a federal initiative in the United States that was instrumental in the creation of a nationally supported science curriculum. That law provided about $700 million to improve science education in the United States between 1958 and 1975 (Matthews, 1994).

Concurrent with this view of the dependency on an informed and scientifically literate public for the sake of national security, in the late 1970s, congress funded Project Synthesis, a move that led many to consider that science education should shift from being a stepping stone for a career in science for a few to preparing all students to deal with the science and technology they would face in their own lives along with situations that their country might face (Yager, 2000). As stated by the National Science Teacher Association (2000) the report in 1983, *A Nation at Risk*, continued the theme that the launch of Sputnik had begun: The United States would become a second-rate power and lose its influential position in the world if our current education system continued to produce illiterate citizens in science, mathematics, and technology.

The National Science Teacher Association (2000) stated that one of the many reform efforts of science education came from Project 2061. The American Association for the Advancement of Science (1993) initiated this effort in 1986. Its fundamental goal was to develop for all American citizens a high level of scientific literacy. In 1989, Project 2061 published *Science for All Americans*, a report that outlined what students needed to develop the understanding and habits of mind to be scientifically literate (National Science Teacher Association 2000). In 1993, the American Association for the Advancement of Science published the *Benchmarks for Science Literacy*. These Benchmarks established, in specific content areas and grade levels, minimum goals of what students should know and should be able to do. Hurd (2000) noted that at its highest level, scientific literacy was a relationship between science and society, a proactive relationship, and an illumination of the combination of science and technology for the current generation.

According to the National Research Council (1996), the *National Science Education Standards* stated that students were scientific literate when they could use their knowledge and understanding of the concepts and processes relevant to science to make personal decisions, participate in civic and cultural affairs, and be economically productive. Literacy is most

commonly associated with language and it usually means one can read and write in a particular language and when one learns a second language, one does not just learn to read and write the words but also must come to understand a different culture or view of the world (Cobern, 1996). Language is more than reading and writing; it is a way of acting, interacting, and thinking (Saul, 2004). As applied to scientific literacy, one must learn and understand the concepts of science and the processes and methods of science; during the progression, one begins to see the world differently (Cobern). Tied to thinking and understanding in all contexts was a student's ability to communicate those thoughts and ideas. Scientific literacy, then, is the ability of a student to communicate. Students must be able to communicate their scientific thinking (Harlen, 2001; Saul).

According to the National Science Teacher Association (2003), scientific literacy for all students involved:

1. teachers learning about and instructing students' knowledge of both the natural and the technological world that is rapidly changing;
2. instructional methods, curriculum, and assessment used by teachers at any level of professionalism being grounded in the ever changing knowledge of how students learn science;
3. students being provided the opportunity to learn fundamental content of the *National Science Education Standards* through inquiry;
4. science teachers being provided by the educational system life-long professional development grounded in acceptable science community standards of proper facilitation and assessment of student learning while integrating new technology and research; and
5. science teachers being supported through any adaptation or change needed and sufficient funding allowing for the professional development and possible new avenues of professional development. (p. 1)

Constructivism

Educators in general have agreed that learning is accomplished through memorization of information, facts, and particular skills. In simplistic terms, we could look up at the moon and stars and believe we have conquered all there is to know and understand about the solar system (Caine & Caine, 1994). Along with the preceding thought, many students are required to understand concepts presented in isolation without being given the whole; yet, they are required to understand the parts and identify associations where they see only inconsistency and to accept as truths what their reasoning ability questions (Brooks & Brooks, 1993).

Caine and Caine (1994) reflected on what could be called the factory model of education where students followed an assembly-line process of education. They were expected to follow a predetermined schedule, to take classes at a particular time, and to learn skills bit by bit with little of the interconnectedness that is crucial to the way the brain learns.

Constructivism, as noted by Piaget and Inhelder (1971), provided an explanation on how people understand and know their world. Brooks and Brooks (1993) wrote:

> The current state of knowledge is a moment in history, changing just as rapidly as knowledge in the past has changed, and, in many instances, more rapidly. Scientific thought, then, is not momentary; it is not a static instance; it is a process. More specifically, it is a process of continual construction and reorganization. (pp. 1-2)

According to Levitt (2001), learning science was more a process of altering one's prior conceptions rather than planting ones that did not previously exist. Students do not add to their knowledge but they also change what they already know (Levitt; Shapiro, 1994). Students are to consistently adjust, restructure, and expand understanding (Carey, 1986).

As pointed out in *Pathways* from the National Science Teacher Association (2000), teachers should not just "show and tell." Students must have an active role in building their own knowledge and understanding. It is an individual and social process where students learn best when provided instruction based on their learning styles and allowed to move at their own pace (National Science Teacher Association, 2000). Students should be allowed to become agents of their own learning. They should be allowed to draw on their previous learning experiences and

social interactions to construct scientific concepts. Students should be allowed to develop personal interpretations and meanings based on existing and previous experiences and be able to link those to new experiences leading to a proactive, continuous learning process (Saul, 2004).

Chrenka (2001) cited Vygotsky as referring to a structuring consciousness, or, a process that enabled students to think in an increasing level of complexity on various potential possibilities. During this process, teachers encouraged students to respond to the presented text or information and to each other. Teachers guided students using scaffolding strategies based on the Socrates didactic method of questioning (Chrenka).

Constructivism advocated that teachers help students to become inquirers who do not give up hope when they do not find what they are looking for but who decide they have just not looked in the right place and who realize that there are an endless number of right places in which to look (Chrenka, 2001). Passman (2001) referred to this process as being a mixture of trust coupled with risk.

In addition, constructivism called for formative evaluation. This is a type of evaluation that does not occur at the end of learning but takes place throughout the learning process with an emphasis in self-assessment. Students truly realize meaning and gain understanding through self-assessment involving reflection and verbalization (Alesandrini & Larson, 2002). Brooks and Brooks (1993) surmised a constructivist classroom as being a classroom where the teacher:

1. encourages and accepts student autonomy and initiative;
2. uses raw data and primary sources along with manipulative, interactive, and physical materials;
3. uses cognitive terminology such as “classify,” “analyze,” “predict,” and “create”;
4. allows students’ responses to drive lessons, shift instructional strategies, and alter content;
5. inquires about students’ understanding of concepts before sharing his or her own understanding of those concepts;

6. encourages students to engage in dialogue both with the teacher and with one another;
7. encourages students' inquiry by asking thoughtful, open-ended questions and encouraging students to ask questions of each other;
8. seeks elaboration of students' initial responses;
9. engages students in experiences that might engender contradictions to their initial hypotheses and then encourages discussion;
10. allows wait-time after posing questions;
11. provides time for students to construct relationships and create metaphors; and
12. nurtures students' natural curiosity through frequent use of the learning cycle model. (p. 103)

Inquiry Learning

Following in the line of constructivism, a major component of science instruction and learning was inquiry. During this natural process, students ask questions. Through many activities and various means, students collect information and use the collected data to determine explanations, answers, and to formulate new questions (National Science Teacher Association, 2000). Many considered inquiry as the starting point of personal construction of meaning and understanding that leads to a high level of science literacy for all (National Science Teacher Association, 2000; National Research Council, 1996; Von Secker, 2002).

In the field of science, inquiry involves proposing explanations founded on evidence gained when the natural world is studied. As applied to schools, it is the acquisition of knowledge and understanding by students participating in daily activities while also gaining an understanding of how the scientific world studies the natural world (National Research Council, 1996).

Lederman and Niess (2000) stated that inquiry could be viewed from three different standpoints: (a) as a teaching approach, it is an instructional method used to facilitate students'

understanding of the standards-based curriculum; (b) as a process skill, it is the students' ability to perform skills such as observing, inferring, and concluding while participating in the investigation, the design, the process itself, and the communication of results; and (c) as inquiry as content, it is the learning about inquiry itself. Students involved in inquiry should continually find connections, make corrections, and expand and apply other terms and definitions with those being studied (St. Omer, 2002). A teacher using inquiry-based instruction must have comprehensive understanding of the science content, individual learning styles of the students, the nature of science itself, and the proper method of engaging students in investigations (Keys & Bryan, 2001).

The standards of inquiry-centered science included authentic, actively engaged students in classrooms immersed in collaboration and teamwork that accommodates all learning styles. Instruction should be in a place where students are provided a chance to explore other ideas and content through integration and demonstrate learning through reflection (National Science Resources Center, 1997).

As pointed out by Yager (2004), science classrooms should not be "training" places where teachers insist that students learn and respond to someone else's ideas and explanations. Students should not be directed in their learning but should be given opportunity to engage their own minds, or, to be drawn out. Teachers should facilitate various inquiry methods and accommodate individual learning styles and backgrounds for academic excellence and equity (Von Secker, 2002).

Standards-Based Reform

The force behind standards-based reform was the notion that schools were failing to provide at-risk, disadvantaged, or poor students with the knowledge and skills to be successful (Kersaint, Borman, Lee, & Boydston, 2001). The conception of standards-based reform was based on strong beliefs about the need to define content and performance standards and to

measure the progress needed to accomplish those beliefs (Thurlow, 2002). According to the National Research Council (1996), equity and excellence for all students were the intended goals of the standards. These standards stated what students needed to know, comprehend, understand, and be able to perform at each grade level regardless of demographics, background, or other personal characteristics such as interest, awareness, or motivation. Standards-based reform was an effort to establish state and local content and student achievement standards. The content standards described the knowledge, skills, and understanding a student should accomplish in explicit content domains. The student achievement standards characterized the levels of achievement that exemplified proficiency as set forth by grade and age (Wehmeyer, Field, Doren, Jones, & Mason, 2004). These standards fulfilled a many-fold mission. They were standards of quality by which students could hold up their performance and be judged, by which schools could hold up their programs and be judged, by which teachers could hold up their instruction and be judged, by which the system could hold up its support systems and be judged, and by which assessment methods and practices could be judged (National Research Council). Standards were a blend of task and performance quality (Wiggins, 1998).

Once the standards had been identified or adopted by a school or system, curriculum was developed to align with the standards and teachers were prepared and supported in order that they might provide a high level of instruction and strategies to implement the curriculum. Finally, once the standards were established, curriculum was aligned, and instructional methods were implemented, the final phase of standards-based reform took place—accountability. A student's progress was determined through the use of state and district assessments using the standards as the measurement criteria (Wehmeyer et al., 2004). Thurlow (2002) pointed out that standards-based reform would lead to improved student performance and instructional programs would improve by knowing what needed to be taught (content and skills) and by knowing what students had learned (standards-based assessments).

Standards-based inquiry learning must begin early. Students in the early grades are naturally curious about the world in which they live and are eager to discover and explore it (National Science Teacher Association, 2000). Standards have been written so that schools may have coordinated, coherent, and consistent science programs (National Research Council, 1996).

Consequences of Standards-Based Reform

As documented by Settlage and Meadows (2002), there were four major negative consequences of standards-based reform that affected science instruction:

1. the downgrading of teacher professionalism,
2. interference in teacher-pupil interpersonal relationships,
3. the trivialization of science methods and practices of teaching, and
4. the adoption of a "triage mentality" in the classroom. (p.116)

The fourth negative consequence, the triage mentality of school improvement as compared to a hospital emergency room, separates patients or students into three groups: those in need of immediate help or they will die, those with nonlife-threatening emergencies who can wait, and those who, even with immediate or long-term help, will not survive. As with the school or emergency room, the first group will receive the most attention, with those in the other two groups being put off until the time and resources are available or perhaps not helped at all (Settlage & Meadow).

Professional Development

According to Huebert and Hauser (1999) and Lappan (2000), successful professional development programs should include: (a) a definitive goal of student learning, (b) promotion of collaboration among teachers, (c) a program strongly connected to the standards and curriculum for which the teacher and school is accountable, (d) a program that not only builds on existing teacher beliefs and knowledge but also leads to the examination of those beliefs and knowledge,

(e) a program that accepts the reality of a teacher's situation and the school's demographics and provides support for that reality, and (f) a program that realizes a one-day or a one-week workshop is not conducive to lasting change; instead, 1 to 3 years of support and practice may be needed.

Another strategy that is becoming more widely accepted in successful professional development is known as collective participation. Collective participation is professional development that focuses on a group of teachers either within a group such as a department or grade level or within the entire faculty. This type of professional development makes use of inside expertise as well as outside talents. It promotes a sharing of effective skills and instructional methodology while reinforcing shared commitment to school goals (Garet, Porter, Desimone, Birman, & Kwang, 2002). This type of professional development can lead to school-wide reform, reform that takes into consideration the school as the unit of change that will most affect students' success (Huffman, Thomas, & Lawrenz, 2003). Reform-type professional development can include activities such as teacher networking, mentoring, study groups, internships, individual projects, or committees or task forces (Desimone, Porter, Garet, Kwang, & Birman, 2002).

According to Garet et al. (2002), another way to determine the effectiveness of a program was to observe whether the program built on earlier workshops or programs and to determine if it was followed up with later, more complex work. Questions to ask included: Is the program coherent? Does it build on previous learning? Is it aligned with local, state, and national standards and assessments emphasizing correct content and pedagogy? Does it offer ongoing, sustained support by promoting and providing access to communication with teachers in similar circumstances?

Another aspect of effective professional development is the essence of the activity itself. The activity should allow the teacher to become actively engaged in the analysis of teaching and learning by providing opportunities for the teacher to review students' work and eliciting

feedback on their teaching skills (Desimone et al., 2002). According to the National Science Resources Center (1997), effective professional development happens when administrators provide continuous and sustained support, ample time and opportunities for professional development, a collegial and collaborative climate, and programs that are designed to fit the various needs and stage categories of their teachers.

Teaching Experience

One of the most consistent predictors of student achievement is the teacher's experience level (Laczko-Kerr & Berliner, 2003). Darling-Hammond (2003) pointed out that teachers' effectiveness increased greatly after the first few years of teaching. This can be attributed to several factors. Veteran teachers are more secure in their management skills in that they feel confident in how they guide and control class events to successful completion of curricular goals and they are able temporarily to change the focus to other issues affecting students if needed. Novice teachers are in more of a "survival" mode and tend to focus disproportionately on academic goals (Rich & Almozlino, 1999). Veteran teachers are more confident, flexible, evaluative, and are better able to solve problems and to extract meaningful knowledge from classroom events than are novice teachers. Veteran teachers have had the opportunity to develop expertise (Rich & Almozlino). According to one case study, student performance was linked to the teacher's experience with the strategies and regular use of a particular assessment (Lawrence & Pallrand, 2000). Even so, others suggested that novice teachers allowed students to implement practices that were more developmentally appropriate because of recent training and they might have had more exposure to developmentally appropriate practices (Maxwell, McWilliam, Hemmeter, Ault, & Schuster, 2001).

Other researchers reported that teaching experience cannot be consistently linked to classroom quality or effective teacher practices (Kontos & Wilcox-Herzog, 2001). However, as

Glasser (1998) pointed out in *The Quality School*, "Teaching is a very hard job that needs … considerable on-the-job training for the lifetime of the teacher" (p. 3).

Assessment

According to Wiggins (1998), assessment should be educative assessment or a progression of performance-feedback-revision-performance. Assessment should not be just an audit of students' performance; rather, it should be an occasion to educate and improve performance. This type of assessment involves authentic tasks and real-word demonstrations requiring innovative, judgmental, and integrated skills with an opportunity for adjustment and refinement (Wiggins).

The National Science Resources Center (1997) maintained that traditional testing fails to adequately measure the variety of learning that an inquiry-centered classroom provides. Adequate measurement comes from the use of "pre and posttests, embedded assessments, prediction activities, and final assessment" (p. 121). Pre- and posttests allow teachers to track students' learning throughout a unit giving insight into students' interests and providing possible extensions of the lesson or ideas for new lessons. Embedded lessons are part of the instructional process that presents opportunities for the teacher to observe and record student-learning data. Prediction activities are measurements of learning through the application of previously learned skills. Final assessments include hands-on assessments, paper-and-pencil tests, and science notebooks or journals (National Science Resources Center).

According to the National Research Council (1996), assessment of science education, students' learning and understanding, instructional methods and practices, and district policies and procedures involve a triage of elements. The first element is the use of multiple methods of data collection and analysis. The second element is feedback. Feedback is as essential and as important as the measurement instrument itself as it provides an avenue of communication. The third element is communication to students, parents, and the community on what is considered

important. All three elements allow for change in policies and procedures that do not measure up (National Research Council).

Assessment should measure achievement at multiple levels and be multifaceted. It should move from what is central to the concepts being taught and outward. Various tests should be used to measure all angles of knowledge (Ruiz-Primo, Shavelson, Hamilton, & Klein, 2002).

Assessment should motivate rather than just measure and this is possible through students' involvement in the assessment process. Students should be able to use assessment data to become responsible for their own learning and to take an active rather role rather than remaining in a passive role making evaluation position (Chappuis & Stiggins, 2002).

High-Stakes Testing

High-stakes testing involves the use of standards to determine the criteria to make judgments on the quality of students' performance (Gunzenhauser, 2003) leading to consequences ranging from grade retention for students and punitive measures or rewards for schools or systems (Marchant, 2004). Horn (2003) reported that high-stakes testing gained its hold on the educational community almost 30 years ago with the minimum competency period of the 1970s and 1980s. This time frame was followed by the release of the report, *A Nation at Risk*. According to Horn, this report stated that minimum competency was not enough for American students; rather, they needed to be held to rigorous and measurable standards.

High-stakes testing is the use of national or state-wide standardized achievement tests. A test is considered standardized if it has a set of rules for administration such as if everyone taking the test receives the same directions and abides by the same restrictions of time and resources. These tests are normally for a specific grade level and are designed to generate a distribution of scores. Some of the more widely used achievement tests are the *Terra Nova* and the *Standard-9* (Marchant, 2004).

Originally, high-stakes testing or a standardized achievement test, was used to provide solid information for diagnostic and prescriptive teaching methods in relation to individual student achievement and ability (Marchant, 2004) and to treat teaching and learning in a simple and fair manner (American Evaluation Association, 2002). Teachers are still using these tests along with other assessments to plan instruction, calculate grades, and place students in particular programs; however, policymakers now are holding schools and systems accountable for the performance or progress of individual students. The "stakes" of high-stakes testing comes into play when test scores are used to assign students to schools, programs, classes (tracking), promotions, or even diplomas as well as for schools when test scores are used to make decisions on whether a district or state should intervene in or take over the administration of a school (Goertz & Duffy, 2003).

Standardized tests have fallen under scrutiny with educational supervisors suggesting that they are detrimental to the goals of National Science Education Standards (NSES) of scientific literacy for all. In addition, teachers are no longer the leaders of reform; rather, they become followers who yield to pressure to teach to the test. This, according to Huber and Moore (2002), is a concept abhorrent to the NSES.

Normally, high-stakes tests are standardized achievement state or national tests. As noted by Marchant (2004), these tests have a set of rules that apply to all who take them regardless of diverse needs and learning styles such as time restrictions and the use of resources. Tests are normally designated for a specific grade level or even subject area (Marchant). According to Huber and Moore (2002), high-stakes tests that are based on standardized tests present two major problems: (a) the tests shape curriculum and (b) they test the wrong type of material in that they tend to test what is easy to test.

According to Gunzenhauser (2003), high-stakes testing is leading schools into a "default philosophy of education" (p. 51). Gunzenhauser explained this philosophy as being one that places excessive importance on scores rather than achievement. He continued by saying that it

lacked reflection, vision, and dialogue between educators and communities on the development and promotion of the mission and goals of the school. He maintained that schools and communities tend to focus dialogue on the tests and scores to the detriment of other visions and expectations. Linn (2000) agreed, saying that assessment systems that are useful monitors lose much of their dependability and credibility for that purpose when high stakes are attached to them.

In a recent position paper, the American Evaluation Association (2002) stated, "High-stakes testing leads to under-serving or miss-serving all students especially the most needy and vulnerable, thereby violating the principal to do no harm" (p. 1). Students are being retained in grades prior to testing grades, and high numbers of students are being expelled or reclassified before tests (Amrein & Berliner, 2003).

Instructional time for science in grades kindergarten through eight is losing out to "basic" subjects (mathematics, reading, and writing) and to time spent teaching test-taking skills. With the "teaching the test" phenomena, there is little reason to believe that science instructional time will increase when it is added as a subject in many standardized testing situations (Amrein & Berliner, 2003; Huber & Moore, 2000; Marchant, 2004).

The National Science Teacher Association's (2000) *Pathways* made a distinction between evaluation and assessment. The evaluation methods most commonly used include multiple-choice tests, true and false items, and short-answer questions. As suggested by the National Science Teacher Association (2000), these evaluation methods do not allow for creative expression or the development of original solutions or answers to problems. These evaluation methods also foster "false competitiveness and value comparisons" (p. 21) by rank-ordering students according to their scores. Students, rather than being encouraged to think, question, and understand, are encouraged to get "high scores" (p. 21).

According to the National Science Teacher Association (2000), assessment of students in elementary grades should be based on the following five principals:

1. its purpose is to direct curriculum based on clear stated measurements and outcomes;
2. its results should be compared to "standard of opportunity to learn" and should reflect students' knowledge, skills and knowledge of the teachers, the school's program and policies, and equipment and community involvement;
3. its data must be valid, reliable and authentic;
4. it must reflect diversity of students and be free of stereotypes and bias; and
5. it must be used to make decisions about programs, courses, and students while teachers keep in mind the inaccuracies, weaknesses, assumptions, and strengths of all assessment practices. (p. 21-22)

Accountability

Wiggins (1998) stated, "Any hope we have of ever being excellent teachers depends on accountability, timely assessment of data that allows adjustment, and revisions of student performance" (p. 289). According to Walberg (2003), the accountability movement began in 1988 when the National Assessment Governing Board was developed by congress to generate assessments and standards. During the National Educational Summit in 1989, President George H. W. Bush and the National Governors Association established *America 2000*, outlining educational goals to be met by the year 2000. The Board, established in 1988, released its first valid state comparisons of achievement on the National Assessment of Educational Progress in 1991. *Goals 2000* became law in 1994; it was a major overhaul of the ESEA Act and required states to develop content standards and standards-based assessments. In 1996, governors met in the second National Educational Summit and pledged to set standards at local and state levels. By 1998, 38 states had set state standards for core subjects. In 2002, *No Child Left Behind* was signed into law requiring all states to have standards in place by 2014 (Walberg).

Fuhrman (1999) listed the seven factors associated with today's accountability as: (a) performance focus, (b) improvement at the school level, (c) inspections, (d) increase in

categories of accountability, (e) public reporting, (f) consequences according to performance, and (g) continual improvement. The question of equity in accountability is a resounding theme. Schools and students vary, yet all are compared against each other without any concessions to differences. Acker-Hocevar and Touchton (2002) pointed out that many principals consider schools should be compared only with schools sharing the same demographics and resources.

How does national accountability affect the balance between testing standards set by a state to judge all its communities whether urban, rural, Hispanic, Black, or White? Lynch (2001) implied that if the scales are tipped too far to the state or global side, students might fail to learn how to meet needs or solve problems on a local level. Accordingly, if scales are tipped too far to the local side, students may fail to understand the concepts and processes that lead to global equity (Lynch).

According to researchers, a foremost consequence of national accountability might be a change in the role of teachers (Schmoker, 2004). Teachers might become passive and reliant on other plans rather than being searchers and developers of what works best for their particular groups of students. Cimbriez (2002) suggested teachers might become less likely to be innovative or to use instructional strategies such as cooperative learning and activities involving higher-order thinking and whole language. Sutton (2004) implied that they might feel a loss of control that could lead to fearful and angry feelings.

Hamilton and Stecher (2004) stated what they considered the positive outcomes of accountability. The authors pointed out that schools, teachers, and students do respond favorably to incentives established by accountability measures and test scores do rise. However, the authors failed to address whether a rise in test scores means true mastery of content standards (Hamilton & Stecher).

No Child Left Behind

According to the National Conference of State Legislatures (2004), the *No Child Left Behind* Act was created to address a challenge felt by many Americans that schools were failing. A second challenge was to produce the type of science-educated citizens that America needs for leadership in the economic global community and for the security of the country in the event of a terrorist threat in this century (National Conference of State Legislatures).

The *No Child Left Behind* Act's solution was to require schools to use research-based instructional and assessment methods; to form partnerships with universities, colleges, community organizations, businesses, museums and science centers; to fill classrooms with "highly qualified" teachers; and to measure the progress of students each year in grades 3 through 5, 6 through 9, and 10 through 12 (U. S. Department of Education, 2004b).

In particular, the *No Child Left Behind* Act required schools to close the gap in achievement between 12 identified subgroups of students, to demonstrate steady gains in achievement for all students, and to provide a highly-qualified teacher for all students. A school must demonstrate students' achievement through annual assessment and accountability measures as detailed by *No Child Left Behind's* adequate yearly progress objective (Linn, Baker, & Betebenner, 2002; Finn & Hess, 2004; U. S. Department of Education, 2004b). The 12 identified subgroups included: low-income students, Whites, Blacks, Native Americans, Hispanics, Asians, multiethnic students, special education students, English language learners, migrants, all students, and all students except special education students (Orlich, 2004). States are allowed to design their own test batteries and to set their own proficiency level for adequate yearly progress with 100% proficiency required by 2014 (Orlich).

As noted by Finn and Hess (2004), public schools are to test their students yearly in grades three through eight in reading and math and show steady improvement in each grade in each subgroup. The *No Child Left Behind* Act also requires judgment on each subgroup with a minimum number of students determined by the states. If a school fails to make adequate yearly

progress in any subgroup, it is deemed "in need of improvement" and interventions must begin. If a school fails to make adequate yearly progress for 2 years in a row, students may move to another school in the system at the system's expense. For 3 years, the system must provide supplemental educational services such as tutoring from the school or private firms. After 4 years, the school must write a school improvement plan and after the 5th year, the school is to be reconstituted (Finn & Hess).

Development of No Child Left Behind

As noted by the National Conference of State Legislatures (2004), the *No Child Left Behind* Act can trace its roots back to Lyndon B. Johnson's "War on Poverty" and the *Elementary and Secondary Education* Act of 1965. The *Elementary and Secondary Education* Act increased funding for public education over 200% in the 10 years following its initial $2 billion appropriation. During Ronald Reagan's tenure as president, he cut federal funds for education by 21% and along with Terrell Bell, Secretary of Education, promoted the establishment of a core curriculum based on the report *A Nation at Risk* that was developed by the National Commission on Excellence in Education. The National Commission on Excellence in Education was assembled by these two leaders to gather information on the state of public education in America (National Conference of State Legislatures).

Following the *Nation at Risk* report, states began to develop and implement individual academic standards. As summarized by DeLoughry (1990), in April 1989, then-President Bush released a seven-part education plan calling for schools with high-achieving students to be rewarded. Following criticism of his proposal because it did not address low achievement, President George H. W. Bush and state governors participated in the National Governors Association Education Summit and developed a plan called *America 2000*. The leaders at the Summit called for school choice and improvement and defended the Department of Education's

student loan program (Stallings, 2002). By 1990, the group had compiled six national goals that states should strive to attain before 2000. According to Cavazos (1991), these goals stated:

1. all children would start school ready to learn,
2. high schools would have graduation rates of 90%,
3. all students would show basic skills improvement,
4. American students would be first in math and science globally,
5. schools would produce literate adults with life-long learning opportunities, and
6. schools would be safe and drug-free with well-disciplined students.

According to Harrington-Lueker (1991), once Lamar Alexander became Secretary of Education, *America 2000* included the original six goals as well as recommendations for merit pay for teachers, an alternative certification plan, a longer school year, better adult literacy programs, national standards for core subjects, voluntary achievement tests, a model school for each congressional district, and school-choice. These recommendations did not pass in the senate although proponents tried for decades to institute their passage (Stallings, 2002).

Stallings (2002) explained that the next act pertaining to education was the *Goals 2000: Educate America* Act. This was the result of President Bill Clinton and Secretary of Education, Richard Riley's plan to promote standards-based education. *Goals 2000* had three tenets: (a) to promote the achievement of national educational goals by the year 2000; (b) to raise expectations for parents, teachers, and students with the aid of high standards; and (c) to give state and local reform efforts greater flexibility and more support. The *Goals 2000* Act incorporated the goals of *America 2000* as well as two new goals advocated by Congress: teachers' preparation improvement and promotion of increased parental involvement (Donahue, 1994). This Act was passed in the Senate and the House of Representatives in the spring of 1994. Federally, the *Goals 2000* Act shifted concern about quality and the process of education to outcomes and accountability (Stallings).

The *Improving America's Schools* Act of 1994, the reauthorization of the Elementary and Secondary Education Act, followed *Goals 2000* and renewed and increased funding for Title I schools and continued the move to give states more flexibility regarding funding and increased the push for standards-based reform. This push for standards-based reform continued throughout Clinton's administration and into President George W. Bush's term (Stallings, 2002).

Mechanism of No Child Left Behind

As stated previously, *No Child Left Behind* is built around four cornerstones: (a) accountability, (b) practices based on scientific research, (c) parental choice, and (d) increased local control and flexibility (U.S. Department of Education, 2004b). Specifically, some goals of *No Child Left Behind* are:

1. by the 2013-2014 school year, all students will be proficient in reading and math;
2. starting in the 2013-2014 school year, all third graders will be proficient in reading at the end of the year;
3. all LEP (students) will be proficient in English;
4. by the 2005-2006 school year, all teachers will be highly qualified;
5. all learning environments will be safe, drug free, and conducive to learning; and
6. There will be 100% graduation rate of all high schools. (U.S. Department of Education, 2004b, n. p.)

Funding

No Child Left Behind has provided $24.3 billion to states and local schools to be used during most of the 2004-2005 school year. This is an increase from 2001-2004 of 39.8% for *No Child Left Behind* programs. According to the U.S. Department of Education (2004b), "Improving the Academic Achievement of the Disadvantaged," a grant of the federal program Title 1, makes up a large percentage of these funds. States and local districts are awarded Title 1 grants for improvement in education of disadvantaged students, teacher quality, choices for

parents, and to assist low-performing schools. Funding for Title 1 has increased 40.8% since the passage of *No Child Left Behind* to $12.3 billion in 2004. Furthermore, with President Bush's budget request for 13.3 billion in 2006, this will be a 52 % increase since 2001.

Although Title 1 is made up of Title 1, Part A through D, only Part A will be addressed here because it relates more specifically to the overall requirements of *No Child Left Behind*. Formula grants are provided to local school districts through Title 1, Part A. These districts then allocate these funds to individual Title 1 schools within their district based on the number of children in poverty with 40% being the poverty threshold. According to the U.S. Department of Education (2004b), these funds may be used two ways:

> (1) High poverty schools, those with 40% or more from low-income families, are eligible to adopt school wide programs to raise the achievement of low achieving students by improving instruction throughout the entire school, thus using Title 1 funds to serve all children. (2) Schools that are not eligible for (or do not choose to operate) school wide programs must use Title 1 funds to provide targeted services to low-achieving students. No Child Left Behind encourages the funds to be used for strategies that increase learning time such as before and after school programs, extended school year, or summer school programs. (n. p.)

Each school district that receives Title 1 funds must spend 5% of its allocation on professional development for teachers. Schools identified as "in need of improvement" are required to spend at least 10% of their Title 1 funds to assist teachers (U.S. Department of Education, 2004b). This could be done by providing professional development related to subject matter.

Improvement of Science Instruction

No Child Left Behind seeks to improve science instruction through the creation of Math and Science Partnerships. These partnerships would be formed between state and local districts along with science, engineering, mathematics, and other high-tech departments of higher education institutes. Funding would be provided on a formula-grant basis to provide professional development for science and math teachers (U.S. Department of Education, 2004a).

Assessment and Accountability

No Child Left Behind requires each state to implement a single, statewide accountability plan to ensure all public schools from kindergarten through 12th grade achieve adequate yearly progress as defined by each state. In addition to the same general accountability structure of the 1994 ESEA reauthorization, *No Child Left Behind* requires each state to include the following in its plan: the plan must be based on state adopted academic standards and assessments, the plan must be used in all public kindergarten- through 12th-grade schools, and the plan must include sanctions and rewards that will be used to hold all public kindergarten- through 12th-grade schools accountable for all students' achievement and adequate yearly progress.

No Child Left Behind assessment guidelines requires states to maintain 1994 ESEA requirements for assessment at three grade spans (3-5, 6-9, 10-12) in reading and math through the 2004-2005 school year. *No Child Left Behind* requires the addition of science assessment in the same three-grade span as reading and math. Beginning in the 2002-2003 school year, the Act requires reading tests written in English for any student living in the United States for 3 or more consecutive years and to annually assess English proficiency of all LEP students. Finally, beginning with the 2002-2003 school year, the Act requires states to participate in the biennial National Assessment of Educational Progress in reading and math for all fourth and eight graders (U. S. Department of Education, 2004b).

Help for Schools in Need

No Child Left Behind requires a school that is determined “in need of improvement” to work with parents, school personnel, district personnel, and outside experts to develop a plan that will turn the school around. Along with this plan, the school must be provided (by its district) with technical assistance such as methods of identifying problems in curriculum or instruction and analysis and revision of the school’s budget for more effective use of resources.

Not only should the school's improvement plan include research-based strategies to improve and strengthen academics but should also include strategies to promote effective parental involvement and teacher-mentoring programs (U. S. Department of Education, 2004b).

Summary

Chapter 2 served as an historical perspective of science literacy, accountability, high-stakes testing, and the *No Child Left Behind* Act. It also served to illustrate science instruction's best practices in terms of instructional methods, professional development, materials, and resources, assessment and administrative support. Chapter 3 presents the methodology and procedures used in the study and describes the participants, data collection and analysis, and methods to ensure validity and reliability of the study.

CHAPTER 3

METHODOLOGY

The purpose of this study was to examine the perceived impact of the *No Child Left Behind* Act on science literacy in elementary education by examining the differences in professional development, assessment, instructional methodology, materials and resources, and administrative support among teachers with differing levels of experience, *No Child Left Behind* on-track and *No Child Left Behind* off-track schools, and small and large schools. Much research has been conducted on the best methods of instructing elementary school students in science but with the introduction of *No Child Left Behind* into this process, many questions arise regarding its impact. This chapter describes the research design, the population, instrumentation, data collection methods, and methods of data analysis. In addition, issues of validity and reliability are addressed.

Research Design

A descriptive quantitative approach was used to determine the differences in how *No Child Left Behind* is perceived to impact teachers with differing levels of experience, *No Child Left Behind* on-track and *No Child Left Behind* off-track schools, and large and small schools in this study. Quantitative research involves statistical data analysis (Hittleman, & Simon, 2002). It is an approach in which the researcher uses positivist claims for developing knowledge and uses experiments and surveys to collect data to support or refute a hypothesis (Creswell, 2003). Descriptive research is used to answer the question, “What exits?" It is also a means of answering questions about differences and similarities and reveals patterns and associations. It answers the questions about a variable status through the creation of numerical descriptions of the frequency in the occurrence of one or more variables (Hittleman, & Simon).

A five-part survey (see Appendix A) was used to gather data to describe third- through fifth-grade elementary school teachers' perceptions of differences regarding the impact of *No Child Left Behind* on assessment, instruction, materials and resources, and administrative support among teachers with differing levels of experience, *No Child Left Behind* on-track or *No Child Left Behind* off-track schools, and small versus large elementary schools. A school is designated by *No Child Left Behind* as being on-track if its status is in good standing, whereas it is considered to be off-track if it has been identified as either targeted or high priority. A survey was designed to gather data because of its ease of use because it provides a rapid turnaround in data collection, and it allows inferences about a large population from a small one (Creswell, 2003).

The data were tabulated, examined, and analyzed before percentages were compared to show trends and differences between and among the groups (Creswell, 2003). By examining the results of the analysis of the data, the researcher was able to draw conclusions and make recommendations about the research questions.

Sample

The study's five-part cross-sectional survey was completed by 51 third- through fifth-grade teachers out of the 72 invited to respond with a 71% response rate in three county school systems in Northeast Tennessee. These systems were comprised of Coby, Orick, and McPherson counties**.** Because of availability and feasibility, the sample for the study was a purposeful sample in that it was representative of the larger population, Northeast Tennessee. The schools selected were chosen because they were within a 100-mile radius of each other and reflected variety in regard to demographics. In order to protect the participants' anonymity, no schools or teachers' names were used, nor were teachers identified by grade level. In addition, fictitious names were substituted for the actual names of counties in the study.

Students across the state of Tennessee in grades three through eight take the TCAP Achievement Test every spring. The TCAP test is made up of multiple-choice questions, has set time limits, and is a measure of students' academic knowledge and skills in three subject areas: reading/language arts, mathematics, and social studies (Tennessee Department of Education, 2004b). The systems participating in this study's 2004 Report Card TCAP test data follow and include criterion- referenced science scores for kindergarten through eighth grade and TVAAS (value-added) scores for kindergarten through eighth plus fourth- and fifth- grade TVASS data (Tennessee Department of Education, 2004b). Table 1 shows the 2004 Report Card data.

Table 1

2004 Report Card Data

	Science CRT K-8 3 yr Avg	Science TVAAS K-8 3yr Avg	Science TVAAS 4th grade 3yr Avg	Science TVAAS 5th grade 3 yr Avg
State of Tennessee	50	-0.4	0.4	-0.4
Coby	48	-0.1	2.2	-1.6
Orick	50	-0.1	-2.0	2.9
McPherson	46	-3.7	-4.4	-1.0

For purposes of this study, the schools were divided into two categories: *No Child Left Behind* on-track and *No Child Left Behind* off-track schools and small or large schools and teachers were divided into categories: novice or veteran.

Instrumentation

The third- through fifth-grade teachers' perceptions of the impact of *No Child Left Behind* was determined by a 28-item survey. I developed the instrument based on important science literacy, instructional methods, and school climate identified during the literature review. The survey was divided into the following five parts: professional development with seven questions, materials and resources with three questions, administrative support with six questions, instructional methodology with seven questions, assessment with five questions, and two open-ended questions concerning the overall impact of *No Child Left Behind* on teachers and students. Each survey question was measured with on a Likert-type scale with strongly agree, agree, unsure, disagree, or strongly disagree.

Table 2 provides a crosswalk between the survey questions and the hypotheses presented in Chapter 1:

Table 2

Hypotheses and Survey Items

Hypothesis	Item on Survey
Hypothesis #1_1: Perceived impact of NCLB on professional development among teachers with differing levels of experience. Hypothesis #2_1: Perceived impact of NCLB on professional development between NCLB on-track and NCLB off-track schools. Hypothesis #3_1: Perceived impact of NCLB on professional development between small and large schools.	See Questions 1, 2, 3, 4, 5, and 6: in-service time specifically for science, continuous and sustained support, engagement time during the day, experience sharing and collaboration, activities for less experienced, indifferent and experienced, provides activities that foster change**.**

Table 2 (continued)

Hypothesis	Item on Survey
Hypothesis #1_2: Perceived impact of NCLB on instructional methodology among teachers with differing levels of experience. Hypothesis #2_2: Perceived impact of NCLB on instructional methodology between NCLB on-track and NCLB off-track schools. Hypothesis #3_2: Perceived impact of NCLB on instructional methodology between small and large schools.	See Questions 17, 18, 19, 20, 21, 22, and 28: reduced class time, actively engaged students, real world activities, accommodation of different learning styles, restriction or enhancement of science curriculum and percentage of time spent actively engaged.
Hypothesis #1_3: Perceived impact of NCLB in administrative support among teachers with differing levels of experience. Hypothesis #2_3: Perceived impact of NCLB in administrative support between NCLB on-track and NCLB off-track schools. Hypothesis #3_3: Perceived impact of NCLB in administrative support between small and large schools.	See Questions 11, 12, 13, 14, 15, and 16: faculty meetings focus on NCLB and Terra Nova, extra assistance provided to low performing schools or grades, teachers feel pressure to increase scores, administrative place importance on student achievement, Terra Nova tests shape goals and objectives.
Hypothesis #1_4: Perceived impact of NCLB on resources and materials teachers with differing levels of experience. Hypothesis #2_4: Perceived impact of NCLB on resources and materials between NCLB on-track and NCLB off-track schools. Hypothesis #3_4: Perceived impact of NCLB on resources and materials between small and large schools.	See Questions 8, 9, and 10: materials and resources distributed equally among schools and teachers, increase in inquiry or hands-on materials.
Hypothesis #1_5: Perceived impact of NCLB on assessment among teachers with differing levels of experience. Hypothesis #2_5: Perceived impact on NCLB on assessment between NCLB on-track and NCLB off-track schools. Hypothesis #3_5: Perceived impact on NCLB on assessment between small and large schools.	See Questions 23, 24, 25, 26, and 27: use of alternative assessments, use of ready-made tests, NCLB testing underserves or misserves the most disadvantaged or at-risk, NCLB accurately measures weaknesses and strengths of a school**.**

In addition, demographic data were collected with the instrument. Teachers were asked to identify their numbers of years of experience and highest education levels attained. Teachers were also asked to identify if the schools in which they taught were a Title I school, if they had been targeted in the past 2 years, and the size of each school.

Data Collection

To preserve privacy and ensure protection from harm for all participants, I obtained approval from the Institutional Review Board at East Tennessee State University prior to data collection (see Appendix F). The researcher obtained written permission to conduct this study from the director of each school system chosen for this study (see Appendix B). To continue the protection of privacy for each school and teacher, a method of coded identities was used.

When permission was granted by the director of schools, I contacted the principal of each school to seek his or her permission to conduct the survey (see Appendix C). The researcher met with each principal who granted permission and hand delivered the surveys. The principal and the researcher agreed upon a person who was responsible for placing surveys in the mailbox of each participating teacher. A cover letter accompanied the survey explaining the purpose of the survey and requesting that teachers fill out the survey and return it to a designated box within 1 week of receiving it. The cover letter also explained how confidentiality would be protected during the analysis and reporting of the study (see Appendix D). The participants completed the five-part survey using a Likert-like scale format with a section for additional comments. The designated person collected the surveys and notified the researcher when the surveys had been returned.

Instrument Reliability and Validity

A pilot study of the survey was conducted using six teachers from a school not participating in the study. These teachers were asked to take the survey and provide feedback

regarding the clearness of directions and statements plus terminology used in the survey. They were first instructed to take the survey as if they were participants of the study. When each teacher finished answering the survey, a short discussion followed allowing each teacher to share with the researcher questions or problems he or she had answering or understanding the statements on the survey. Minor changes were made relating to clarity and readability not substance on the survey's statements.

Data Analysis

The first step of data analysis involved descriptive statistics to provide a profile of the population studied. Second, the participants' responses were analyzed by frequency to determine their perceptions and attitudes of the 28 statements of the survey (see Appendix E). Finally a chi-square analysis was conducted to analyze the participants' responses based on demographic data: (a) teachers with differing levels of experience, (b) *No Child Left Behind* on-track or *No Child Left Behind* off-track schools, and (c) small schools and large schools. For all three steps in data analysis, the Statistical Program for the Social Sciences (SPSS) was used.

Summary

The purpose of this study was to identify and describe the impact of *No Child Left Behind* on assessment, instructional methodology, resources and materials, administrative support and climate, and overall programs. The descriptive quantitative method involving surveying 51 participants was employed. The methods of participant selection, data collection, and data analysis have been identified in this chapter. Chapter 4 presents the results of the data analysis in the form of frequencies and percentages of the responses from participants and analysis of responses by demographic data.

CHAPTER 4

ANALYSIS OF DATA

No Child Left Behind continues to be debated among those in the educational community on its value and the service it is providing to the children for which it was designed to provide an enhanced educational experience. One way to determine its value is to determine the perceptions held by those who are daily responsible for carrying out its specific edicts. Those specifics include not only what happens during the school day in the classroom, but the preparation and support surrounding the teacher responsible for what is happening in the classroom. The purpose of conducting this study was to identify the impact of the *No Child Left behind Act* specifically on science literacy in elementary education by examining the differences in professional development, assessment, instructional methodology, materials and resources, and administrative support among teachers with different levels of experience and between *No Child Left Behind* on-track schools and *No Child Left Behind* off-track schools and small and large schools.

The sample in this study included 51 third- through fifth-grade elementary science teachers in Coby, McPherson, and Orick County, Tennessee. The directors of the three systems plus the eight principals of the eight schools contacted to conduct the survey granted permission. Initially, 72 surveys were distributed to teachers teaching elementary science. From these, 51 were returned for a response rate of 71%. This chapter contains an analysis of sample data collected from 51 teachers from eight schools.

For the purposes of this study, the investigation was guided by three research questions. Computer data analysis was performed using the Statistical Package for the Social Sciences (SPSS) to test 15 null hypotheses. Demographic characteristics of the population included: gender, age, years of teaching experience, educational level attained, *No Child Left Behind*

school status, Title 1 or nonTitle 1 school, school size, and highly-qualified status. A demographic profile of the population is shown in Table 3.

Table 3

Demographic Profile of the Population

Characteristics	*F*	*%*
Gender:		
Male	8	15.7
Female	43	84.3
Total	51	100.0
Age:		
20-29	11	22.0
30-39	9	18.0
40-49	19	38.0
50-59	9	22.0
60 +	2	4.0
Total	50	100.0
Years of Teaching Experience:		
1 to 4	11	22.0
5 to 10	12	24.0
11 to 15	3	6.0
16 to 20	4	8.0
21 +	20	40.0
Total	50	100.0
Highest Educational Degree:		
Bachelor's degree	25	50.0
Master's degree	22	44.0
Specialist's degree	3	6.0
Doctoral degree	0	0.0
Total	50	100.0

Table 3 (continued)

Characteristics	*F*	%
No Child Left Behind School Status:		
Good standing	35	68.6
Targeted	16	31.4
High Priority	0	0.0
Total	51	100.0
Title I Status:		
Title I School	51	100.0
Nontitle I School	0	0.0
Total	51	100.0
School Size:		
Fewer than 400 students	19	37.3
More than 400 students	32	62.7
Total	51	100.0
Highly-Qualified Status:		
Highly qualified	48	96.0
Not highly qualified	2	4.0
Total	50	100.0

Survey Statement Responses

The survey contained 7 statements concerning the impact of *No Child Left Behind* and professional development, 3 concerning materials and resources, 6 concerning administrative support, 6 concerning instructional methodology, and 5 concerning assessment. For these 27 questions, respondents were to circle SA for strongly agree, A for agree, U for unsure, D for disagree and SD for strongly disagree. For one statement, respondents were to circle time spent engaged in science activities during the school week. Finally, the survey included 2 open-ended questions asking respondents to identify the overall impact of *No Child Left Behind* on teachers and students. A copy of the survey is provided in Appendix A and the frequency of responses to the survey questions can be found in Appendix E.

Hypotheses Testing

The nonparametric test, chi-square test for independent samples, was used to test for statistical difference in responses among respondents with differing levels of experience, from *No Child Left Behind* on-track or *No Child Left Behind* off-track schools and from small and large schools on professional development, instructional methodology, materials and resources, and administrative support and assessment. For the testing of each hypothesis, the alpha .05 was used.

Research Question #1

Is there a difference in the perceived impact of the *No Child Left Behind Act* among teachers with differing levels of experience on professional development, instructional methodology, administrative support, assessment, and resources and materials?

$Ho1_1$: There is no significant difference in the perceived impact of *No Child Left Behind* on professional development among teachers with differing levels of experience regarding each of the following statements:

a. The system provides inservice time specifically for science.
b. The system provides continuous and sustained support for professional development in science.
c. The system provides teachers release time to engage in professional development activities during the day.
d. The system promotes experience sharing and collaboration.
e. The system promotes activities that support the less experienced.
f. The system promotes activities that support and sustain the experienced teacher.
g. The system provides activities that foster and support change.

Chi-square analyses were used to determine the difference in perceptions among teachers with differing levels of experience on professional development.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 27.587) based on the degrees of freedom (*df* =17) and an alpha of 0.05 against the calculated to see if it is statistically significant. As shown in Table 4, the x^2 value is greater than the critical value of x^2; therefore, because the x^2 value is greater than the critical value, the null hypothesis is rejected. In addition, the *p* value (.009) is less than the predetermined alpha of .05.

$Ho1_2$: There is no significant difference in the perceived impact of *No Child Left Behind* on instructional methodology among teachers with differing levels of experience regarding each of the following statements:

a. Class time has been reduced since 2001-2003.
b. During science instructional time, students are provided opportunity to be actively engaged.
c. During science instructional time, the real world is brought into the classroom.
d. During science instructional time, different learning styles are accommodated.
e. Science curriculum and instruction is restricted by NCLB testing requirements.
f. Science curriculum and instruction is enhanced by NCLB testing requirements.

Chi-square analysis was used to determine the differences in perceptions among teachers with differing levels of experience on instructional methodology.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 16.919) based on the degrees of freedom (*df* = 9) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 4, the x^2value is less than the critical value of x^2; therefore, the null hypothesis is retained. In addition the *p* value (.217) was greater the predetermined alpha of .05.

$Ho1_3$: There is no significant difference in the perceived impact of *No Child Left Behind* in administrative support among teachers with differing levels of experience regarding each of the following statements:

a. Faculty meetings focus on NCLB.

b. Faculty meetings focus on *Terra Nova* test data.

c. Extra assistance has been provided for either financially through resources or professional development to low scoring schools or grades.

d. Teachers feel pressured to increase test scores.

e. Administrators place more importance on students' achievement than test scores.

f. *Terra Nova* test scores shape curriculum goals and objectives.

Chi-square analysis was used to determine the difference in perceptions among teachers with differing levels of experience on administrative support.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 19.675) based on the degrees of freedom (*df* = 11) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 4, the x^2 value is greater than the critical value x^2; therefore, the null hypothesis is rejected. In addition, the *p* value (.011) is less than the predetermined alpha of .05.

$Ho1_4$: There is no significant difference in the perceived impact of *No Child Left Behind* on resources and materials among teachers with differing levels of experience regarding each of the following statements:

a. Materials and resources are distributed equally among schools in the district.

b. Materials and resources are distributed equally among teachers.

c. Inquiry-centered and/or hands-on materials have increased.

Chi-square analyses were used to determine the difference in perceptions among teachers with differing levels of experience on materials and resources.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 19.675) based on the degrees of freedom (*df* = 11) and an alpha of .05 against the calculated to see if it is statically significant. As shown in Table 4, the x^2 value is greater than the critical value of x^2; therefore, the null hypothesis is rejected. In addition, the *p* value (.009) is less than the predetermined alpha of .05.

$Ho1_5$: There is no significant difference in the perceived impact of *No Child Left Behind* on assessment among teachers with differing levels of experience regarding each of the following statements:

a. Student progress is measured primarily through the use of alternative assessments.

b. Ready-made pretests are used extensively.

c. The testing necessary to measure the mandates of NCLB underserves or misserves the most disadvantaged or at-risk students.

d. NCLB accurately measures the weakness of a school.

e. NCLB accurately measures the strengths of a school.

Chi-square analyses were used to determine the difference in perceptions among teachers with differing levels of experience on assessment.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 19.675) based on the degrees of freedom (df = 11) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 4, the x^2 value is greater than the critical value of x^2; therefore, the null hypothesis is rejected. In addition, the p value (.013) is less than the predetermined alpha of .05.

Table 4

Teaching Experience

Subtest	*N*	*df*	x^2	*p*
1 to 5 years experience	13			
6+ years experience	37			
$Ho1_1$ Professional development		17	33.653	.009
$Ho1_2$ Instructional methodology		9	11.936	0.217
$Ho1_3$ Administrative Support		11	24.435	0.011
$Ho1_4$ Resources and materials		11	25.000	0.009
$Ho1_5$ Assessment		11	24.000	0.013

Research Question #2

Is there a difference in the perceived impact of the *No Child Left Behind Act* between *No Child Left Behind* on-track schools and *No Child Left Behind* off-track schools on professional development, instructional methodology, administrative support, assessment and resources and materials?

$Ho2_1$: There is no significant difference in the perceived impact of *No Child Left Behind* on professional development between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools regarding the following statements:

a. The system provides in-service time specifically for science.
b. The system provides continuous and sustained support for professional development in science.
c. The system provides teachers release time to engage in professional development activities during the day.
d. The system promotes experience sharing and collaboration.
e. The system promotes activities that support the less experienced.
f. The system promotes activities that support and sustain the experienced teacher.
g. The system provides activities that foster and support change.

Chi-square analyses were used to determine the difference in perceptions between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools on professional development.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 27.587) based on the degrees of freedom (*df* =17) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 5, the x^2 value is greater than the critical value of x^2; therefore, the null hypothesis is rejected. In addition, the *p* value (.009) is less than the predetermined alpha of .05.

$Ho2_2$: There is no significant difference in the perceived impact of *No Child Left Behind* on instructional methodology between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools regarding the following statements:

a. Class time has been reduced since 2001-2003.
b. During science instructional time, students are provided opportunity to be actively engaged.
c. During science instructional time, the real world is brought into the classroom.

d. During science instructional time different learning styles are accommodated.

e. Science curriculum and instruction is restricted by NCLB testing requirements.

f. Science curriculum and instruction is enhanced by NCLB testing requirements.

Chi-square analysis was used to determine the differences in perceptions between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools on instructional methodology.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 16.919) based on the degrees of freedom (*df* = 9) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 5, the x^2 value is less than the critical value of x^2; therefore, the null hypothesis is retained. In addition, the *p* value (.217) was greater the predetermined alpha of .05.

$Ho2_3$: There is no significant difference in the perceived impact of *No Child Left Behind* in administrative support between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools regarding the following statements:

a. Faculty meetings focus on NCLB.

b. Faculty meetings focus on *Terra Nova* test data.

c. Extra assistance has been provided for either financially through resources or professional development to low scoring schools or grades.

d. Teachers feel pressured to increase test scores.

e. Administrators place more importance on students' achievement than test scores.

f. *Terra Nova* test scores shape curriculum goals and objectives.

Chi-square analyses were used to determine the difference in perceptions between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools on administrative support.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 19.675) based on the degrees of freedom (*df* = 11) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 5, the x^2 value is greater than the critical

value x^2; therefore, the null hypothesis is rejected. In addition, the *p* value (.011) is less than the predetermined alpha of .05.

Ho2$_4$: There is no significant difference in the perceived impact of *No Child Left Behind* on resources and materials between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools regarding the following statements:

a. Materials and resources are distributed equally among schools in the district.
b. Materials and resources are distributed equally among teachers.
c. Inquiry-centered and/or hands-on materials have increased.

Chi-square analyses were used to determine the difference in perceptions between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools on materials and resources.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 19.675) based on the degrees of freedom (*df* = 11) and an alpha of .05 against the calculated to see if it is statically significant. As shown in Table 5, the x^2 value is greater than the critical value of x^2; therefore, the null hypothesis is rejected. In addition, the *p* value (.009) is less than the predetermined alpha of .05.

Ho2$_5$: There is no significant difference in the perceived impact of *No Child Left Behind* on assessment between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools regarding the following statements:

a. Student progress is measured primarily through the use of alternative assessments.
b. Ready-made pretests are used extensively.
c. The testing necessary to measure the mandates of NCLB underserves or misserves the most disadvantaged or at-risk students.
d. NCLB accurately measures the weakness of a school.
e. NCLB accurately measures the strengths of a school.

Chi-square analyses were used to determine the difference in perceptions between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools on assessment.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 19.675) based on the degrees of freedom (*df* = 11) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 5, the x^2 value is greater than the critical value of x^2; therefore, the null hypothesis is rejected. In addition, the *p* value (.013) is less than the predetermined alpha of .05.

Table 5

No Child Left Behind On-track and Off-track

Subtest	*N*	*df*	x^2	*p*
NCLB On-track	35			
NCLB Off-track	16			
$Ho2_1$ Professional development		17	33.653	.009
$Ho2_2$ Instructional methodology		9	11.936	0.217
$Ho2_3$ Administrative Support		11	24.435	0.011
$Ho2_4$ Resources and materials		11	25.000	0.009
$Ho2_5$ Assessment		11	24.000	0.013

Research Question #3

Is there a difference in the perceived impact of the *No Child Left Behind Act* between small and large schools on professional development, instructional methodology, administrative support, assessment, and resources and materials?

$Ho3_1$: There is no significant difference in the perceived impact of *No Child Left Behind* on professional development between small and large schools regarding the following statements:

a. The system provides inservice time specifically for science.
b. The system provides continuous and sustained support for professional development in science.
c. The system provides teachers release time to engage in professional development activities during the day.
d. The system promotes experience sharing and collaboration.
e. The system promotes activities that support the less experienced.
f. The system promotes activities that support and sustain the experienced teacher.
g. The system provides activities that foster and support change.

Chi-square analyses were used to determine the difference in perceptions between small and large schools on professional development.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 27.587) based on the degrees of freedom (*df* =17) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 6, the x^2 value is greater than the critical value of x^2; therefore, the null hypothesis is rejected. In addition, the *p* value (.009) is less than the predetermined alpha of .05.

$Ho3_2$: There is no significant difference in the perceived impact of *No Child Left Behind* on instructional methodology between small and large schools regarding the following statements:

a. Class time has been reduced since 2001-2003.
b. During science instructional time, students are provided opportunity to be actively engaged.
c. During science instructional time, the real world is brought into the classroom.
d. During science instructional time, different learning styles are accommodated.
e. Science curriculum and instruction is restricted by NCLB testing requirements.
f. Science curriculum and instruction is enhanced by NCLB testing requirements.

Chi-square analyses were used to determine the differences in perceptions between small and large schools on instructional methodology.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 16.919) based on the degrees of freedom (df = 9) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 6, the x^2 value is less than the critical value of x^2; therefore, the null hypothesis is retained. In addition, the p value (.217) was greater the predetermined alpha of .05.

Ho3_3: There is no significant difference in the perceived impact of *No Child Left Behind* in administrative support between small and large schools regarding the following statements:

a. Faculty meetings focus on NCLB.
b. Faculty meetings focus on *Terra Nova* test data.
c. Extra assistance has been provided for financially, either through resources or professional development, to low scoring schools or grades.
d. Teachers feel pressured to increase test scores.
e. Administrators place more importance on students' achievement than test scores.
f. Terra Nova test scores shape curriculum goals and objectives.

Chi-square analysis was used to determine the difference in perceptions between small and large schools on administrative support.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 19.675) based on the degrees of freedom (*df* = 11) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 6, the x^2 value is greater than the critical value x^2; therefore, the null hypothesis is rejected. In addition, the *p* value (.011) is less than the predetermined alpha of .05.

$Ho3_4$: There is no significant difference in the perceived impact of *No Child Left Behind* on resources and materials between small and large schools regarding materials and resources:

a. Materials and resources are distributed equally among schools in the district.
b. Materials and resources are distributed equally among teachers.
c. Inquiry-centered and/or hands-on materials have increased.

Chi-square analyses were used to determine the difference in perceptions between small and large schools on materials and resources.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 19.675) based on the degrees of freedom (*df* = 11) and an alpha of .05 against the calculated to see if it is statically significant. As shown in Table 6, the x^2 value is greater than the critical value of x^2; therefore, the null hypothesis is rejected. In addition, the *p* value (.009) is less than the predetermined alpha of .05.

$Ho3_5$: There is no significant difference in the perceived impact of *No Child Left Behind* on assessment between small and large schools regarding the following statements:

a. Student progress is measured primarily through the use of alternative assessments.
b. Ready-made pretests are used extensively.
c. The testing necessary to measure the mandates of NCLB underserves or misserves the most disadvantaged or at-risk students.
d. NCLB accurately measures the weakness of a school.
e. NCLB accurately measures the strengths of a school.

Chi-square analyses were used to determine the difference in perceptions between small and large schools on assessment.

Chi-square analysis was used to first test the magnitude of the critical value x^2 (x^2 = 19.675) based on the degrees of freedom (*df* = 11) and an alpha of .05 against the calculated to see if it is statistically significant. As shown in Table 6, the x^2 value is greater than the critical value of x^2; therefore, the null hypothesis is rejected. In addition, the *p* value (.013) is less than the predetermined alpha of .05.

Table 6

Small and Large Schools

Subtest	*N*	*df*	x^2	*p*
Small Schools	32			
Large Schools	19			
$Ho3_1$ Professional Development		17	33.653	.009
$Ho3_2$ Instructional Methodology		9	11.936	0.217
$Ho3_3$ Administrative Support		11	24.435	0.011
$Ho3_4$ Resources and Materials		11	25.000	0.009
$Ho3_5$ Assessment		11	24.000	0.013

Table 7 shows a summary of the null hypotheses along with the finding for each.

Table 7

Summary of Null Hypotheses

Null Hypotheses	Findings
$Ho1_1$: There is no significant difference in the perceived impact of *No Child Left Behind* on professional development among teachers with differing levels of experience.	Rejected
$Ho1_2$: There is no significant difference in the perceived impact of *No Child Left Behind* on instructional methodology among teachers with differing levels of experience.	Retained
$Ho1_3$: There is no significant difference in the perceived impact of No Child left behind in administrative support among teachers with differing levels of experience.	Rejected
$Ho1_4$: There is no significant difference in the perceived impact of No Child Left Behind on resources and materials among teachers with differing levels of experience.	Rejected
$Ho1_5$: There is no significant difference in the perceived impact of *No Child Left Behind* on assessment among teachers with differing levels of experience.	Rejected
$Ho2_1$: There is no significant difference in the perceived impact of *No Child Left Behind* on professional development between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools.	Rejected
$Ho2_2$: There is no significant difference in the perceived impact of *No Child Left Behind* on instructional methodology between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools.	Retained
$Ho2_3$: There is no significant difference in the perceived impact of *No Child Left Behind* in administrative support between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools.	Rejected
$Ho2_4$: There is no significant difference in the perceived impact of *No Child Left Behind* on resources and materials between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools.	Rejected

Table 7 (continued)

Null Hypotheses	Findings
$Ho2_5$: There is no significant difference in the perceived impact of *No Child Left Behind* on assessment between *No Child Left Behind* on-track and *No Child Left Behind* off-track schools.	Rejected
$Ho3_1$: There is no significant difference in the perceived impact of *No Child Left Behind* on professional development between small and large schools.	Rejected
$Ho3_2$: There is no significant difference in the perceived impact of *No Child Left Behind* on instructional methodology between small and large schools.	Retained
$Ho3_3$: There is no significant difference in the perceived impact of *No Child Left Behind* in administrative support between small and large schools.	Rejected
$Ho3_4$: There is no significant difference in the perceived impact of *No Child Left Behind* on resources and materials between small and large schools.	Rejected
$Ho3_5$: There is no significant difference in the perceived impact of *No Child Left Behind* on assessment between small and large schools regarding the following statements.	Rejected

Teachers with 5 years or less experience with a mean score of 3.35, schools in good standing with a mean score of 3.27, and schools with fewer than 400 students with a mean score of 3.52 more strongly agreed that professional development is impacted by the *No Child Left Behind* Act.

Teachers with 5 years or less experience with a mean score of 4.00, targeted schools with a mean score of 3.96, and schools with fewer than 400 students with a mean score of 3.97 more strongly agreed that administrative support is impacted by the *No Child Left Behind* Act.

Teachers with more than 5 years experience with a mean score of 3.396, schools in good standing with a mean score of 3.45, and schools with fewer than 400 students with a mean score of 3.49 more strongly agreed that resources and materials are impacted by the *No Child Left Behind* Act.

Teachers with 5 years or less experience with a mean score of 3.03, targeted schools with a mean score of 3.07, and schools with more than 400 students with a mean score of 3.01 more strongly agreed that assessment is impacted by the *No Child Left Behind* Act.

Analysis of Open-Ended Questions

The respondents of this study were given the opportunity to respond to two open-ended questions concerning the overall impact of *No Child Left Behind* on teachers and the overall impact of *No Child Left Behind* on students. Of the 51 respondents, over half (69%) chose to respond to these two questions with their responses relating to the issues addressed in the main focus of the survey.

Aligned with the instructional methodology section of the survey on the overall impact of *No Child Left Behind* on teachers, many negative responses were given. One respondent commented on the impact by saying, “Not much; would like to do more science but time or physical room doesn’t seem to allow for it.” Another commented, “It has restricted the ability of teachers to allow students to perform experiments and hands on activities.” Another respondent stated, “I find that more time is spent on vocabulary with our students and our students are receiving less skill-development time.” Another stated, “[There is] more pressure to focus on reading and math with less emphasis on science.”

Respondents replied addressing creativity and individuality by saying, “[It] takes away creativity and individuality" and “[It] takes away creativity, individuality, adds stress and pressure, and takes the fun out of teaching.” Another replied, “[I] can’t teach science and focus more on reading.” Adding to this sentiment, several replied, “Teachers have focused all their time on reading and math and there has not been time for science,” “[It] inhibits teachers from having formal instruction in science as well as social studies,” “It has caused us to put more time into reading and less time on other subjects,” and “It has caused us to neglect science and social studies.” One respondent stated, “Teachers are now restricted by NCLB because it hinders the

instructional methodology of science; science needs to be demonstrated repeatedly." Without addressing the negativity or positive outcome, one respondent stated, "NCLB drives the curriculum and directs instruction." Finally, one respondent stated, "It puts pressure to excel on language arts and math; thus, leaving less time for fun hands-on things."

The theme on the over all impact of *No Child Left Behind* on students as it relates to instructional methodology remained negative. One respondent stated, "It seems unrealistic." Others stated, "The students receive a narrow band of the curriculum" and "Students are getting less time with hands-on activities because of pressure to focus on reading and math." When asked to address focus, some statements given were, "It adds stress and pressure and takes fun out of learning. All focus is on reading--a lot of other subjects [are] not being taught," "[Students] are not getting a well-rounded education; music, art, social studies, and science are being pushed to bottom of the ladder," "Life skills-not taught for a well-rounded curriculum," and "Students are not getting science, just more reading." Another participant stated, "[It] inhibits students from participating in science projects that encourage high order thinking skills." One stated, "The students are not given a well-rounded curriculum." Another stated, "It causes teachers to spend less time teaching science and social studies and more time teaching reading and math. This can discourage students about school in general. They are not as excited about their subjects." Along the same theme, other statements included, "It puts all students in the same box and leaves no time for the whole school experience--not taught a well-rounded curriculum," "Fewer opportunities to learn by doing--more of a "rushed" feeling," "[There is] less real world knowledge and more focus on test scores," and "Pressure finally catches up as years go by and the children don't like school as much as they used to." Out of the many negative responses, one respondent gave a positive statement, saying, "It increases knowledge for terminology usage and understanding of passages."

Regarding the administrative support section of the survey on the overall impact of *No Child Left Behind* on teachers, some comments were, "It increases pressure to cover specific

items; other, not-tested things are left out," "stress," "to much pressure," and "unrealistic goals." One respondent gave a positive statement, saying, "Teachers are more aware of specific goals that need to be met in education. Awareness has proved to be a driving factor in performance."

Adding to the overall impact of *No Child Left Behind* legislation on students, some comments made by respondents were, "tremendous pressure," "stress," and "unrealistic goals." There was one positive statement, "Students are not aware of the impact of NCLB, but [they] will receive some of the benefits as schools and families work more closely together in order to see them succeed."

Aligned with the assessment section of the survey on the overall impact of *No Child Left Behind* on teachers, respondents again had many negative comments. Several simply stated, "very poor," "stressful," and "more teaching to the test." One respondent emphatically stated, "Stress! Teachers are also being undermined and mistrusted about what to teach in their classroom. It is as if we are not trusted to do what is right for our students--that we don't have their best interests." Another stated, "[There is] too much attention on testing and not enough on student learning--a lot more paperwork." Finally, one respondent stated, "There is more pressure on teachers to teach to the test." One respondent positively stated, "[It] is making us more accountable and aware of our weaknesses and it allows teachers the opportunity to make goals for students who are labeled NCLB and to see yearly progress."

Again, as with the previous, two respondents simply stated when addressing the overall impact of *No Child Left Behind* on students, "very poor" and "overwhelming." One respondent stated, "[It has] taken away some of the hands-on projects, the sometimes spontaneous, stop and check something out." Another participant commented:

> The students who really need the help are left behind. These students are those who do not qualify for special education services but are still far below grade level. I feel teachers do not have the time to help these types of students because you must focus on covering the objectives.

Others stated, "Students are taught how to take a test and not to think" and "Students are tested to death to be sure they have mastered the objectives on the test." At last, there were two

positive comments from respondents addressing this issue. These were, "[It] causes them to gain more knowledge and higher test scores" and "[It] gives students a chance to improve if they fall in the NCLB category. They are given more one-on-one assistance in an educational setting."

Summary

This chapter included descriptive data from the respondents from the three counties included in this study and an analysis of data. Chi-square analysis was used to determine if any relationship existed among teachers with differing levels of experience, *No Child Left Behind* on-track schools and *No Child Left Behind* off-track schools and small and large schools on professional development, instructional methodology, resources and materials, and administrative support and assessment. Chapter 5 includes findings and conclusions along with recommendations for further research and to improve practice.

CHAPTER 5

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this chapter is to summarize the results of the study and identify and explain the perceptions of the respondents on the *No Child Left Behind* legislation's impact on elementary science education. This study focused on three demographics: teachers with differing levels of experience, teachers from schools labeled high priority, targeted, and good standing, and teachers from small and large schools. After an extensive literature review, the research steered the focus to the following issues surrounding science education: administrative support, assessment, resources and materials, instructional methodology, and professional development.

This focus led to the development of a teacher questionnaire on perceptions of *No Child Left Behind's* impact on the previously stated issues using a Likert-type format with two optional open-ended questions. These surveys were delivered to elementary schools in Coby, Orick, and McPherson Counties.

The surveys were analyzed using SPSS Statistical Software for Students with results and responses to the two open-ended questions presented in Chapter 4. Frequency responses are presented in the findings section in this chapter.

Findings

Of the 72 teachers invited to participate in this study, 51 returned the survey with a 71% return rate. A frequency analysis was conducted on demographic data and revealed that 43 respondents to the survey were female and 8 were male. The age of the respondents was varied with the majority of the teachers being over 40. Teaching experience of the respondents was almost equal in those with fewer than 15 years of experience and those with more than 15 years

of experience. Of the respondents, 25 held bachelor's degrees, 22 had masters, and 3 held specialist's degrees. In addition, 35 of the respondents' schools were classified as being in good standing and 16 were targeted; 19 of the respondents taught in schools with fewer than 400 students whereas 32 taught in schools with more than 400 students; and 48 of the respondents were highly qualified and 2 were not. Additional findings are summarized as responses to the three research questions.

Research Questions

1. Is there a difference in the perceived impact of the *No Child Left Behind* Act among teachers with differing levels of experience on professional development, instructional methodology, administrative support, assessment, and resources and materials?
2. Is there a difference in the perceived impact of the *No Child Left Behind* Act between *No Child Left Behind* on-track schools and *No Child Left Behind* off-track schools on professional development, instructional methodology, administrative support, assessment, and resources and materials?
3. Is there a difference in the perceived impact of the *No Child Left Behind* Act between small and large schools on professional development, instructional methodology, administrative support, assessment and resources and materials?

These research questions addressed the perceptions and attitudes of teachers on the impact of *No Child Left Behind* legislation on science in the elementary classroom.

Professional Development

Survey questions 1, 2, 3, 4, 5, 6, and 7 were used in the data analysis. These questions focused primarily on if the system provides inservice specifically for science, if the system provides continuous and sustained support for professional development in science, if the system provides teachers with release time to engage in professional development activities during the

day, if the system promotes activities that support the less experienced, if the system promotes activities that support and sustain the experienced teacher, and if the system provides activities that foster and support change.

Analysis using chi-square indicated that there were perceived differences in how teachers with differing levels of experience, *No Child Left Behind* on-track schools and *No Child Left Behind* off-track schools, and small and large schools viewed the impact of *No Child Left Behind* on professional development.

Frequency distribution revealed that when all respondents were asked if the system provided inservice time specifically for science, 11.8% strongly agreed or agreed; 66.7% disagreed or strongly disagreed; and 21.6% reported they were unsure. When asked if the system provides continuous and sustained support for professional development in science, 3.8% strongly agreed or agreed; 60.8% disagreed or strongly disagreed; and 25.5% reported being unsure. When asked if the system provides teachers release-time to engage in professional development activities during the day, 56.9% strongly agreed or agreed; 19.7% disagreed or strongly disagreed; and 21.6% were unsure. When asked if the system promotes experience sharing and collaboration, 86.3% strongly agreed or agreed; 7.8% disagreed or strongly disagreed; and 5.9% were unsure. When asked if the system promotes activities that support the less experienced, 51% strongly agreed or agreed; 37.3% disagreed or strongly disagreed; and 11.8% were unsure. When asked if the system promotes activities that support and sustain the experienced teacher, 62.7% strongly agreed or agreed; 29.4% disagreed or strongly disagreed; and 5.9% were unsure. When asked if the system provides activities that foster and support change, 74.5% strongly agreed or agreed; 15.6% disagreed or strongly disagreed; and 9.8% were unsure.

Instructional Methodology

Survey questions 17, 18, 19, 20, 21, and 22 were used in data analysis. These six questions focused primarily on finding if teachers felt class time had been reduced for science since 2001-2002; if during science instructional time, students are provided opportunity to be actively engaged; if during science instructional time, the real world is brought into the classroom; if during science instructional time, different learning styles are accommodated; if science curriculum and instruction is restricted by *No Child Left Behind* testing requirements; and if science curriculum is enhanced by *No Child Left Behind* testing requirements.

Analysis using chi-square indicated there were no perceived differences between how teachers with differing levels of experience, *No Child Left Behind* on-track and *No Child Left Behind* off-track schools and small and large schools viewed the impact of the *No Child Left Behind* Act on instructional methodology.

Frequency distribution revealed that when all respondents were asked if class time had been reduced since 2001-2002, 53% strongly agreed or agreed, 15.7% disagreed or strongly disagreed, and 31.4% were unsure. When asked if during science instructional time, students are provided opportunity to be actively engaged, 54.9% strongly agreed or agreed; 21.5% disagreed or strongly disagreed; and 19.6% were unsure. When asked if during science instructional time, the real world is brought into the classroom, 60.8% strongly agreed or agreed; 17.7% disagreed or strongly disagreed; and 15.7% were unsure. When asked if during science instructional time, different learning styles are accommodated, 62.8% strongly agreed or agreed; 13.7% disagreed or strongly disagreed; and 17.6% were unsure. When asked if science curriculum and instruction is restricted by *No Child Left Behind* testing requirements, 54.9% strongly agreed or agreed; 21.5% disagreed or strongly disagreed; and 29.4% were unsure. When asked if science curriculum and instruction is enhanced by *No Child Left Behind* testing requirements, 11.8% strongly agreed or agreed; 43.2% disagreed or strongly disagreed; and 43.1% were unsure.

Respondents added additional comments reflecting a negative view of the *No Child Left Behind* Act's impact on instructional methodology. Many emphasized the restriction NCLB has placed on science related activities and the loss of individuality and creativity. Others stated the loss of science instructional time in favor of math and reading. Several responded on the lack of students' abilities to receive a well-rounded education and a narrowing of the curriculum. One respondent added that the build-up of pressure over the years for students leads to a dislike of school. Included among the negative impacts were stress, pressure, and the loss of "fun" in learning.

Administrative Support

Survey questions 11, 12, 13, 14, 15, and 16 were used in data analysis. These six questions focused on if faculty meetings focus primarily on *No Child Left Behind*, if faculty meetings focus on *Terra Nova* test data, if extra assistance has been provided either financially through resources or professional development to low scoring schools or grades, if teachers feel pressure to increase test scores, if administrators place more importance on students' achievement than test scores, and if *Terra Nova* test scores shape curriculum goals and objectives.

Analysis using chi-square indicated there were perceived differences between how teachers with differing levels of experience, *No Child Left Behind* on-track schools and *No Child Left Behind* off-track schools and small and large schools view the impact of the *No Child Left Behind* Act on administrative support.

Frequency distribution revealed that when all respondents were asked if faculty meetings focus on *No Child Left Behind*, 82.4% strongly agreed or agreed; 15.6% disagreed or strongly disagreed; and 2% were unsure. When asked if faculty meetings focus on *Terra Nova* test data, 88% strongly agreed or agreed and 12% disagreed or strongly disagreed. When asked if extra assistance has been provided either financially through resources or professional development to

low scoring schools or grades, 72.5% strongly agreed or agreed; 2% disagreed or strongly disagreed; and 25.5% were unsure. When asked if teachers feel pressure to increase test scores, 94.1% strongly agreed or agreed and 4% disagreed or strongly disagreed. When asked if administrators place more importance on students' achievement than test scores, 21.5% strongly agreed or agreed; 56.9% disagreed or strongly disagreed; and 15.7% were unsure. When asked if *Terra Nova* test scores shape curriculum goals and objectives, 90.2% strongly agreed or agreed; 4% disagreed or strongly disagreed; and 5.9% were unsure.

Respondents again related additional comments on the impact of *No Child Left Behind* on administrative support. Many noted the increase in pressure and stress on both teachers and students. It was stated that goals are now more specific and awareness might be a driving factor in success. One respondent said she felt *No Child Left Behind* would lead to families and schools working more closely together for student success.

Materials and Resources

Survey questions 8, 9, and 10 were used in data analysis. These three questions focused primarily on if materials and resources are distributed equally among schools in the district, if materials and resources are distributed equally among teachers, and if inquiry-centered and/or hands-on materials have increased.

Analysis using chi-square indicated there were perceived differences between how teachers with differing levels of experience, *No Child Left Behind* on-track and *No Child Left Behind* off-track schools, and small and large schools view the impact of the *No Child Left Behind* Act on materials and resources.

Frequency distribution revealed that when all respondents were asked if materials and resources are distributed equally among schools in the district, 37.2% strongly agreed or agreed; 29.4% disagreed or strongly disagreed; and 33.3% were unsure. When asked if materials and resources are distributed equally among teachers, 58.9% strongly agreed or agreed; 23.5%

disagreed or strongly disagreed; and 17.6 were unsure. When asked if inquiry-centered and/or hands-on materials have increased, 62.8% strongly agreed or agreed; 17.7% disagreed or strongly disagreed; and 19.6% were unsure.

Assessment

Survey questions 23, 24, 25, 26, and 27 were used in data analysis. These five questions focused primarily if student progress is measured primarily through the use of alternative assessments, if ready-made pretests are used extensively, if the testing necessary to measure the mandates of the *No Child Left Behind* Act underserves or misserves the most disadvantaged or at-risk students, if the *No Child Left Behind* Act accurately identifies the weakness of a school, and if the *No Child Left Behind* Act accurately identifies the strengths of a school.

Analysis using chi-square indicated there were perceived differences between how teachers with differing levels of teaching experience, *No Child Left Behind* on-track schools and *No Child Left Behind* off-track schools, and small and large schools view the impact of the *No Child Left Behind* Act on assessment.

Frequency distribution revealed that when all respondents were asked if student progress is measured primarily through the use of alternative assessments, 39.2% strongly agreed or agreed; 31.4% disagreed or strongly disagreed; and 25.5% were unsure. When asked if ready-made pretests are used extensively, 49% strongly agreed or agreed; 33.3% disagreed or strongly disagreed; and 17.6% were unsure. When asked if the testing necessary to measure the mandates of *No Child Left Behind* underserves or misserves the most disadvantaged or a-risk students, 64.7% strongly agreed or agreed; 3.9% disagreed or strongly disagreed; and 29.4% were unsure. When asked if *No Child Left Behind* accurately identifies the weakness of a school, 23.5% strongly agreed or agreed; 54.9% disagreed or strongly disagreed; and 21.6% were unsure. When asked if *No Child Left Behind* accurately identifies the strengths of a school, 19.6% strongly agreed or agreed; 56.8% disagreed or strongly disagreed; and 23.5% were unsure.

Respondents' comments relating to assessment reflected a negative tone. Many respondents again pointed out the stress associated with the necessary testing along with feelings of being overwhelmed. Comments from many respondents also reflected that teachers felt an obligation to teach to the test at the expense of learning. One commenter bemoaned the necessity to leave behind those that really needed help. However, some comments stating the labeling of students in *No Child Left Behind* categories allowed the weaknesses of those students to be identified along with goals and opportunities to improve.

One last question addressed the percentage of science instructional time students were engaged in activities such as inquiry-based, hands-on, science experiments, and science projects before and after the passage of *No Child Left Behind*. For inquiry-based activities, 19% responded less, 22% more, and 59% no difference. For hands-on activities, 22% responded less, 22% more, and 56% no difference. For science experiments, 32% responded less, 23% more, and 45% less. For science projects, 32% responded less, 23% more, and 45% no difference.

Conclusions

Several conclusions are deemed from this study. There were difference in attitudes and perceptions among teachers with differing levels of experience, *No Child Left Behind* on-track and *No Child Left Behind* off-track schools, and small and large school on professional development, administrative support, materials and resources and assessment. However, no difference was found in the attitudes and perceptions among teachers with differing levels of experience, *No Child Left Behind* on-track schools and *No Child Left Behind* off-track schools and small and large schools on instructional methodology.

Many of the attitudes and perceptions of the teachers participating in this study reflected positive outcomes of the *No Child Left Behind* Act. Most reported that they feel schools are promoting sharing and collaboration while providing opportunities to help teachers at different stages in their careers. Most said they feel they are being given the tools necessary to adapt to

the changes brought on in this day of accountability. Many teachers did say faculty meetings focus on *No Child Left Behind* and the testing it requires and that it does shape goals and curriculum. As one teacher expressed, it provides schools with an opportunity to make goals for students who are labeled with deficiencies. Along with this, many expressed thoughts that low scoring schools and grades are receiving help.

However, the majority of the teachers emphatically expressed concerns relating to the *No Child Left Behind* Act. Many respondents mentioned the stress and pressure associated with the testing necessary on teachers and students. Most said they felt science instruction along with other subjects such as social studies are being restricted and reduced because of concerns over math and reading. Even though research-based teaching is a main component of *No Child Left Behind*, many stated they are not receiving inservice specifically for science. Some teachers did not agree that *No Child Left Behind* serves in the best interests of those students with the most needs. In addition, although teachers did state *No Child Left Behind* does identify the weakness of some students, most said they did not feel it accurately identified the strengths and weaknesses of a school.

Recommendations for Further Research

As a result of the researcher's review of literature, the findings in this study, and consideration of the short time span the *No Child Left Behind* Act has been law, several recommendations are proposed to encourage further research:

1. Additional research needs to be conducted with parents or other caregivers to identify their understanding of the mandates of the *No Child Left Behind* Act and their perceived role in their child's success.
2. Replication of this study is needed at the middle- and high-school level.
3. Replication of this study is needed when science becomes one of the testing categories in 2008.

4. Replication of this study is needed with schools not designated as Title 1.
5. Additional research should be conducted concerning the amount and substance of professional development related to science elementary teachers.
6. Additional research is needed to identify if the *No Child Left Behind* Act is bridging the barrier between the subcategories of students labeled and those not labeled.

Recommendations to Improve Practice

As a result of the researcher's findings, several recommendations are proposed to improve current practices:

1. A collaborative effort should be made between schools in a district and teachers, if not each grade level, at least from grades k-2, 3-5, 6-8, and 9-12, to see that materials are equally distributed, to allow teachers to know what is available, and to prevent duplication.
2. An effort should be made within schools and within a district to address the stress and pressure teachers and students are experiencing. Outside support may be necessary in some instances. Or, in some instances, the recognition and admission of its existence by the administration might be all that is necessary.
3. A collaborative effort should be made between schools within a district or with small districts to provide teachers with inservice dealing strictly with science.
4. An effort should be made within a school to identify its strengths and weaknesses not associated with testing and to promote or improve those that are identified.
5. An effort should be made within a school to explore and implement ways to continue to improve math and reading without sacrificing other subjects or the whole experience of school.

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APPENDICES

APPENDIX A

Impact of *No Child Left Behind* Teacher Survey

The following information will only be used to classify responses by aggregate demographic groups.

GENDER: MALE_____ FEMALE_____

AGE: _____

YEARS OF TEACHING EXPERIENCE: _____

HIGHEST EDUCATIONAL DEGREE ATTAINED:

Bachelor's degree_____ Master's degree_____
Specialist's degree_____ Doctoral degree_____

NO CHILD LEFT BEHIND SCHOOL STATUS:
Good standing_____ Targeted_____ High Priority_____

TITLE 1 SCHOOL_____ NONTITLE 1 SCHOOL_____

SCHOOL SIZE: Fewer than 400 students_____ More than 400 students_____

HIGHLY QUALIFIED STATUS: Yes_____ No_____

Please respond to the following statements concerning the impact of *No Child Left Behind.* Throughout the survey, *No Child Left Behind* will referred to as NCLB.

KEY: SA = STRONGLY AGREE
A = AGREE
U = UNSURE
D = DISAGREE
SD = STRONGLY DISAGREE

Please answer each item keeping in mind what is happening in your science classroom today as compared to before the passage of *No Child Left Behind* in January of 2002.

I. PROFESSIONAL DEVELOPMENT

1. The system provides in-service time specifically for science……..SA A U D SD

2. The system provides continuous and sustained support for professional development in science……SA A U D SD

3. The system provides teachers release-time to engage in professional development activities during the day…… ……..…SA A U D SD

4. The system promotes experience sharing and collaboration……SA A U D SD

5. The system promotes activities that support the less experienced (less than five years teaching experience)…….. SA A U D SD

6. The system promotes activities that support and sustain the experienced teacher (more than five years teaching experience)…….……..SA A U D SD

7. The system provides activities that foster and support change……..SA A U D SD

II. MATERIALS AND RESOURCE

8. Materials and resources are distributed equally among schools in the district….…….SA A U D SD

9. Materials and resources are distributed equally among teachers…….……..SA A U D SD

10. Inquiry-centered and/or hands-on materials have increased……SA A U D SD

III. ADMINISTRATIVE SUPPORT

11. Faculty meetings focus on NCLB……..…….. ….SA A U D SD

12. Faculty meetings focus on Terra Nova test data…….SA A U D SD

13. Extra assistance has been provided either financially, through resources or professional development to low scoring schools or grades…… SA A U D SD

14. Teachers feel pressured to increase test scores……SA A U D SD

15. Administrators place more importance on students' achievement than test scores……...……..SA A U D SD

16. Terra Nova test scores shape curriculum goals and objectives… .SA A U D SD

IV. INSTRUCTIONAL METHODOLOGY

17. Class time has been reduced in science since 2001-2002……SA A U D SD

18. During science instructional time students are provided opportunity to be actively engaged (experiments, projects, hands-on activities etc.)……..…….SA A U D SD

19. During science instructional time the real world is brought into the classroom……SA A U D SD

20. During science instructional time different learning styles are accommodated……SA A U D SD

21. Science curriculum and instruction is restricted by NCLB testing requirements…… …SA A U D SD

22. Science curriculum and instruction is enhanced by NCLB testing requirements…..…… ……SA A U D SD

V. ASSESSMENT

23. Student progress is measured primarily through the use of alternative assessments…….SA A U D SD

24. Ready-made pretests are used extensively……SA A U D SD

25. The testing necessary to measure the mandates of NCLB underserves or misserves the most disadvantaged or at-risk students……..SA A U D SD

26. NCLB accurately identifies the weakness of a school…….SA A U D SD

27. NCLB accurately identifies the strengths of a school……..SA A U D SD

28. Students spend what percentage of their science instructional time engaged in the following activities per week?

	Before passage of NCLB (Jan. 2002)	After passage NCLB
Inquiry-based activities…..	0% 20% 40% 60% 80%	0% 20% 40% 60% 80%
Hands-on activities……..0%	20% 40% 60% 80%	0% 20% 40% 60% 80%
Science experiments……	0% 20% 40% 60% 80%	0% 20% 40% 60% 80%
Science projects……..	0% 20% 40% 60% 80%	0% 20% 40% 60% 80%

Overall impact of NCLB on teachers_____
_____
_____

Overall impact of NCLB on students_____
_____
_____

APPENDIX B

Letter to Directors of Schools

1707 Chinquipin Road
Sneedville, Tennessee 37869
April 1, 2005

Dear

As part of the requirements toward the completion of a Doctor of Education degree at East Tennessee State University, I am planning to complete a study of the perceived impact of the *No Child Left Behind Act* on science education in elementary third through fifth grade classrooms. Specifically, I am planning to determine the perceived impact of the *No Child Left Behind Act* on science education in third through fifth grade classrooms of Title 1 and Non Title 1 schools, No Child Left Behind targeted, high priority schools or those in good standing and large and small schools. Procedures will include and analysis of teacher surveys. This letter is to request your permission for me to conduct this study in three of your schools. I would like to survey third through fifth grade teachers at XX, XX and XX. This letter is to request your permission for me to conduct this study and also to request permission for me to ask the principals at the schools I need to survey to allow their schools to participate in my study.

Having taught in Hancock County for fifteen years as a seventh grade science teacher and as a high school chemistry and environmental science teacher, I realize the importance of science education in the early grades. These early grades set the foundation in terms of attitude, habits, context and interests that lead to success as a high school student; therefore, it is imperative that the perceived impact of the *No Child Left Behind Act* be addressed. With *No Child Left Behind* being a recent law, with changing conditions and mandates this study will contribute to research on the affects of high-stakes testing and the Law itself.

Upon completion, I will be happy to share the results of my study with you.

I appreciate your consideration in this matter. If you have any further questions, do not hesitate to call me at Hancock Middle and High School (423-733-4611) or home (423-733-2323).

Sincerely,

Angela V. Kinsler

APPENDIX C

Letter to Principals

1707 Chinquipin Road
Sneedville, Tennessee 37869
April 1, 2005

Dear

As part of the requirements toward the completion of a Doctor of Education degree at East Tennessee State University, I am planning to complete a study of the perceived impact of the *No Child Left Behind Act* on science education in elementary third through fifth grade classrooms. Specifically, I am planning to determine the perceived impact of the *No Child Left Behind Act* on science education in third through fifth grade classrooms of Title 1 and Non Title 1 schools, No Child Left Behind targeted, high priority schools or those in good standing and large and small schools. Procedures will include and analysis of teacher surveys. This letter is to request your permission for me to conduct this study in your school. I have contacted your director and he has granted permission for me to conduct a survey of your teachers. The survey should take 15 to 20 minutes to complete.

Having taught in Hancock County for 15 years as a seventh grade science teacher and as a high school chemistry and environmental science teacher, I realize the importance of science education in the early grades. These early grades set the foundation in terms of attitude, habits, context and interests that lead to success as a high school student; therefore, it is imperative that the perceived impact of the *No Child Left Behind Act* be addressed. With No Child Left Behind being a recent law, with changing conditions and mandates, this study will contribute to research on the effects of high-stakes testing and the Law itself.

Upon completion, I will be happy to share the results of my study with you.

I appreciate your consideration in this matter. If you have any further questions, do not hesitate to call me at Hancock Middle and High School (423-733-4611) or home (423-733-2323).

Sincerely,

Angela V. Kinsler

APPENDIX D

Letter to Teachers

1707 Chinquipin Road
Sneedville, TN 37869

Dear Teachers,

I am an educator in Hancock County and I am working on a doctoral study concerning the perceived impact of the *No Child Left Behind Act* on elementary science in third- through fifth-grade classrooms.

I have been granted permission by your director of schools and principal to conduct a survey of your feelings and attitudes on the perceived impact of the *No Child Left Behind Act*. I realize as a teacher myself, especially at this time of year, you face a vast daily workload. I would, however, greatly appreciate it if you would complete and return the enclosed survey.

Your principal and I will decide whether time will be made available during a faculty meeting for its completion or if the survey instruments will be placed in your mailbox by a designee of your principal. If the latter choice is made you will place the survey in the designee's mailbox after it is completed within 14 days of receiving the survey.

This survey will take 15 to 20 minutes to complete and as you complete the survey, keep in mind what is going on in your classroom today as compared to before the passage of the *No Child Left Behind Act* in January of 2002.

Every attempt will be made to see that the study's results are kept confidential. A copy of the records from this study will be stored in a filing cabinet in my home for at least 10 years after the end of this research. The results of this study may be published and/or presented at meetings without naming you as the subject. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the East Tennessee State University /IRB and research related personnel from the ETSU Department of Educational Leadership and Policy Analysis have access to the study records. My records will be kept completely confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above.

Your name or grade level taught will not be used and however unlikely it is that school administrators would match your responses to you, it is possible. Therefore, you may omit answering any questions you feel uncomfortable answering.

Upon completion I will be happy to share the results of my study with you.

If you have any questions please contact me at 423-733-2323 (home) or at 423-733-4611 (Hancock Middle and High School), or Dr. Nancy Dishner at 423-439-6162. You may call the Chairman of the Institutional Review Board at 423-439-6955 for any questions you may have about your rights as a research subject.

Sincerely,

Angela V. Kinsler

APPENDIX E

Frequency of Survey Responses

Survey Question	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
The System provides in-service specifically for science	5.9	5.9	21.6	37.3	29.4
The system provides continuous And sustained support for Professional development In science.	2.0	11.8	25.5	35.3	25.5
The system provides teachers Release time to engage in Professional development Activities during the day.	5.9	51	21.6	13.7	5.9
The system promotes experience Sharing and collaboration	11.8	74.5	5.9	3.9	3.9
The system promotes activities That support the less experienced	3.9	47.1	11.8	25.5	11.8
The system promotes activities That support and sustain the Experienced teacher.	3.9	58.8	5.9	19.6	9.8
The system provides activities That foster and support change	5.9	68.6	9.8	7.8	7.8
Materials and resources are Distributed equally among Schools in the district.	13.7	23.5	33.3	15.7	13.7
Materials and resources are Distributed equally among Teachers.	11.8	47.1	17.6	13.7	9.8
Inquiry-centered and/or Hands-on materials have Increased	5.9	56.9	19.6	15.7	2.0
Faculty meetings focus on NCLB	21.6	60.8	2.0	7.8	7.8
Faculty meetings focus on Terra Nova test data.	45.1	41.2	0	7.8	3.9
Extra assistance has been provided either financially, through resources or professional development to low scoring schools or grades	19.6	52.9	25.5	0	2.0

Teachers feel pressure to Increase test scores	68.6	25.5	0	2.0	2.0
Administrators place more Importance on students' Achievement than test scores	3.9	17.6	15.7	37.3	19.6
Terra Nova test scores shape Curriculum goals and objectives	56.9	33.3	5.9	2.0	2.0
Class time has been reduced in Science since 2001-2002	27.5	25.5	31.4	15.7	0
During schience instructional Time students are provided Opportunity to be actively Engaged	5.9	49.0	19.6	17.6	3.9
During science instructional Time the real world is brought Into the classroom	3.9	56.9	15.7	15.7	2.0
During science instructional Time different learning styles Are accommodated	2.0	60.8	17.6	9.8	3.9
Science curriculum and Instruction is restricted by NCLB testing requirements	21.6	33.3	29.4	13.7	0
Science curriculum and Instruction is enhanced by NCLB testing requirements	0	11.8	43.1	21.6	21.6
Student progress is measured Primarily through the use of Alternative assessments	0	39.2	25.5	21.6	9.8
Ready-made pretests are used Extensively	13.7	35.3	17.6	29.4	3.9
The testing necessary to Measure the mandates of NCLB Underserve or misserves the most Disadvantaged or at-risk students	23.5	41.2	29.4	3.9	0
NCLB accurately identifies the Weakness of a school	3.9	19.6	21.6	37.3	17.6
NCLB accurately identifies the Strengths of a school	0	19.6	23.5	39.2	17.6

APPENDIX F

Informed Consent Form

PRINCIPAL INVESTIGATOR: Angela V. Kinsler

TITLE OF PROJECT: *The Perceived Impact of No Child Left Behind on Third- Through Fifth-Grade Elementary Science Classrooms*

This Informed Consent will explain about being a research subject in an experiment. It is important that you read this material carefully and then decide if you wish to be a volunteer.

PURPOSE
The purpose of this research is as follows: To determine the perceived impact of the *No Child Left Behind Act* on professional development, instructional methodology, administrative support, materials and resources, and assessment. Because the *No Child Left Behind Act* has only been law for a short amount of time, this study should provide foundational information for school systems and other studies.

DURATION
The duration of your participation will be the time it takes to complete the survey, approximately twenty minutes.

PROCEDURES
You will be asked to complete a survey. Your principal and I will decide whether time will be made available during a faculty meeting for its completion or if the survey instruments will be placed in the mailboxes of third- through fifth-grade elementary science teachers by a designee of your principal. It will take you approximately twenty minutes to complete the survey. If the latter choice is made you will place the survey in the designee's mailbox after it is completed.

POSSIBLE RISKS/DISCOMFORTS
However unlikely it is that school administrators would match your responses to you, it is possible. Therefore, you may omit answering any question you feel uncomfortable answering.

PRINCIPAL INVESTIGATOR: Angela V. Kinsler

TITLE OF PROJECT: *The Perceived Impact of No Child Left Behind on Third- Through Fifth-Grade Elementary Science Classrooms*

POSSIBLE BENEFITS AND/OR COMPENSATIONS

The teacher and school system will benefit because of the examination of the perceived impact of the *No Child Left Behind Act*. Teachers and schools will have a better understanding of the *No Child Left Behind Act* allowing administrators to improve communication and professional development and teachers to improve instruction.

CONTACT FOR QUESTIONS

If you have any questions, problems or research-related problems at any time, you may call Angela V. Kinsler at 423-733-2323 or Dr. Nancy Dishner at 423-439-6162
You may call the Chairman of the Institutional Review Board at 423/439-6055 for any questions you may have about your rights as a research subject.

CONFIDENTIALITY

Every attempt will be made to see that the study's results are kept confidential. A copy of the records from this study will be stored in a filing cabinet in the researcher's home for at least 10 years after the end of this research. I understand the results of this study may be published and or presented at meetings without naming me as a subject. Although my rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the East Tennessee State University/IRB and research related personnel from the ETSU Department of Educational Leadership and Policy Analysis have access to the study records. My records will be kept completely confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above.

VOLUNTARY PARTICIPATION

The nature, demands, risks, and benefits of the project have been explained to me as well as are known and available. I understand what my participation involves. Furthermore, I understand I am free to ask questions and withdraw from the project at any time, without.

PRINCIPAL INVESTIGATOR: Angela V. Kinsler

TITLE OF PROJECT: *The Perceived Impact of No Child Left Behind on Third- Through Fifth-Grade Elementary Science Classrooms*

penalty. I have read, or have had read to me, and fully understand the consent form. I sign it freely and voluntarily. A signed copy has been given to me.

My study record will be maintained in strictest confidence according to current legal requirements and will not be revealed unless required by law or as noted above.

_____ _____

SIGNATURE OF VOLUNTEER DATE

_____ _____

SIGNATURE OF INVESTIGATOR DATE

VITA

ANGELA V. KINSLER

Personal Data:

Date of Birth: December 1, 1964
Place of Birth: Sneedville, TN
Marital Status: Single

Education:

Carson Newman College, Jefferson City, Tennessee;
B.A. Biology;
1987

East Tennessee State University, Johnson City, Tennessee;
MAT, Secondary Education;
1990

East Tennessee State University, Johnson City, Tennessee;
Educational Leadership and Policy Analysis, Ed.D.;
2006

Professional Teaching Experience:

Seventh-grade science teacher,
Hancock Central Elementary School, Sneedville, TN;
1990-1993

Chemistry teacher,
Hancock County High School, Sneedville, TN;
1993-1999

Assistant Principal,
Hancock Central Elementary School, Sneedville, TN;
1999-2000

Chemistry teacher,
Hancock County High School, Sneedville, TN;
2000 – Present