SCHOOL of GRADUATE STUDIES
EAST TENNESSEE STATE UNIVERSITY

East Tennessee State University
Digital Commons @ East Tennessee State University

Electronic Theses and Dissertations

Student Works

5-2008

An Examination of Science NCE Scores of Students of Participating and Nonparticipating Teachers in East Tennessee State University Summer Science Institute.

Kevin Ward
East Tennessee State University

Recommended Citation

Ward, Kevin, "An Examination of Science NCE Scores of Students of Participating and Nonparticipating Teachers in East Tennessee State University Summer Science Institute." (2008). *Electronic Theses and Dissertations.* Paper 1944. https://dc.etsu.edu/etd/1944

An Examination of Science NCE Scores of Students of Participating and NonParticipating Teachers in East Tennessee State University Summer Science Institute

---

A dissertation
presented to
the faculty of the Department of Educational Leadership and Policy Analysis
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Doctor of Education

---

by
Kevin Ward
May 2008

Dr. Louise MacKay, Chair
Dr. James Lampley
Dr. Jack Rhoton
Dr. Pamela Scott

Keywords: ETSU Summer Science Institute, Math and Science Partnership, National Science Foundation, Professional Development

ABSTRACT

An Examination of Science NCE Scores of Students of Participating and NonParticipating Teachers in East Tennessee State University Summer Science Institute.

by

Kevin Ward

The purpose of this study was to determine the effectiveness of East Tennessee State University's summer science institute training through the effect on mean Normal Curve Equivalent science test scores of students in a Northeast Tennessee school system whose teachers participated in the ETSU summer science institute training. Data analysis were compiled using students' science NCE scores to determine if there were significant differences in scores for those students whose teachers participated in the summer science institutes and those who did not participate. Students' NCE scores were compiled from the middle school setting over a 3-year academic period: 2004-2005, 2005-2006, and 2006-2007. Paired-samples *t* tests were used to analyze the effectiveness of teacher participation by comparing preparticipation and postparticipation students' science NCE scores for years 3 years. Independent-samples *t* tests were used to compare students' gender, socioeconomic status (free- and reduced-price meals), and NCE science scores (using 5th grade only) for 2 consecutive years of the study (2005-2006 through 2006-2007). Two analyses were used to determine teachers' participation and the effect on students' NCE science scores among two subgroups: gender and socioeconomic status. For research questions 4 and 5, a mean net gain and NCE raw scores average was performed.

The findings from this study indicated significant differences in years 2004-2005 and 2006-2007 favoring students of teachers who participated in the summer science institutes However, the

results from year 2005-2006 showed no significant differences in students' science NCE scores of teachers who participated or did not participate in summer science institutes. In the consecutive year (2005-2006 through 2006-2007) using 5th grade only comparisons, data analyses showed significant differences in students' science NCE scores when performing NCE raw scores comparisons for gender and socioeconomic status. The comparisons for gender showed male students' science NCE scores were higher than were females' science scores. The NCE raw scores comparisons for socioeconomic status showed those students on the meals program had higher science NCE scores than did those students not on the program. There was no significance in students' science NCE scores when using mean net gain scores comparison for gender and socioeconomic status.

DEDICATION

This work is dedicated to my loving mother, Betty J. Ward. Her love and guidance throughout my life were invaluable, and I know I could never have completed this program without her encouragement and support. She touched so many lives as she shared her kind and gentle heart with others. Her commitment to God and family served as an excellent example to follow. I think of her daily, and I love and miss her more than words could ever express.

I also dedicate this project to my sons, Blake and Drew Ward. I want them to always remember they are the anchors of their father's life, and that I am very proud of the young men they have grown up to be. I admire and immensely respect the determination and courage they display daily.

ACKNOWLEDGMENTS

I would like to thank Dr. Louise MacKay, my committee chairperson, who has been consistently dependable to extend her hand for assistance and to speak kind and motivating words of encouragement. To know and understand Dr. MacKay's approach is for one to know and understand the love that she has for her students and the unique way in which she has to uplift and empower others to succeed. Thank you, Dr. MacKay, for sharing your wisdom and academic experience and for guiding me through the doctorate program and dissertation process.

Thank you Dr. Lampley for serving on my committee as my research specialist and for your patience, understanding, and the assistance you provided me with my dissertation. Your input into my dissertation is sincerely appreciated.

Thank you Dr. Rhoton for your expertise and insight into the area of science education. I admire and appreciate your dedication to science education and the commitment you have shown toward teacher development and effective practices.

Thank you Dr Scott for answering my questions before the qualifying exams and the exceptional notes and comments you provided to me after my preprospectus defense.

Thanks to Jennifer Phillips, Danny McClain, Andy People, and all the other cohort members for your friendship and support throughout the program.

Thank you Dr. Jerri Beth Lyons for your exceptional proof reading abilities and for the encouraging words you provided. Your insight into the doctoral process served me well and I truly appreciate your friendship.

Mr. Dallas Williams, director of Carter County Schools: Thank you for the guidance and leadership that you provide and for the positive influences that you bestow on others. Your ability to look ahead to map a course for direction serves as a steady influence for those who work around you.

Lastly, thanks to Aunt Sue, Carol, Uncle Mike, brother Kale, and Dad for your support and the many things you do for Blake and Drew. I am truly blessed to have good family.

CONTENTS

Page

Chapter Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The East Tennessee State University (ETSU) Summer Science Institute is held annually in the month of June. Science teachers from Northeast Tennessee school systems are selected to participate. It was noted by the Center of Excellence in Math and Science Education (2007):

> This project will actively engage teachers in the process of inquiry-oriented science, as outlined in the Tennessee State Science Standards, and [demonstrate] how to utilize various strategies for delivering the middle and the high school science curriculum, with the instructors facilitating experiences that model what teachers should do with their own students. An emphasis will be placed on student growth and achievement and addressing system and school plans for improving science teaching and learning. (p. 1)

The science institute engages teachers in high quality staff development with an emphasis placed on providing participants with opportunities to enhance inquiry-oriented science skills. It also demonstrates standards-based teaching strategies, imparts technology skills, and provides project participants with science tools and materials to implement project goals. Those who participated in the ETSU Summer Science Institute have benefited in the following ways:

1. teachers earned three graduate credit hours (free tuition worth $1,050);
2. teachers received a stipend of $360;
3. teachers were engaged in content and professional development training provided by university personnel;
4. teachers received $2,000 worth of science supplies to use in their classrooms;
5. teachers received appropriate methodology for implementing inquiry science programs; and
6. teachers received selected science modules (Center of Excellence in Math and Science Education).

The training of science teachers is more important today than ever. The mandates placed on school districts across the country through the passage of the *No Child Left Behind* Act have placed high-stakes accountability on school systems, principals, and teachers (Kelley, 2006). Kelley added, “Coupled with that fact is the knowledge that student performance in America is lagging behind other countries such as China and India in the areas of science and math” (p. A8).

Schools throughout the country are exploring new and innovative ways to train teachers. Science partnership arrangements are providing professional development training for teachers and helping them to become stronger in teaching science in the content areas. Partnerships are also focusing on quality instruction, the use of assessment standards as part of daily practices, and exposing teachers to data interpretation and research methodology. The purpose of the Math and Science Partnership (MSP) program is to bring together efforts of the National Science Foundation and the Department of Education to improve teaching and learning in science, technology, engineering, and mathematics education in grades 5-12 (The White House, 2007). The primary goals of the MSP program included the following:

1. improve the performance of students in math and science by encouraging the development of more rigorous curricula that are aligned with state and local academic standards;
2. encourage institutions of higher education to assume greater responsibility in improving math and science teacher education; and
3. bring math and science teachers together with scientists, mathematicians, and engineers to improve their teaching skills. (p. 1)

There are a number of efforts taking place throughout the country to increase teachers' and students' skills in math and science. The MSP program has supported projects to improve math and science education through partnerships that include, at a minimum, a high-need Local Education Association (LEA) and the mathematics, science, or engineering department of an institution of higher education (U.S. Department of Education, 2007).

The MSP’s goals have been to raise the achievement levels of students and narrow the achievement gaps in the mathematics and science performance of students in diversified populations. The MSP program is intended to increase academic achievement of students in mathematics and science by providing professional development in content knowledge and enhancing the teaching skills of classroom teachers. According to the Michigan Department of Education (2006), "Partnerships between high-need school districts and the science, technology, engineering, and mathematics faculty in institutions of higher education are at the core of these improvement efforts" (p. 1).

The Math and Science Partnership Program (2008) is a grant program offered to states. The program's dollar awards are based on student population and the state's poverty rates. The local school districts' Science Partnership Agreements seek to improve teaching and learning methods in science in grades 5 through 12. The National Science Foundation (2008) and the United States Department of Education have been working cooperatively to improve students' science performance by providing a more challenging curriculum and ensuring that teachers are qualified to teach science and mathematics. According to the Math and Science Partnership Program:

> The MSP program responds to concerns over the performance of the nation's children in mathematics and science. Institutions of higher education--their disciplinary faculties in departments of mathematics, the sciences and engineering, education faculty, and administrators--partners with K-12 districts and others to effect deep, lasting change in K-12 mathematics and science education through five key features: partnership-driven, teacher quality, quantity and diversity, challenging courses and curricula, evidence-based design, and institutional change and sustainability. (p. 8)

The five features are to be accomplished through the use of intense and high quality staff development training of science teachers in higher education summer workshops. According to the AIP Bulletin for Science Policy News (2003), the program is designed to "bring together all relevant stakeholders, including university or college engineering, mathematics or science departments, businesses, and state agencies to address specific local needs. The program provides flexibility in allowing the partnership to recruit, train and mentor new science teachers" (p. 1).

The 2008 Senate Appropriations Bill (H.R. 3043) provides funding for the Department of Education's Mathematics and Science Partnerships. The Bush Administration proposed a MSP budget of 182.1 million, a figure that equaled the 2007 budget. However, the Senate approved a 184.0 million budget for the 2008 MSP program. The Senate felt compelled to increase the MSP funding because of challenges that America's students face in an increasingly competitive global economy. In 2005, 48%of fourth graders who were identified as lower socioeconomic scored below the average competency level and 37% of eighth graders who were identified as lower socioeconomic performed below the average competency level in science (AIP Bulletin for Science Policy News, 2007).

Statement of the Problem

The purpose of this study was to determine the effectiveness of East Tennessee State University's summer science institute training through the effect on mean Normal Curve Equivalent (NCE) science test scores of students in a Northeast Tennessee school system whose teachers participated in the ETSU summer science institute training. The mean NCE science test scores of participating teachers were analyzed to determine if any associations exist between pretraining year scores (2004, 2005, and 2006) and posttraining year scores (2005, 2006, and 2007). This was a study using NCE scores for 3 years of students whose teachers participated in summer science workshop-professional development training. The science NCE scores of students whose teachers participated in summer science institute training were analyzed by comparing the pretraining year scores of 2004, 2005, and 2006 to posttraining data results for years 2005, 2006, and 2007. The pretraining student scores consisted of data and test scores from the year before entering the teacher's class who participated in summer training. The posttraining year scores (2005, 2006, and 2007) consisted of data and test scores from the year the student was actually in the participating teacher's science class. In each of the 3 years of the study, there were two sets of student scores to analyze: pre- and posttraining NCE scores for year 1 (2004-2005), year 2 (2005-2006), and year 3 (2006-2007). Cross comparisons of the two subgroups, gender and socioeconomic status, were examined using NCE scores to determine if there were any differences in NCE scores within the pre- and posttraining subgroups.

Significance of the Study

This study focused on the associations of student test scores of science teachers who have participated in a higher education summer science institute-workshop sponsored by the Math and Science Partnerships Program. Based on the findings from this study, the Northeast Tennessee school system involved could use the summer science institute more effectively for improving pedagogy practices, content knowledge, and classroom experimental design for beginning and experienced science teachers in grades five through eight.

Research Questions and Null Hypotheses

The following research questions and null hypotheses guided the analysis. For research questions 1 through 3 and null hypotheses 1, 2, and 3, data analysis was performed by using paired-samples *t* tests.

1. Is there a difference in students' science NCE scores (preparticipating year 2004 and postparticipating year 2005) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

   Ho1: There is no difference in students' NCE scores (preparticipating year 2004 and postparticipating year 2005) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute.

2. Is there a difference in students' science NCE scores (preparticipating year 2005 and postparticipating year 2006) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

   Ho2: There is no difference in students' science NCE scores (preparticipating year 2005 and postparticipating year 2006) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute.

3. Is there a difference in students' science NCE scores (preparticipating year 2006 and postparticipating year 2007) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

   Ho3: There is no difference in student's science NCE scores (preparticipating year 2006 and postparticipating year 2007) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute.

For research questions 4 and 5 and null hypotheses 4_1, 4_2, 5_1 and 5_2, data analysis was performed by using a *t* test for independent samples.

4. For those students whose teachers attended ETSU summer science institute, is there a difference in mean net gain science NCE scores or a difference in NCE raw scores between males and females?

   Ho4_1: There is no difference in mean net gain science NCE scores between males and females of students whose teachers attended ETSU summer science institute.

   Ho4_2: There is no difference in NCE raw scores between males and females of students whose teachers attended ETSU summer science institute.

5. For those students whose teachers attended ETSU summer science institute, is there a difference in mean net gain science NCE scores or a difference in NCE raw scores of students identified as lower socioeconomic status (as measured by free- and reduced-price meals status) and those students not classified as lower socioeconomic status?

   Ho5_1: There is no difference in mean net gain science NCE scores of students identified as lower socioeconomic (as measured by free- and reduced-price meals status) or those students not classified as lower socioeconomic status for those students whose teachers attended ETSU summer science institute.

   Ho5_2: There is no difference in NCE raw scores of students identified as lower socioeconomic (as measured by free- and reduced-price meals status) or those students not classified as lower socioeconomic status for those students whose teachers attended ETSU summer science institute.

Delimitations

One delimitation to this study was sample size. The sample for this study was taken from nine schools in a rural Tennessee school district and included 23 middle school teachers. The fifth- through eighth-grade middle school teachers' NCE scores were accumulated over a 3-year period: year 1 of study (pretraining 2004, posttraining 2005), year 2 of study (pretraining 2005, posttraining 2006), and year 3 of study (pretraining 2006, posttraining 2007). This study was conducted by using fifth- through eighth- graders' science test scores from one rural Northeast Tennessee school district.

These scores were taken from grades five through eight on the Tennessee Comprehensive Assessment Program (TCAP) test. The TCAP Tests shows what academic achievement gains a student has made in the past school year. According to the Tennessee Department of Education (2008):

> Students in grades three through eight take the TCAP Achievement Test each spring. The Achievement Test is a timed, multiple choice assessment that measures skills in Reading, Language Arts, Mathematics, Science and Social Studies. Student results are reported to parents, teachers, and administrators. (p. 1)

Definitions of Terms

1. *Constructivism*: A learning process in which the learner is building an internal illustration of knowledge, a personal interpretation of experience (Constructivist Theories, 2008, p. 1).
2. *Gender*: The socially constructed roles, behaviors, activities, and attributes that a particular society considers appropriate for men and women (World Health Organization, 2008, p. 1).

3. *Math and Science Partnership (MSP)*: The program is designed to improve the content knowledge of teachers and the performance of students in the areas of mathematics and science by encouraging states, IHEs, LEAs, and elementary and secondary schools to participate (Ed.gov: MSP, 2007a, p. 1).
4. *National Academies of Science (NAS)*: Established in 1863, membership is composed of approximately 2,100 members who give advice on scientific and technology issues to national leaders (National Academies of Science, 2007, p. 1).
5. *Normal Curve Equivalency (NCE)*: Normalized standard scores that have a mean of 50 and are constructed to have a standard deviation of 21.06 (CTB/McGraw-Hill, 2007, p. 1).
6. *National Science Foundation (NSF)*: An independent federal agency created by congress in 1950 to promote the progress of science; to advance the national health, prosperity, and welfare; to secure national defense (National Science Foundation, 2008, p. 1).
7. *No Child Left Behind* Act: Reauthorized the Elementary and Secondary Education Act (ESEA). The main federal law affecting education from kindergarten through high school. This educational legislation that was signed into law by President Bush in 2002 (ED.gov: NCLB, 2007b, p.1).
8. *Pedagogy*: Teaching skills teachers use to impact the specialized knowledge content of subject area (McKenzie, 2003, p. 1).
9. *Pedagogy Content Knowledge* (PCK): The teachers have a special understanding and ability to integrate the knowledge of science content, curriculum, learning, and teaching (Cochran, 1997).
10. *Free- and reduced-price meals:* Federal assisted meal program operating in public and nonprofit private schools. It provides nutritionally balanced low-cost or free meals to children each school day (U.S. Department of Agriculture, n. d., p. 1).

11. *Scale scores*: A conversion of a student's raw score on a test or a version of the test to a common scale that allows for a numerical comparison between students (Pearson Educational Measurement Group, 2008, p. 1).
12. *Tennessee Comprehensive Assessment Program (TCAP):* Tennessee's student assessment program that measures students' academic knowledge and application skills in various subject areas for grades kindergarten through eight (Tennessee Department of Education, 2008).

Target Group

The target group for this study included teachers who had participated in a higher education summer science workshop in years 2004, 2005, or 2006. There were 23 teachers from nine schools located in a rural Northeast Tennessee school district. The NCE scores in science for 1,198 students were analyzed in this study. The study consisted of pretraining and posttraining data using the same group of students. The 1,198 students whose scores were selected for this study were in the participating teachers' classes the year after his or her summer training. For example, a sixth-grade teacher who participated in the 2004 summer science workshop, had NCE scores from the next school year (2005) serving as posttraining data. The pretraining data consisted of students' NCE scores from the year prior to summer training or in this case, the 2004 fifth-graders' NCE scores consisted of the same group of students in the 2004 participating teacher's class. A student must have had 2 consecutive years of TCAP NCE test scores (pre- and posttraining data) in order for his or her data to be used in this study. The students whose scores were selected to be analyzed in this study consisted of those in the participating teachers' classes the year after the teacher participated in higher education summer science training. This was a 3-year study with a timeline as follows: year 1: 2004 and 2005, year 2: 2005 and 2006, and year 3: 2006 and 2007. The grade levels targeted for this study were fifth-, sixth-, seventh-, and eighth-grade science classes

Table 1 illustrates the teachers' grade levels alignment for pre- and posttraining analysis.

Table 1

Grade Levels Alignment for Pre- and Posttraining Analysis

Pretraining NCE Scores	Posttraining NCE Scores
Grade 4	Grade 5
Grade 5	Grade 6
Grade 6	Grade 7
Grade 7	Grade 8

Overview of the Study

Chapter 1 contained an introduction to the study, a statement of the problem, the significance of the study, research questions and null hypotheses, delimitations, definitions of terms, and a description of the target group. Chapter 2 provides a review of literature focusing on the history of science education, fundamental tenets of science, and the role of gender, genetic, and socioeconomic factors on students' science achievement scores. Chapter 3 includes the methods and procedures used in the study along with a description of data analysis. Chapter 4 presents the findings and analysis of data and Chapter 5 concludes the study with a summary of findings, conclusions, and recommendations for further research and practice.

CHAPTER 2

LITERATURE REVIEW

Recent History of Science Education

Science education has fundamentally changed from 1955 up to the present because of advancement of new technologies. Between 1955 and 1970, the emphasis went from "new math" and "alphabet" science to "standards-based" math and science for all of the current-day reforms. During the late 1950s, there was much controversy over the advancement of the Russian space program and with the evolution of the Sputnik space project.

On Friday, October 14, 1957, the Soviets launched an artificial satellite that made its first orbit around the world. While President Eisenhower congratulated the Soviets and tried to downplay the importance of the accomplishment, he misjudged the public's reaction to the event. "Rather than celebrating this momentous scientific feat, Americans reacted with a great deal of fear" (Dwight D. Eisenhower Presidential Library, n. d., p. 1). The Soviets' space accomplishment was a cause of great concern for American citizens and served as a catalyst for the Eisenhower Administration to call for a renewed focus on space exploration. Eisenhower responded by creating the National Aeronautics and Space Agency (NASA). During the summer of 1958, Congress passed the *National Aeronautics and Space Act* and it was signed into law on July 29, 1958. Public opinion was in favor of an aggressive space policy; this gave President Eisenhower the mandate needed to create a focus on technology and scientific advancement (Launius, 2007). The launch of Sputnik focused President Eisenhower's and Congress members' immediate attention on the need for improvements in mathematics and science education.

It was between the years of 1970 and 1980 that the computer began to find its way into computer science education. The term constructivism was commonly used during the 70s and 80s, and an analysis of correct constructivism in computer science education led to two claims: students did not have an effective model of a computer and computers form an accessible ontological reality. The 1970s was known for the advancements made by the American Society for Information Science and Technology (2008). During this period, traditional libraries began a transformation process by installing computers and databases for information retrieval. According to the American Society for Information Science and Technology:

> The move from batch processing to online modes, from mainframe to mini and micro computers accelerated in the 1970s. Traditional boundaries among disciplines began to fade and library schools added "information" in their titles. American Society for Information Science and Technology (ASIS&T) stopped administering the ERIC Clearinghouse on Library and Information Services, made the Mid-Year Meeting an annual event focusing on a single topic of current interest, sponsored a bicentennial conference (1976) on the role of information in the country's development, was an active participant in the planning and implementation of the White House Conference on Library and Information Services, and the *Bulletin of the American Society for Information Science* appeared and became a mainstay membership publication of the Society. (p. 2)

During the 1980s, math and science gained a renewed focus. Most of U.S. mathematics and science educators either read or said they believed the forceful commentators' reactions to the 1983 influential publication, *A Nation at Risk* (1993), an inspiring change-agent document. As a surprise to many, it was later discovered after reading Berliner and Biddle's (1995) American Education Research Association's award winning book, *The Manufactured Crisis*, that the national report was full of opinions and misleading assumptions. During the 1980s and 1990s, many authors characterized the "failures" of school mathematics and science programs without providing readers with reasonable arguments linked to evidence.

During the 1990s, a strong infusion of multiculturalism was seen throughout the public schools. Multiculturalism in education has involved the inclusion of all students and cultures. Schools must assume the responsibility of recognizing the value of diversity and respond to the needs of the disadvantaged student population. The *No Child Left Behind* Act legislation of 2002 has addressed this issue by requiring school systems to examine data performance of subgroup populations (Luna, Borjian, & Conrad, 2005). High stakes accountability standards have been put in place as a guide for school systems across the country to follow. The *No Child Left Behind* legislation has forced school systems to become more diverse and more closely examine the needs of disadvantage students. This has had a strong impact on science education. One of the most significant political actions took place under the governance of President George W. Bush and his (NCLB) legislation. It was in 2002 that President Bush signed this NCLB legislation into law, which can be traced back to 1965 during which the requirements of the *Elementary and Secondary Act* changed under President Johnson (Luna et al.). Federal funds under NCLB are mostly distributed to school districts whose populations come from lower income families and represent culturally diverse populations (African Americans, Native Americans, Asians, and Latinos). Those who support the NCLB have viewed its mission as narrowing the achievement gap and holding school districts and states accountable (Luna et al.). President Bush's initiative has had bipartisan support among congressional members and was designed to create additional funds, higher standards, and constant high-stakes testing (Kulm, Capraro, & Capraro, 2007).

Fundamental and Essential Tenets of Science

There are several fundamental components that students need to grasp and understand when learning the objectives of science. Beliefs, imagination, reasoning, cause and effect relationships, self-examination, and skepticism are some of the fundamental and essential tenets for students to understand when studying science.

In an article titled, "Between Science and Religion," the author explained the views of various scientists who met in a public forum to discuss the topic of science and religion. Herlinger (2006) stated:

> Science and religion are inner-connected and should not be separated. All of human experiences and knowledge are one. But if there was general agreement about the connection between science and faith, panel members suggested there are ways the two can and perhaps should stand apart. (p. 1)

When it comes to the nature of science, imagination has not been used nor emphasized enough. In fact, from a renowned publication, *Daedalus*, an article was found titled, "Fear and Loathing of the Imagination in Science" (Daston, 2005). Daston concluded that imagination has no place in science as we know it today. In contrast, Chandra (2003) wrote, "The imagination has been a source of interest in science, the intersection of art and science is a fertile place, a ground where fact and imagination meet in surprising ways" (p. 4). Neu, Baum, and Cooper (2004) documented how one student's creativity was instrumental in winning a science award. The noteworthy point to make is that the student had not previously demonstrated an interest or aptitude in science. He was able to find success in science by making a connection between the Civil War and science. In another study conducted by Root-Bernstein and Root-Bernstein (2001) the researchers concluded, "In order to inspire the scientific mind, the imagination must be engaged" (p. 35).

According to Trends in International Mathematics and Science Study (TIMMS) (2007), "A major purpose of science education is to prepare students to engage in scientific reasoning to solve problems, develop explanations, draw conclusions, make decisions, and to extend their knowledge to new situations" (p. 72). Scientific reasoning entails the principles involved in governing experimental design, hypothesis testing, and the interpretation of data. Scientific Reasoning (2008) pointed out:

> Even if we are not scientists, we should be able to make use of good reasoning to explain, predict and control the events around us. This is particularly true in the new "knowledge economy" that is increasingly being driven by technology and information. (n. p.)

Many colleges and universities have been establishing their own standards or definitions of scientific reasoning. The University of Virginia has expected graduates from its College of Arts and Sciences, School of Architecture, School of Commerce, and School of Education to have a basic understanding and knowledge of skills that enhance scientific reasoning in an effort to effectively and productively produce self-efficiency within individuals. The graduates are expected to use scientific reasoning to form patterns of consistency and logical thought processes that are used during the process of scientific inquiry. According to a report conducted by Institutional Assessment and Studies (2004), "Individuals should be able to propose relationships between observed phenomena in order to accomplish the following:

1. design experiments which test hypotheses concerning the proposed relationships;
2. determine possible alternatives and outcomes;

3. consider probabilities of occurrences;
4. predict logical consequences;
5. weight evidence, or proof; and
6. use a number of instances to justify a particular conclusion. (p. 2)

“Cause-and-effect” may be viewed as a fundamental tenet of science, but as discovered long ago, reasoning and cause-and-effect represent a tenet that has been essential to science. Cause-and-effect has continually been incorporated with ongoing studies that are within the scientific sphere. Several principles, concepts, and tools have been found to be extremely useful in applications involving causal relationships. These principles, which are based on structural-model semantics, have been the fundamental building blocks in which functional relationships represent dependent physical processes (Pearl, 2002). According to Pearl:

> A new light has been cast on the riddles of causation, colored with an engineering flavor: How should a robot acquire causal information from the environment? Another question raised regarding cause-and-effect was, “How should a robot process causal information received from its creator-programmer? (p. 95).

Schaefer (2002), a professor of political science who studied the topic of self-examination and skepticism, weighed in on the topic citing Montaigne, Tocqueville, and the politics of skepticism. Schaefer proposed an examination of the relationship between healthy liberal skepticism and the dogmatic relativism, or closed-mindedness, that has threatened to replace it. According to Schaefer, Montaigne and Tocqueville suggested that it might be harder than we might expect "to separate the healthy form of popular skepticism from its more dogmatic and radical offspring" (p. 204).

Best Practices for Effective Schools

The passage of the *No Child Left Behind Act* and the ensuing adequate yearly progress mandates have forced schools and school districts across the country to place a greater emphasis on what actually transpires within the classrooms. Tableman (2004) recently compared and listed some of the elements of instructional methods that were commonly found in effective schools. According to Tableman, the following best practices were commonalities in effective schools:

1. the communication and collaboration among teachers allowed for the various groups to be able to work together within and across grade levels to align instruction to state standards and assessment and to create program consistency;
2. collaboration on instruction among classroom teachers and specialists was evident;
3. peer-coaching practices had been put into place to help the development of young teachers;
4. teachers and staff worked together to help all students succeed and become successful;
5. emphasis was placed on both basic skills and higher order comprehension skills;
6. a systematic curriculum was based on assessment to monitor students' progress;
7. instructional density with literacy instruction was integrated with the rest of the curriculum and included reading as part of science instruction;
8. ability-based group assignments included changes that were made as assessment scores showed improvement;
9. implemented coaching and scaffolding by probing students who gave the wrong answers;
10. used structuring comments;
11. employed multiple levels of questions; and
12. applied coaching for students in the use of a range of word recognition and strategies. (p. 3)

National Science Foundation and Math Science Partnerships

The Math and Science Partnership (MSP) program is a major research and development effort that has supported innovative partnerships to improve kindergarten through 12th graders' achievement in math and science. MSP projects have been expected to raise the achievement levels of all students and reduce achievement gaps in the math and science performance of diverse student populations. Each MSP proposal must identify with key features such as: (a) partnership-driven and participant involved; (b) teacher quality, (c) quality and diversity that involves drawing on expertise of scientists, mathematicians, and engineers in partner organizations; (d) challenging courses and curricula that develops an awareness of innovative approaches that enhances learning opportunities and raises student achievement; (e) evidence-based design and outcomes that conform with most current research and disaggregate data by race, ethnicity, socioeconomic status, gender, and disability; and (f) institutional change and sustainability that creates and sustains an environment that improves math and science teaching and learning (National Science Foundation, 2006).

The National Science Foundation (2006) has supported six types of awards through its Math and Science Partnership Program:

1. targeted partnerships will focus on math and science achievement at specific grade levels;
2. institute partnerships – Teacher Institute for the 21st Century are designed to meet needs for teachers who have deep knowledge of disciplinary content and are school or district based intellectual leaders in math and science;
3. MSP-start partnership are for new awardees to MSP program, especially from the minority serving institutions, community colleges, and primarily undergraduate institutions to support the necessary data analysis, project design, evaluation, and team building activities needed to develop a full MSP targeted institute partnership;
4. Phase II partnerships are for prior participating MSP Partnerships that focus on specific innovative areas of their work where evidence of significant positive impact is clearly documented and where additional investment of time and resources would produce even better results;
5. research, evaluation, and technical assistance projects directly support the work of the partnerships by developing tools to assess teachers' growth in the knowledge of

mathematics or the sciences needed for teaching and conducting longitudinal studies of teachers and their students who participate in the MSP projects; and

6. innovation through institutional integration projects enables institutions to think and act strategically about the creative integration of NSF funded awards, with particular emphasis on awards managed through programs in the directorate for education and human resources, but is not limited to those awards. (p. 3)

The National Science Foundation developed policies to engage school districts in a range of activities to support reform. Banilower (2006) listed the following policies from the reform process:

1. building a comprehensive, shared vision of science education;
2. conducting a detailed self study to access the systems needs and strengths;
3. promoting active partnerships and commitments among an array of stake-holders;
4. designing a strategic plan that includes mechanisms for engaging teachers in high quality professional development;
5. developing clearly defined and measurable outcomes for teaching; and
6. creating an evaluation plan that provides formative and summative feedback. (p. 1)

Students' understanding of the nature of science, teachers' conceptions, and classroom variables have been the focus of research studies. Lederman (1992) suggested that both students and teachers must have an understanding of the scientific enterprise. He explained, "There is no singularly preferred or informed nature of science and the nature of science is as tentative, as specific as knowledge itself" (p. 342).

In an article written by Vergano (2006), he discussed the concern that America was about to be dethroned as the world's leader in science and technology. President George W. Bush called for an additional $136 billion in science education and research. Such concerns for science competitiveness had not been seen since 1957 when the Russians started the space race with a basketball size satellite known as Sputnik. Vergano discussed his concerns with gaps in education (a) U.S. 12th graders tested below the international average for 21 countries in mathematics and science; (b) many students have been taught by teachers lacking a background in science or math; (c) foreign scientist are staying at home; and (d) foreign science students have been denied entrance to colleges and universities because of national security concerns. The United States currently leads the world in spending on research and development that has been estimated to reach $328 billion this year (Vergano).

National Academies of Science

In addition to the National Science Foundation, a hallmark historical program was developed in 1863 during the height of the civil war. The *National Academies of Science* (NAS) was signed into law by President Abraham Lincoln on March 3, 1863. Since 1863, the nation's leaders have often turned to the National Academies for advice on the scientific and technology issues that frequently pervade policy decisions (National Academies of Science, 2007). The academy membership has been composed of approximately 2,100 members and 380 associates; of these, "200 have won Nobel Prizes" (p. 1).

The NAS has examined the problem of man-power shortages in the science and mathematics fields. The NAS determined that school districts must work cooperatively with universities through the use of partnership agreements. They also recommend that kindergarten-through 12th-grade curriculum materials be modeled on world-class standards and a national panel that would collect, evaluate, and develop rigorous kindergarten- through 12th-grade materials. It was also suggested that the materials be made available free of charge as a voluntary national curriculum (National Academies of Science, 2007).

International Mathematics and Science Studies

Trends in International Mathematics and Science Study (TIMSS, 2007) has been organized under the auspices of the IEA and is directed in the United States by the NCES with additional support from the National Science Foundation. TIMSS assess students every 4 years “to provide participating nations with regular information on their understanding of mathematics and science topics taught through school curricula” (ED.gov: News, 2004, p. 2).

An analysis of the curricula used in countries who participated in TIMSS (2007) revealed that the areas of study that were emphasized and the amount of time spent on these areas varied from country to country. According to Bracey (1997):

> The U.S. curricula analyzed in this mathematics and science study has been characterized as “a mile wide and an inch deep”. This is not unlike what the author wrote about in one April 1993 column, in which he characterized U.S. curricula as “overstuffed and under nourished. (p. 411)

It has been of great concern that science studies at both the domestic and international levels indicated that America’s eighth graders were not international leaders. It was stated in an article titled “Falling Behind” (2000), “In science, students in Britain, Canada, Hungary, and Slovenia scored better than their peers did on the TIMSS in 1999. Overall, American students have lower scores than students in Hungary, Finland, and Russia” (p. 4).

A 2003 press release titled “*U.S. Students Show Improvement in International Mathematics and Science Assessment*” (Ed.gov: News, 2004) discussed how fourth graders and eighth graders in America outperformed many of their peers from other countries. Results from TIMSS in 2003 showed that eighth graders performed better than in previous years (1995 and 1999), and showed gains across student groups that included boys, girls, and minority students. However scores for America’s fourth-grade students remained the same in math and science (TIMSS, 2007).

Some key findings from TIMSS (2007) was evidence that science achievement has been improving and much of the credit should be given to colleges and universities across the nation for the working relationship that they have developed with local education associations. For example, according to ED gov: News (2004):

1. science scores in 2003 were lower in the fourth grade when comparing 1995 science scores to 14 other countries that participated in the studies;

2. fourth-grade girls and boys showed no measured change in science achievement between 1995 and 2003. However, the boys showed a decline in science performance over the same period;
3. between the years 1995 and 2003, African American fourth graders and eighth graders and Hispanic American eighth graders improved remarkably in both math and science;
4. Hispanic fourth graders showed no change in science performance and as a result the achievement gap between White and Black students in fourth and eighth grade in the U.S. narrowed between the years 1995 and 2003 in both science and math. (n. p.)

The National Assessment of Educational Progress (NAEP), also known as “The Nation’s Report Card,” has been a national participant that conducts continuous assessment of what America’s students can do in various subject areas. The Nation’s Report Card reported that the average science scores in 2005 were higher in grade four, going from an average scale score of 147 in 1996, unchanged in 2000, and increased to 151 in 2005 (NAEP, 2005c). At grade eight, the average science score in 2005 showed no difference, with a scale score of 149 for each of the three reporting years: 1996, 2000, and 2005 (NAEP, 2005d). At the 12th-grade level, the average science score was lower. In 1996, the 12th-grade average scale score was 150 compared to a score of 146 in year 2000 (NAEP, 2005a). The 2005 science scale score result was 147, once again, lower than the 1996 science scale score of 150 (NAEP, 2005b).

The Program for International Student Assessment (PISA, 2006) survey measured the knowledge and skills of 15-year-olds and has been a collaboration of countries and economies through the Organization for Economic Cooperation and Development (OECD). The 2006 PISA study included more than 400,000 students from 57 countries.

The findings from the PISA (2006) science report were as follows:

1. Finland was the highest performing country on the 2006 PISA report;
2. Canada, Japan, and New Zealand were next highest;
3. 1.3% of 15-year-olds reached level 6 – the highest performance level;

4. 3.9% of the population of New Zealand and Finland students scored at level 6;
5. Korea was among the highest performing countries on the 2006 PISA science scale;
6. the United States performed below the OECD average;
7. the United States and Korea had similar percentages of students at level 6 – highest performance level; and
8. One in five students in Finland and over one in six students in New Zealand reached at least level 5. (p. 3)

Based on the results of international studies, American students have made progress in science achievement over the past few years. However, it is also evident and important to note, American students' achievement scores in math and science remained lower than those of most industrialized countries (Kulm et al., 2007).

Pedagogy

The ETSU Summer Science Institute has placed a heavy emphasis on the use of hands-on materials to facilitate learning. Gulati (2004) stated that pedagogies based on constructivism suggest that learning is accomplished best by providing real-life contexts in a setting of flexibility, allowing for freedom to choose learning resources and an openness in discussing issues.

As stated in McKenzie (2003), the National Board for Professional Teaching Standards defined pedagogy as, "Teaching skills teachers use to impact the specialized knowledge/content of their subject area. Effective teachers display a wide range of skills and abilities that lead to creating a learning environment where students feel comfortable that they can succeed academically" (p. 1).

The process of pedagogical preparedness has proven to be successful in helping to increase student achievement. The combination of good quality professional development in the areas of best practices and pedagogical preparedness has helped many school districts throughout the country raise student test scores of participating teachers. Rhoton (2001) stated:

> The importance of teachers being well grounded in both science content and pedagogical skills cannot be overemphasized; teachers who demonstrate content and pedagogy knowledge are better prepared to create effective learning environments that allow students to engage in the excitement of science and move to an inquiry-based science classroom. (p. 16)

According to Shulman (1986), "Education professionals have become more knowledgeable about research-based programs to inform, support, and improve their teaching practices. Knowledgeable and skilled teachers process and use comprehensive professional knowledge in their efforts to help students understand complex idea" (p. 8). This type of knowledge has been called Pedagogical Content Knowledge (PCK). According to Cochran (1997), PCK includes the teacher having a special understanding and ability to integrate the knowledge of science content, curriculum, learning, and teaching. Teachers often use this type of knowledge to make effective decisions while developing learning objectives, teaching strategies, assessment tasks, and curriculum materials. Cochran pointed out:

> Pedagogical Content Knowledge is a type of knowledge that is unique to teachers, and is based on the manner in which the teacher relates his or her pedagogical knowledge (what is known about teaching) to the subject matter knowledge (what is known about what is taught) (p. 1).

The meaning of PCK has been summarized by Johnson (1990) as "knowing one's subject, knowing one's audience, and [knowing] how to introduce one to the other including the important third dimension of organizing the materials for the audience and productively involving the audience with the subject matter" (p. 2).

Developing a professional culture and improving the practice of teaching is important to all teachers. According to Clough (1992), "Teachers are urged to cultivate an awareness of current educational research recognizing that it provides a scientific pedagogical research-based rationale that can help teachers bypass typical mistakes and thoughtfully utilize well-supported concepts to improve their teaching" (p. 37). Most participating programs and projects have focused their efforts on trying to blend content, pedagogy, and instructional materials together in order to form a more effective program for teachers to use. This has been made possible by using the modules or kits as the incentive for conveying content and pedagogical knowledge. Most participating projects have implemented instructional materials and pedagogy as opposed to the introduction of science content.

According to Ruby (2006), The Center for Social Organization of Schools has developed a teacher supported model that focuses on talent development. The talent development model is aimed at creating a teacher support system for poorly prepared teachers that will decrease high teacher turnover. The goal of the program has been to provide science teachers with quality standards-based academic science instructional strategies while improving their knowledge of subject matter and instructional pedagogy. The talent development model is based on findings that urban science teachers needed a detailed curriculum and required materials in order to be effective. During the first year, the workshops focused on the materials and lessons that teachers would use, the content knowledge that the teachers would need to know to teach the lesson, and the pedagogical techniques they would use while teaching them. The talent development program with its structured approach helped free up time and allowed for "inexperienced teachers to use this time to focus on learning classroom management and pedagogy" (Ruby, p. 1009).

Science Standards

According to the National Science Education Standards (2007) their standards have been designed to guide the nation toward a scientifically literate society. In addition:

> Science education standards are criteria to judge quality: the quality of what students know and are able to do, the quality of the science programs that provide opportunity for students to learn science, the quality of science teaching, the quality of the system that supports science teachers and programs, and the quality of assessment practices and policies. (p. 1)

The National Science Education Standards have been instrumental in terms of integrating programs and providing innovative instructional materials in middle school science rooms.

According to Gilbert (1997), the Certificate and Accreditation in Science Education Project (CASE) has helped teachers to understand two important processes involving written and hands-on assignments. Through the efforts of the CASE Project, teachers have been more effective in using best practices in science education. The CASE Project has pursued an undertaking to develop educational standards for science teachers. Gilbert listed the standards for science teachers as follows:

1. consistent with the national science education standards and other standards projects;
2. applicable to multiple levels of preparation;
3. based on research and best practice;
4. performance based; and
5. flexible enough to allow for program variation and experimentation. (p. 6)

Professional Development and Integrated Programs

For the most part, innovative instructional materials in middle school science especially integrated programs such as innovative practices, approaches, and methods have been beneficial to students in both science and mathematics. The use of instructional materials in the classroom has enabled the teacher to use a constructivist approach in his or her daily teaching practices. For example, in terms of integrated programs in kindergarten- through eighth-grade schools, there has been a relationship between professional development, teachers' instructional practices, and achievement of students in science and math. According to Rhoton (2001), "Teachers are the crucial link between curriculum and students; therefore, professional development is an essential element in developing teacher leadership skills" (p. 17).

According to Lawrenz's 2003 study conducted for the purpose of examining the relationship between different types of professional development, it was found that students' performance and teachers' instructional practice improved after teachers received quality professional development. Data regarding teachers' instructional practices and the amount of professional development were collected using teacher surveys. Ninety-four middle-school science teachers and 104 middle-school mathematics teachers participated in the study.

From an examination of the literature, it seems that professional development has been the key to quality teacher instruction by yielding positive results in student achievement scores.

Wheeler (2006) concluded, educators most often use the science content portion of the NSES, but are largely unfamiliar with other areas within the framework of NSES. Many educators are not exposed to the experience of NSES standards for professional development. From the literature, professional development seems to be responsible for the gains and successes among many middle-school science students.

According to Garet, Porter, Desimone, Birman, and Yoon (2001), “The success of any science partnership depends on the quality of interventions and the ability of the project coordinator to engage the participants in meaningful staff development” (p. 934). Garet et al. named a number of dimensions that needed to be included in staff development practices. For example, the providers must be well prepared and teachers must have supportive learning environments. Teachers must also have opportunities to build upon content knowledge and pedagogy practices. Finally, teachers need high quality instructional materials and the necessary support and follow-up training throughout implementation (Garet et al.). Science Partnership evaluators often have been asked to rate the general quality of the projects’ professional development programs. Regression analyses using modeling, with time points fixed to the projects, were often used to evaluate the effectiveness of the projects professional development (Garet et al.).

There has been a direct relationship between teacher participation in science professional development and teachers who frequently used investigative classroom practices. According to the Technical Education Research Center (2007), “Quality curricula alone will not ensure that a school’s or district’s students reach educational goals. Teacher professional development and educator support have a powerful impact on instruction, school culture, and student outcomes” (p. 1).

Teachers’ preparedness often has been a reflection of the success of their professional development experience. However, a high proportion of teachers reporting this sense of preparedness might also indicate that it was a false sense of preparedness. The following weaknesses in teacher instruction have been identified: (a) limited student engagement, (b) ineffective use of the instructional materials, (c) inefficient use of higher-level questioning techniques, and (d) lack of dialogue in regard to the meaning behind activities or how these activities fit into the unit (Pasley, 2002).

Although professional development sessions have tended to focus on a variety of training experiences, one of the most important objectives has been to prepare teachers to use the instructional materials they are given for attending the training. The large number of sessions being taught to train teachers on specific materials use is not uncommon; given the fact that implementation of materials has been a major focus of most science partnerships.

Innovative Instructional Materials in Kindergarten- Through Eighth-Grade Science

Both the National Science Education Standards (2007) and the Benchmarks for Science Literacy echoed the science education community's support for the notion of engaging all students in active, meaningful learning. Such learning often has been associated with hands-on instructional strategies and a student-centered classroom environment. However, many science teachers have failed to employ such research-supported best practices and instead relied on teacher-centered methods. The idea of changing teacher and student roles and offering learning environments by moving instruction away from teacher-centered approaches to more hands-on student-centered activities has served as one of the driving forces behind the use of science kits in formal education (Clark, Dawkins, & Horne, 2006).

Science kits have been particularly useful when teaching science in kindergarten- through eighth-grade schools. Although there has been considerable influence on inquiry-based active learning and standards documents, curriculum documents, and textbooks, there still exists a great deal of debate regarding the effectiveness of specific curricula and instructional approaches, including kit-based instruction (Clark et al., 2006).

Over the past 30 years, many have questioned the effectiveness of kits in promoting and facilitating the type of active learning claimed by reform-based kits. Criticisms have included inappropriate implementation of kits in such ways that instruction is rendered ineffective. However, Clark et al. (2006) argued:

> The merits of using science kits on the grounds that they may generate greater active participation among students empower and engage populations who otherwise feel left out and ignored, promote a positive classroom environment, increase teacher content knowledge, increase teacher confidence to teach science and provide enjoyment for teachers who use them. (p. 43)

According to the University of California: Lawrence Hall of Science (2003), the Full Option Science System (FOSS) is a research-based science program for grades kindergarten through eight developed at Lincoln High School with support from the National Science Foundation. FOSSweb is designed to provide enrichment for students and support for teachers, administrators, and families who are actively involved in implementing the FOSS program materials. FOSS has shared additional sites that might be of further interest to educators seeking information about the FOSS program goals, features of the program, and standard correlations. Specific information found on the FOSS site included: (a) strategies and materials for full engagement of students with disabilities, (b) current research projects related to FOSS in classrooms, and (c) information about science and literacy (University of California: Lawrence Hall of Science).

The Project Wild (2007) approach to science has taken place in the context of a "hands-on" approach. Project Wild has involved young people and wildlife and is a supplementary educational program emphasizing awareness, appreciation, and understanding of wildlife and natural resources. Project Wild might spark a new interest in students and provide new and exciting ways to approach traditional subjects. The Project Wild program could be used as a supplement for a science curriculum to make learning science fun for students. Project Wild has taught young people how to think about wildlife, not what to think. Students in kindergarten through 12th grade learn basic concepts about wild animals, their needs, and the importance of their relationship to people and the environment. The hands-on activities has engaged students in responsible human actions and helped to produce effective decision making skills. Project Wild uses a balanced curriculum that provides materials and professional training workshops. The goal of Project Wild has been to develop awareness, knowledge, skills, and commitment to wildlife and natural resources. The program has taught students to make informed decisions, carry out responsible behavior, and develop constructive action concerning wildlife and the environment (Project Wild).

Powell and Wells (2001) used classroom exams and written reflections to assess the effects of the activities. Powell and Wells' model revealed no significant differences among the three lessons in meeting state standards. However, the lessons showed significant success on student knowledge gain. Therefore, Project Wild (2007) has appeared to be an effective program.

Innovative Instructional Materials in High School Science

Biology Sciences Curriculum Study has reflected a hands-on approach. BSCS biology has been described as a human-approach program by BSCS (BSCS: Curriculum Development, 2006). BSCS biology is a standards-based, introductory biology program appropriate for students of all ability levels. Developed with a grant from the National Science Foundation, the program has involved students in conceptual biology by using a human perspective, organizing content around six unifying themes, and teaching through inquiry and hands-on activities.

This thematic approach has encouraged depth of coverage rather than breadth, and with it a strong emphasis was placed on individuals. The text has presented biology in a context that is meant to be relevant to a students' lifelong learning. According to BSCS: Projects and Partnership (2007), in one controlled study, "Assessing biological knowledge with an independent, objective exam, students using "a human approach" out performed those using a traditional curriculum" (n. p.). Other reports regarding BSCS biology have been both positive and relevant. The 10th and latest edition, "*BSCS Biology: An Ecological Approach* was designed for first year high school biology students. BSCS's *Green Version* textbook integrated the major concepts of biology into an ecological framework. "Embedded into the curriculum are fundamental concepts such as science as inquiry, the history of science, the impact of science on society, and the diversity of life" (BSCS: Curriculum Development, 2006, p. 1).

These hands-on approaches have reflected new insights in teaching biology. It appears that insights in biology go hand in hand with the ongoing and advanced understanding that educators have been making in this area. Some of these insights in biology have been teacher oriented. It is very important for a teacher to provide enough structure to calm students who are unaccustomed to self-motivated learning. According to Heady (1997), the instructor should teach their students how to think critically and provide them with opportunities to identify with their educational progress. Evaluation processes should be clearly communicated to the students, while at the same time making them aware of their expectations.

To understand how materials are used and selected, Bryan (2006) explained that preservice elementary students in a conceptual physics course were given resources that enhanced classroom inquiry activities. The performance of these students showed a significant increase on assessment items related to the inquiry of physics activities. The results were significantly higher than were assessment items linked to traditional activities (Bryan). The standards have called for a pedagogical shift from a teacher-centered to a student-centered instructional paradigm that can engage students in a socially active scientific inquiry and facilitate lifelong learning. No longer are students to be passive recipients of teacher and textbook knowledge; instead, they are to take an active role in their own learning. Bryan pointed out that this trend has been repeated throughout the programs of math, science, biology, chemistry, and conceptual physics. The use of this method has been endorsed by the AAAS through its benchmarks for Scientific Literacy and Science for All Americans.

In today's community, chemistry, like many other science related endeavors, has assumed a direction of its own. According to Schank and Kozma (2002), many students have received high school chemistry courses that contained profound misunderstandings about the nature of matter, chemical process, and chemical systems. One innovative project called the Chem-Sense Project, (produced by SRI International, Center for Technology in Learning), addressed this problem through a multidisciplinary program of research and development to examine the impact of representational tools, chemical investigations, and the discourse of learning and teaching chemistry in high schools and colleges (Schank & Kozma). This work has intersected several theoretical approaches to learning including collaborative project-based investigations, representational competence, knowledge building, and the design of chemistry curriculum. Schank and Kozma explained that the ChemSense Knowledge Building Environment allows teachers and students to cooperatively investigate chemical phenomena, collect data, build representations and conclusions, and participate in scaffolding exercises to explain the underlying chemical mechanisms.

Role of Gender and Genetics in Students' Science Achievement Scores

Gender disparity in science education has been a topic for researchers to study for many years. Over the past 20 years, a large body of literature has developed to address gender disparity in science and science education. Researchers have conducted extensive studies to determine if a biological effect exists that causes males to outperform females in the area of science. Biological and genetic differences among males and females in science achievement have been a debated topic for decades.

The journal article titled, *"Gender Disparity in Science Education: The Cause, Consequence, and Solutions*," by Tindall and Hamil (2004), relied upon several primary and secondary sources from past researchers to conduct their study. Many of the references listed dated back to the early 1980s. The review of the subject matter (gender disparity) was organized into subgroups and presented so that readers could develop a thorough comprehension of the subject matter. The subgroups in this article clearly identified the effects and impact that certain environmental factors have had on the science gender gap. The environmental factors that Tindall and Hamil listed as being contributing causes to science disparity among male and females were (a) early childhood science related interest; (b) gender stereotypes; (c) family expectations; (d) testing procedures; and (e) gender-biased materials in schools. The documentation and references used in Tindall's and Hamil's work supported many of the reasons as to why gender disparity exists today.

According to researchers Tindall and Hamil (2004), there does exist differences (or what are often referred to as 'spatial differences') not only in science, but in academic learning settings. A shortage of female science professionals remains profound, especially in the physical sciences. Improving women's undergraduate learning and achievement in science is important to increasing their science participation and creating choices.

Rozman and Potter (2004) indicated that women's interest, continued course enrollment, and achievement in science have been significantly greater in high inquiry classrooms compared to low or non-inquiry classrooms. Science educators should seek a better understanding of the variables of learning and motivation within such high inquiry classrooms in order to provide learning experiences that promote all students' participation in science (Rozman & Potter).

According to research conducted by the National Assessment of Educational Progress, a narrow achievement gap between males' and females' does exist in both math and science (NAEP, 2005). According to Widhalm (2005), "Computer science classes often are taught in an individually competitive environment relying heavily on theory as opposed to hands-on and in groups, which girls prefer" (p. A6).

In a book titled *"Unlocking the Clubhouse: Women in Computing,"* Margolis and Fisher (2003) described the many challenges that women face when looking to enter the field of computer science. The male dominated and stereotypical background coupled with the cognitive developmental differences in boys and girls during preschool and elementary school years have been identified as major factors that could discourage women from entering the field of computer science. Through a deliberate and focused effort, teachers can help recruit girls into computer science (Margolis & Fisher). "Girls are interested but intimidated or girls don't quite know what computer science is; they could be very interested, but need an extra word of encouragement from teachers, parents or counselors" (Margolis & Fisher, p. 115).

Researchers have shown that women "are far from having the same opportunities in science education as White men" (Bianchini, Cavazus, & Helms, 2000, p. 516). These authors acknowledged that from kindergarten through high school, boys have had greater access to science materials and more opportunities to manipulate the use of these materials. Bianchini et al. concluded that by the time students reached the third grade, 51% of boys as compared to 37% of girls have used a microscope. In another study, Martin, Mullis, Gonzalez, and Chrostowski (2004) discussed the impact that science teachers have had on student gender achievement and ways in which teachers could create equal opportunities for female students within the science classroom. Teachers must examine their own beliefs and dispel the notion and biased thought that science is only for boys. After all, according to Martin et al., "One's beliefs affect one's behavior" (p. 280). Science teachers should look for ways to create a classroom environment that promotes equal recognition and equal involvement in class projects for both males and females (Martin et al.).

Career stereotyping in science has been most volatile regarding training future scientists. "There are more and more women who are scientists now than was the case in the past" (Dean, 2005, p. 1). One must ask young people in grades kindergarten through 12 how they view science, especially as a possible career interest. In a study that included sixth grade adolescents, researchers Turner, Steward, and Lapan (2004) tested a causal model based on the social cognitive career theory of math and science. Turner et al. found:

> Career gender-typing mothers' and fathers' support pursuing math and science careers, as well as the structure of the family itself, predicted young adolescents' math self-efficacy; career gender typing mothers' support predicted math outcome expectations; and math self-efficacy and outcome expectations predicted math and science career interests. Career recommendations based on these findings were considered within the conclusions. (p. 46)

Gender differences in mathematics and science achievement, as well as related scores, revealed certain stereotypes within society, school, and family. Lee (1998) provided the results of gender differences concerning male and female elementary students. According to Lee, "Males were found to show higher motivation levels than females who were stereotyped as not having mathematical skills. The same results were found to be true in science as well, in terms of differences between male and female science achievement scores" (p. 7). Research on gender differences in academic achievement has offered educators of young adolescents thought-provoking information on the implications and guidance of options to them.

Martin et al. (2004) reviewed the TIMSS 2003 report that presented science achievement score results for fourth- and eighth-grade students from various countries who participated in the study. According to Martin et al., the 2003 TIMSS report showed that boys outperformed girls at the eighth-grade level across participating countries by six scale points. It was also shown that in 11 countries, the gender difference was not significant. The female gender differences in science achievement were significant and favored girls in the following countries: Macedonia, Moldova, Armenia, the Palestinian National Authority, Saudi Arabia, Jordan, and Bahrain. However, results from most of the 33 participating countries showed evidence that boys, on average, outperformed girls and often by a large margin (Martin et al.).

From the 2003 TIMSS report in regard to the United States, Martin et al. (2004) pointed out:

> Both boys and girls in the United States showed higher science achievement scores than in previous years 1995 and 1999. At the fourth grade, gender differences in science content areas were less pronounced, and there was a more even balance between boys' and girls' achievement levels. In some respects, the patterns in the performance of girls and boys found in TIMSS 2003 are consistent with previous IEA science assessments. Girls tended to perform about the same as boys in life science in both previous TIMSS assessments and the Second International Science Study (SISS), while boys were markedly stronger in earth science and physics in previous studies. (p. 120)

The PISA (2006) report showed that 15-year-old males and females showed no differences in average science performance in the majority of the countries (22 of the 30 participating countries). In 12 countries, females outperformed males, whereas males outperformed females in 8 countries. Most of these differences were small science-gender differences. In some countries, females were stronger in identifying scientific issues, whereas males were stronger at explaining phenomena scientifically. However, males outperformed females substantially better when answering physics questions. It was also reported that in most countries more females were on higher performing academic tracks than were males. As result, in many countries gender differences in science were substantial within schools and programs. (PISA).

Effects of Socioeconomic Factors on Students' Science Achievement Scores

In a study conducted by Wilson (1997), the family's background perspective played a key role in student's science achievement and how well they performed on science tests. Wilson stated:

> Student's test scores are not determined by the size of their classrooms, the physical condition of their school buildings, the number of volumes in their libraries, or the amount of money their school districts spend per pupil. Rather, these scores are more strongly associated with the occupations, income, and levels of education of their parents and with the number of books and magazines in their homes. (p. 5)

The National Assessment Educational Progress (NAEP, 2005a) in its report for fourth graders documented:

> Fourth-grade students in 7 of 10 participating districts scored at least as well, on average, as students attending public schools in large school central cities nationally. In many cases, the same was true when students from the Trail Urban District Assessment (TUDA) were compared with peers from the same racial/ethnic groups in large central cities nationally. Although the science scores in nearly all the participating districts were lower than the national average, when only the scores of students from low-income families were compared, there were fewer score differences among districts" (NAEP 4th, 2005, pg. 6).

However, the NAEP (2005b) eighth-grade report listed that half of the districts scored as well as public school students in large central cities, but, all districts scored below the average score for the nation. "When only students from low-income families were compared, the score gaps between the districts and the nation ranged from 4 to 10 points" (NAEP, 2005b, p. 16). When comparing low-income scores between fourth- and eighth-grade students, a significant difference existed, with the eighth grade scores showing larger score gaps between the districts, with a score gap for the nation that ranged from 4 to 19 points.

The NAEP (2005a) fourth- and eighth-grade reports used students' eligibility for free or reduced-price school lunch as an indicator of socioeconomic status. According to NAEP (2005a):

> Typically, eligible students are from low-income families and have average scores that are significantly below those of students from higher-income families. In fourth grade, Austin and Charlotte were in the top tier, while Chicago and Los Angeles were in the lowest tier. (p. 8)

The NAEP (2005b) report for eighth graders showed Austin and Charlotte were in the top tier of science test scores, whereas eighth graders in Atlanta were in the bottom tier science scores.

Several studies have shown that there is a strong association of socioeconomic disadvantage and poor school performance. In a book titled, *Handbook on Early Literacy Research*, Dickinson and Neuman (2006) discussed the socioeconomic disadvantage of a child's home environment and the stable influences that a child needs to grow physically and to mature mentally and healthy. Another factor that contributed to socioeconomic disadvantaged students' falling behind academically before they start preschool was the mother's inability to provide good quality prenatal care for her infant. The lack of quality prenatal care affected the child's cognitive development and could set the child behind when entering preschool. The authors also pointed out the significance in the findings of the National Assessment of Education Progress report in 2003. Dickinson and Neuman noted that children between the ages of 9 to 13 and 17-year-old students with parents who have less than high school education scored lower on reading, math, and science tests than did children of parents who had completed some education after high school. More significantly was that "children from low-socioeconomic status families start school behind their more affluent peers and progress more slowly through early years of pre-school and elementary school" (Dickinson & Neuman, p. 377). It was also found that children identified as lower socioeconomic status were slower in developing language and literacy skills (Ravin, Kessenich, & Morrison, 2004). These authors concluded that home environment could have a positive effect on student's achievement scores.

The PISA (2006) report found, “Student’s socioeconomic differences accounted for a significant part of between-school differences in some countries. This factor contributed most to between-school performance variation in “the U.S., The Czech Republic, Luxembourg, Belgium, The Slovak Republic, Germany, Greece, and New Zealand” (p. 4). Socioeconomic results from PISA’s 2006 report also showed:

> Poor performance in school does not automatically follow from a disadvantaged home background. However, home background, measured on an index summarizing each student’s economic, social and cultural status, remains one of the most powerful factors influencing performance. On average across the OECD countries it explained 14% of the student performance variation in science. (p. 33)

Cognitive Development, Approaches, and Strategies for Teaching Science

Huitt and Hummel (2003) focused on Piaget’s theory of cognitive development. Based upon teachings by Piaget, teaching causal reasoning through a cognitive apprenticeship might be a particularly important identifiable method of teaching. According to Huitt and Hummel, students enjoyed the format and said the instruction was fun and more exciting than standard science instruction. Huitt and Hummel said that students in the class where the teaching model focused on abstract lessons reported that instruction was boring and repetitive. Many preschool and primary programs have been using Piaget’s theory, which has provided the foundation for constructivist learning. According to Huitt and Hummel:

> Parents and teachers are to challenge the child’s ability, but not present materials that are too far beyond the child’s level. It is also suggested that teachers use a wide variety of concrete experiences to help the child learn (e.g., use of manipulates, working in groups to get experience seeing from another’s perspective, field trips, etc). (p. 2)

Hendricks (2001) reported:

> Students who are at the formal operations stage, which begins at age 14, are more successful at predicting the causal outcomes of experiments than are students who are at the concrete operations stage. Most participants in this study were younger than 14 years, and most achieved mastery. The causality instruction as measured by the post test was based on Piaget’s notions. (p. 309)

According to TIP: Theories (2007), Vygotsky’s theory was based on the idea that the potential for cognitive development depends upon the “zone of proximal development” (ZPD): a level of development attained when children engage in social behavior (p. 1). “Full development of the ZDP depends upon social interactions. The range of skills that can be developed with adult guidance or peer collaboration exceeds what can be attained alone” (p. 1).

Klein (2004) identified the teacher’s role in the computer learning environment. Klein’s study was designed to examine the effects of different types of mediation on the cognitive performance of young children who used computers. Today, one cannot evaluate the science related academic process within the inclusion of the computer. The basis of this study (simply stated studying mediation) was in line with Vygotsky’s theory of mediated teaching. Klein suggested, when children used computers with adult assistance, cognitive processes such as abstract reasoning and logical, and reflective thinking were improved. Facilitators have been taught to encourage a continual stream of dialogue in a constructivist atmosphere, “where meaning is created in relation to students’ prior experience and knowledge” (Truman, Davis, & Thompson, 2000, p. 50).

One essential investigation that addressed constructivism in elementary preservice science teacher preparation focused on the impact of the constructivist learning model on elementary preservice teachers’ beliefs in regard to their constructivist knowledge and the practical application of this knowledge. According to Alawiye (2003):

> As the student teachers’ knowledge of constructivism increased, their belief that they would be able to apply constructivist principles in the classroom learning situation tended to increase. This correlation coefficient, r=.76 is considered to be a relatively high positive measure of the strength of the relationship. The high correlation assumes that the more knowledgeable student teachers are in regards to constructivism, the more likely they will be able to apply constructivist principles in the classroom. (p. 334)

Summary

School districts in the United States have experienced many changes in science education since the 1950s. The changes have been because of corresponding changes in society, developments in technology and research studies, and even federal legislation such as the *No Child Left Behind* Act. There are certain fundamental components of science education that must be delivered to students. Additionally, effective schools show commonalities in the teaching and instruction found in science classrooms as well as others.

Organizations and foundations formed over the years to both study the effectiveness of science education in the United States and provide assistance to schools in their quest to improve science education. Partnerships between school districts and institutions of higher learning began with the goal of improving student achievement in both math and science in schools in the United States.

The ETSU Summer Science Institute is one such partnership that has provided professional development for teachers. The program includes components that research has shown to be important factors: emphasis in science content and pedagogical skills; a focus on the effective use of high quality science instructional materials; and information about relevant student differences such as gender, socioeconomic status, and cognitive development.

CHAPTER 3

METHODS AND PROCEDURES

Introduction

The purpose of this study was to determine the effectiveness of East Tennessee State University's summer science institute training through the effect on mean Normal Curve Equivalent (NCE) science test scores of students in a Northeast Tennessee school system whose teachers participated in the ETSU summer science institute training.

CTB/McGraw-Hill (2007) explained Normal Curve Equivalent score as:

> . . . normalized standard scores that have a mean 50 and were constructed to have a standard deviation of 21.06. This value was selected because it produces an exact match between NCEs of 1 and 99 and percentiles of 1 and 99. Therefore, NCEs have the same range (1 to 99) and midpoint (50) as percentiles. It is from this correspondence that NCEs derive their meaningfulness. (p. 1)

The NCE scores of students in middle school grades five through eight were used in the study. Student NCE test scores were collected as preparticipating (students' NCE scores before entering the participating teachers class) and compared to postparticipating (students' NCE scores after teacher had participated in ETSU summer science institute training the previous summer). It is important to note that an NCE score of 50 means that the student is on grade level.

Chapter 3 describes the methodology and procedures used in this study. It is organized into the following sections: introduction; research design; population; instrumentation; data analysis; research questions; hypotheses that were statistically analyzed by using pair-samples *t* test for Ho1, Ho2, and Ho3; a *t* test for independent samples model that was used to statistically analyze hypotheses $Ho4_1$, $Ho4_2$, $Ho5_1$, $Ho5_2$; and a summary statement.

Research Design

A quantitative research design was chosen for this study. This was a comparative analysis study that examined the differences, if any, in the NCE test scores of students whose teachers participated in ETSU summer institute training to students' NCE test scores of teachers who were nonparticipants in ETSU summer science institute. Norm Curve Equivalent scores taken from the Tennessee Comprehensive Assessment Program (TCAP) were used to measure the dependent variables that were identified as mean NCE scores.

The predictor independent variables used were socioeconomic and gender status measured in terms of whether or not students who participated in the federal free- or reduced-price meals program scored higher NCE scores in teachers' classes who participated in ETSU summer science institute and whether there were gender differences for the same students.

Teacher participation and teacher nonparticipation in ETSU summer science institute was also used as a predictor or independent variable for this study. Nine elementary-middle schools and 1,198 students who took the TCAP test during school years 2005, 2006, and 2007 were included in this study.

The treatment group for this study included 23 teachers who each participated in ETSU summer science institute training at a higher education institution in 2004, 2005, or 2006. It is important to note that there were 3 years of teacher training with a total of 23 teachers being trained in three separate summer institute training groups over a 3-year period (Table 3 in Chapter 4 shows the number of teachers attending in 2004, 2005, and 2006).

Instrumentation

The instrument used for this study was the Tennessee Comprehensive Assessment Program (TCAP) test. The TCAP test was chosen for the consistency and reliability that the state mandated test brought to the study. The TCAP was developed by the Tennessee State Department of Education.

The use of NCE scores from two different school years as preparticipating and postparticipating NCE scores brought up "threats to validity" concerns. Using pre- and post TCAP test results from two different school years might make one ask the question, "How valid are the results, when comparing scores from two different school years (pre and post), two different grade levels, and two different teachers?" To answer the question in regard to threats concerning validity of the study, it became important for readers to understand the grade level scale score and NCE conversion process.

Grade level NCE conversion tables were used to convert the TCAP scale score to a NCE score. Each grade-level conversion chart was designed to allow for cross-grade level comparisons to see if academic achievement growth had occurred from one year to the next. The data from each of the 3 years included in this study were divided into two groups: preparticipation and postparticipation NCE scores.

Data analysis was conducted by separating the two groups (pre and postparticipation) and using paired-samples *t* test for statistical analysis of research questions 1 through 3 and null hypotheses 1, 2, and 3. To evaluate research questions 4 and 5 and null hypotheses 4_1, 4_2, 5_1, and 5_2, a *t* test for independent samples was used for statistical analysis. Research questions and null hypotheses 4_1, 4_2, 5_1, and 5_2 were designed to eliminate variables that might negatively affect the study.

To eliminate the risk of preparticipating teachers having previously participated in summer science workshop training and therefore skewing the results when comparing them to participating teachers' student NCE scores, during the 2nd and 3rd year of the study (2005-2006 and 2006–2007), fifth-grade students' science NCE scores were the only scores used for statistical analysis. The reason for this adjustment was that fourth-grade science NCE scores came from teachers who were less likely to have had the opportunity to participate in an ETSU summer science institute because the summer workshop training includes teachers from middle school grades five through eight only.

Sample

Prior to conducting this study, approval was obtained from the Institutional Review Board (IRB) at East Tennessee State University. Data collection was carried out using the software program "Test Mate Clarity" to acquire TCAP Achievement NCE scores for teachers and students for school years: 2004-2005, 2005-2006, and 2006-2007. The director of schools for the Northeast Tennessee school system granted permission to use teacher and student assessment data for this study.

Grades five through eight TCAP science achievement NCE scores were compared to see if any differences existed between the NCE test scores of students whose teachers participated in ETSU summer science institute as compared to NCE scores of students whose teachers did not participate in higher education summer science workshop training.

The percentage of students receiving free- or reduced-price meals and student gender information was obtained from the Northeast Tennessee school system in which this study was conducted. Those who participated in this study were selected nonrandomly with convenience sampling using natural formed groups.

The population for this study were multi-stage that included student stratification characteristics such as: gender, socioeconomics (free- or reduced-price meals status), and student grade level. Teacher stratification characteristics were derived from the grade level that the teacher taught who participated in the ETSU summer science institute.

Between January 2008 and March 2008, data were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 11.0 software program. Findings of the data analysis are presented in Chapter 4 as tables.

Research Questions and Null Hypotheses

The following research questions and null hypotheses guided the analysis. For research questions 1 through 3 and null hypotheses 1, 2, and 3, data analysis was performed by using paired-samples *t* test.

1. Is there a difference in students' science NCE scores (preparticipating year 2004 and postparticipating year 2005) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

Ho1: There is no difference in students' NCE scores (preparticipating year 2004 and postparticipating year 2005) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute.

2. Is there a difference in students' science NCE scores (preparticipating year 2005 and postparticipating year 2006) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

   Ho2: There is no difference in students' science NCE scores (preparticipating year 2005 and postparticipating year 2006) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute.

3. Is there a difference in students' science NCE scores (preparticipating year 2006 and postparticipating year 2007) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

   Ho3: There is no difference in student's science NCE scores (preparticipating year 2006 and postparticipating year 2007) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute.

For research questions 4 and 5 and null hypotheses 4_1, 4_2, 5_1, and 5_2, data analysis was performed by using a *t* test for independent samples.

4. For those students whose teachers attended ETSU summer science institute, is there a difference in science NCE scores or a difference in NCE raw scores between males and females?

   Ho4_1: There is no difference in mean net gain science NCE scores between males and females of students whose teachers attended ETSU summer science institute.

$Ho4_2$: There is no difference in NCE raw scores between males and females of students whose teachers attended ETSU summer science institute.

5. For those students whose teachers attended ETSU summer science institute, is there a difference in science NCE scores or a difference in NCE raw scores of students identified as lower socioeconomic status (as measured by free- and reduced-price meals status) and those students not classified as lower socioeconomic status?

   $Ho5_1$: There is no difference in mean net gain science NCE scores of students identified as lower-socioeconomic (as measured by free- and reduced-price meals status) and those students not classified as lower socioeconomic status for those students whose teachers attended ETSU summer science institute.

   $Ho5_2$: There is no difference in NCE raw scores of students identified as lower socioeconomic (as measured by free- and reduced-price meals status) and those students not classified as lower socioeconomic status for those students whose teachers attended ETSU summer science institute.

Data Analysis

Descriptive statistics were obtained to provide a profile of the sample being studied. The Statistical Program for the Social Sciences (SPSS) was used to analyze data. A paired-samples *t* test and a *t* test for independent samples were used to determine if there were mean NCE score differences between students' scores of teachers who participated in ETSU summer science institute as compared to students' scores of nonparticipating teachers on the TCAP science achievement test. This study was conducted and data accumulated over 3 school years: 2004-2005, 2005-2006, and 2006-2007. The teacher summer science workshop training occurred during the months of June 2004, June 2005, and June 2006.

The preparticipation and postparticipation data represented in each of the 3 school years (2004-05, 2005-06, 2006-07) was a representation of three different groups of students who were clustered together for data analysis purposes. Differences between students who were receiving free- or reduced-price meals and student gender status were analyzed. Using the state's lower socioeconomic (free- or reduced-price meals) data, the free- or reduced-price meals recipients were coded 1 and the nonrecipients were coded 2. Gender was identified by coding males 1 and females 2.

Paired-samples *t* test and a *t* test for independent samples were used to identify differences in teachers' mean NCE scores of students in grades five through eight using independent factors: socioeconomic (free- or reduced-price meals) and gender status. The mean NCE science scores served as the dependent variable for this study. All statistical tests were conducted using alpha level of .05 to determine if statistically significant differences occurred in grades five through eight science NCE test scores on the TCAP test. The statistics used were consistent with the design of the study.

Summary

ETSU Summer Science Institute occurred in June, 2004, June 2005, and June 2006. NCE test score data were collected at the end of school years 2005, 2006, 2007. The science data from those school years served as the preparticipation and postparticipation NCE scores of students who entered the participating teachers' classes at the beginning of each school year.

The post-participation scores were recorded at the end of the 2005, 2006, and 2007 school years. The NCEs were recorded and comparisons were made using gender and free- or reduced-price meals status to determine if differences exist because of teachers' participation in ETSU summer science institute.

Chapter 3 presented the research design, population, and statistical procedures that were used for data analysis. The study used quantitative procedures to compare the TCAP science achievement scores of students in grades five through eight. The study consisted of five research questions and seven null hypotheses. The study's population included 1,198 students and 23 teachers who participated in ETSU summer science institute over 3 school years: 2004-2005, 2005-2006, and 2006-2007.

Data from TCAP and school report cards were used for this study. Chapter 4 provides an analysis of the data and Chapter 5 includes a summary, conclusions, and recommendations for further research and practice.

CHAPTER 4

RESULTS

Participants

This study focused on the performance of students taught by teachers who participated in a summer science teachers' workshop. Twenty-three teachers participated in 2004 (*N* = 9), 2005 (*N* = 9), or 2006 (*N*= 5). Following the workshops, these teachers instructed 1,198 students (595 in academic year 2004-2005, 474 in 2005-2006, and 129 in 2006-2007). Table 2 shows the pre- and post-training timeline with the summer training year. Table 3 shows the teacher and student population for each year of this study.

Table 2

Summer Training Timeline

School Year	Nonparticipation Year	Summer Training Year	Participation Year
2004-05 School Year (Year 1)	2004	2004	2005
2005-06 School Year (Year 2)	2005	2005	2006
2006-07 School Year (Year 3)	2006	2006	2007

Table 3

Teacher and Student Population

Year	Group	Teachers (N)	Students (N)
2004-2005	Group 1	9	595
2005-2006	Group 2	9	474
2006-2007	Group 3	5	129
Totals		23	1, 198

The students' Normal Curve Equivalent scores from the Tennessee Comprehensive Assessment Program (TCAP) were the variables examined to determine if students' performance improved from the year before they were instructed by a teacher who participated in the workshop to the year after they were instructed by a workshop participant. Data from 3 academic years (2004-2005, 2005-2006, and 2006-2007) were analyzed to answer research questions 1-3. Data from fifth-grade students only from years 2005-2006 and 2006-2007 (combined) were analyzed to answer research questions 4 and 5.

Research Question #1

Is there a difference in students' science NCE scores (preparticipating year 2004 and postparticipating year 2005) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

Ho1: There is no difference in students' NCE scores (preparticipating year 2004 and postparticipating year 2005) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute.

Analysis for 2004-2005

Data from the 2004-2005 academic year indicated that six schools were represented by nine teachers (see Appendix A for 2004-2005 test subjects' descriptive statistics). A total of 595 students in grades four through nine were taught by the participating teachers. The average pretest NCE was 55.10, whereas the average posttest NCE was 60.44. The data indicate that 77% were proficient or advanced on the TCAP in 2004 and 87% were proficient or advanced in 2005. The data also indicate 62% were on the free meals program and 51% were male; virtually all were native English speakers (99.5%). Just over a 10th (11.1%) were in special education and almost all were White (97.8%).

A paired-samples *t* test was conducted to evaluate whether teacher participation in a summer science institute was related to student achievement scores. The results indicated that the mean scores of students whose science teachers participated in a summer science institute ($M = 60.44$, $SD = 20.16$) was significantly greater than the mean scores of students of nonparticipating science teachers ($M = 55.10$, $SD = 17.87$), $t(593) = 8.48$, $p = < .01$. Therefore, Ho1 was rejected.

The standardized effect size index η^2 was .11. The 95% confidence interval for mean difference between the two ratings was 6.58 to 4.10. Students of teachers who participated in a summer science institute (2004-2005) tended to score better than did students of nonparticipating teachers.

Figure 1 illustrates the 2004-2005 preparticipation and postparticipation mean NCE science scores.

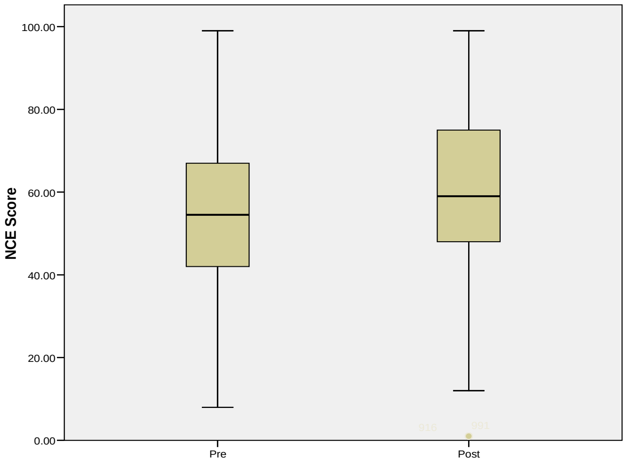

Figure 1. 2004-2005 Mean NCE Science Scores Before and After Teacher Training Workshop

Research Question #2

Is there a difference in students' science NCE scores (preparticipating year 2005 and postparticipating year 2006) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

Ho2: There is no difference in students' science NCE scores (preparticipating year 2005 and postparticipating year 2006) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute.

Analysis for 2005-2006

Data from the 2005-2006 academic year indicated that six schools were represented by nine teachers (see Appendix B for 2005-2006 test subjects' descriptive statistics). A total of 474 students in grades four through eight were taught by nine teachers. The mean pretest NCE was 54.00 whereas the mean posttest NCE was 53.08. The data indicate that 86% were proficient or advanced on the TCAP in 2005 and 82% were proficient or advanced in 2006. The data also indicate 61% were on the free meals program and 51% were male; all were native English speakers. Just under a 10th (9.7%) were in special education and 97.5% were White.

A paired-samples *t* test was conducted to evaluate whether teacher participation in a summer science institute was related to student achievement scores. The results indicated that the mean scores of science teachers who participated in a summer science institute (*M* = 54.00, *SD* = 15.91) were not significant when compared to the mean scores of nonparticipating science teachers (*M* = 53.08, *SD* = 16.85), *t*(472) = 1.48, *p* = .141. Therefore, Ho2 was not rejected. The standardized effect size index η^2 was .005. The 95% confidence interval for mean difference between the two ratings was -.30 to 2.13. Students of teachers who participated in a summer science institute (2005-2006) performed no better than did nonparticipating teachers' students.

Figure 2 illustrates the 2005-2006 preparticipation and postparticipation mean NCE science scores.

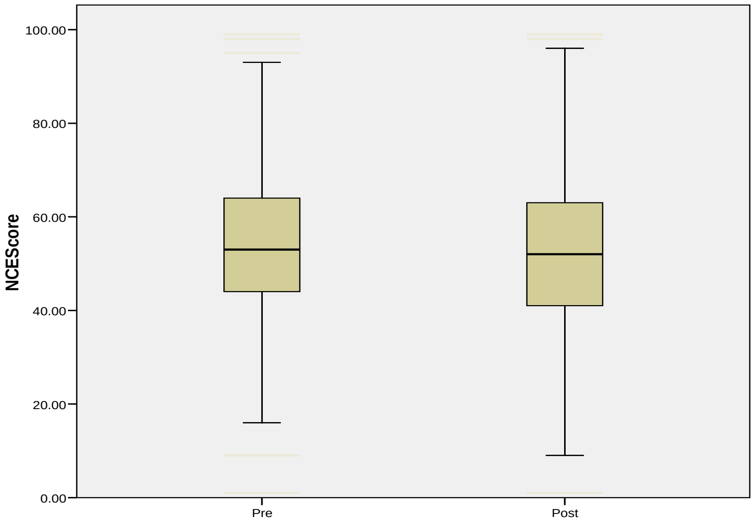

Figure 2. 2005-2006 Mean NCE Science Scores Before and After Teacher Training Workshop

Research Question #3

Is there a difference in students' science NCE scores (preparticipating year 2006 and postparticipating year 2007) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

Ho3: There is no difference in student's science NCE scores (preparticipating year 2006 and postparticipating year 2007) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute.

Analysis for 2006-2007

Data from the 2006-2007 academic year indicated that five schools were represented by five teachers (see Appendix C for 2006-2007 test subjects' descriptive statistics). A total of 129 students in grades five, six, and eight were taught by the teachers. The average pretest NCE was 60.53 whereas the average posttest NCE was 63.28. The data indicate that 94% were proficient or advanced on the TCAP in 2006 and 89% were proficient or advanced in 2007. The data also indicate 61% were on the free meals program and 56% were male. All were native English speakers. Seven percent (7%) were in special education and almost all were White (98.4%).

A paired-samples *t* test was conducted to evaluate whether teacher participation in a summer science institute was related to student achievement scores. The results indicated that the mean scores of science teachers who participated in a summer science institute ($M = 63.28$, $SD = 20.23$) were significantly greater than the mean scores of nonparticipating science teachers ($M = 60.53$, $SD = 18.01$), $t(127) = 3.58$, $p = < .001$. Therefore, Ho3 was rejected. The standardized effect size index η^2 was .09. The 95% confidence interval for mean difference between the two ratings was 4.25 to 1.22. Students whose teachers participated in a summer science institute (2006-2007) tended to score better than those students whose teachers did not participate.

Figure 3 illustrates the 2006-2007 preparticipation and postparticipation mean NCE science scores.

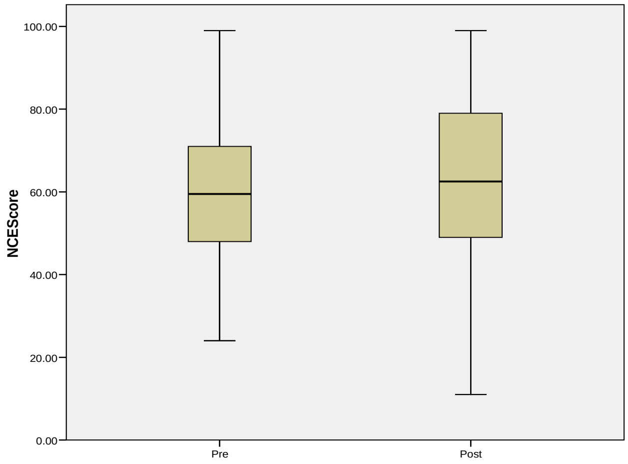

Figure 3. 2006 - 2007 Mean NCE Science Scores Before and After Teacher Training Workshop

Research Question #4

For those students whose teachers attended ETSU summer science institute, is there a difference in mean net gain science NCE scores or a difference in NCE raw scores between males and females?

Ho4_1: There is no difference in mean net gain science NCE scores between males and females of students whose teachers attended ETSU summer science institute.

Ho4_2: There is no difference in NCE raw scores between males and females of students whose teachers attended ETSU summer science institute.

Mean Net Gain Science NCE Scores

A *t* test for independent samples was conducted to evaluate whether the mean net gain science scores of males were higher than females (fifth-grade students only from years 2005-2006 through 2006-2007) of teachers who participated in the summer science institute. The mean net gain scores of students was the test variable and the grouping variable was male and female students. The test was not significant when using a mean net gain scores analysis, *t*(257)

= .43, *p* = .966. Therefore, $Ho4_1$ was not rejected. The η^2 index was .09, which indicates a medium effect size. There was little or no difference in males' mean net gain scores (*M* = 3.50, *SD* = 12.78) as compared to female scores (*M* = 3.43, *SD* = 11.40). The 95 % confidence interval for the difference in means was -2.91 to 3.04. Female students of teachers who attended a summer science institute tended to perform about the same as did the male students whose teacher attended a summer science institute. Figure 4 shows the distributions for the two groups.

Figure 4 illustrates 2005-2006 through 2006-2007 (fifth grade only) males' and females' mean net gain from preNCE to postNCE.

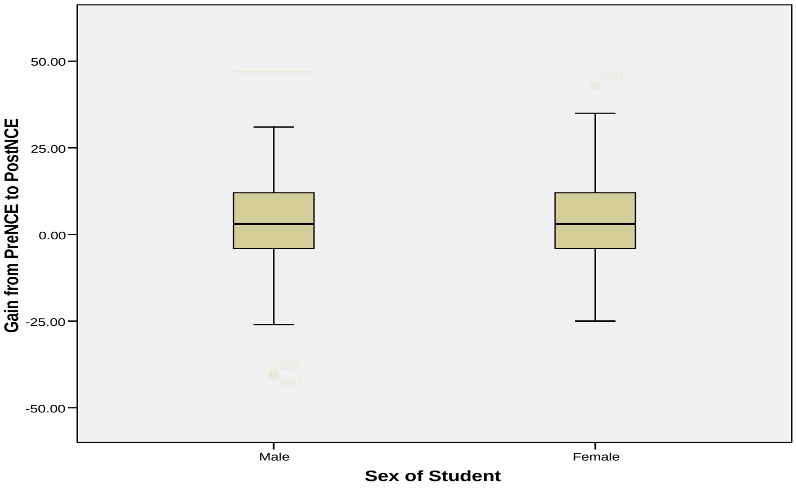

Figure 4. 2005-2006 through 2006-2007 (Fifth Grade Only) Mean Net Gain From PreNCE to PostNCE for Males and Females

NCE Raw Scores

A *t* test for independent samples was conducted to evaluate whether the NCE raw scores for males were higher than females (fifth-grade students only from years 2005-2006 through 2006-2007) of students whose teachers participated in the summer science institute. The NCE raw scores of students was the test variable and the grouping variable was male and female students. The test was significant when using a NCE raw score analysis, $t(257) = 2.02$, $p = .044$. Therefore, $Ho4_2$ was rejected. The NCE raw scores for males were higher ($M = 63.05$, $SD = 18.69$) than were the females scores ($M = 58.31$, $SD = 18.95$). The 95% confidence interval for the difference in means was .123 to 9.36. The η^2 index was .02, which indicated a small effect size. Male students of teachers who attended a summer science institute appeared to perform slightly better than did the female students. Figure 5 shows the distribution for the two groups. Figure 5 illustrates NCE raw scores for current years for male and female students.

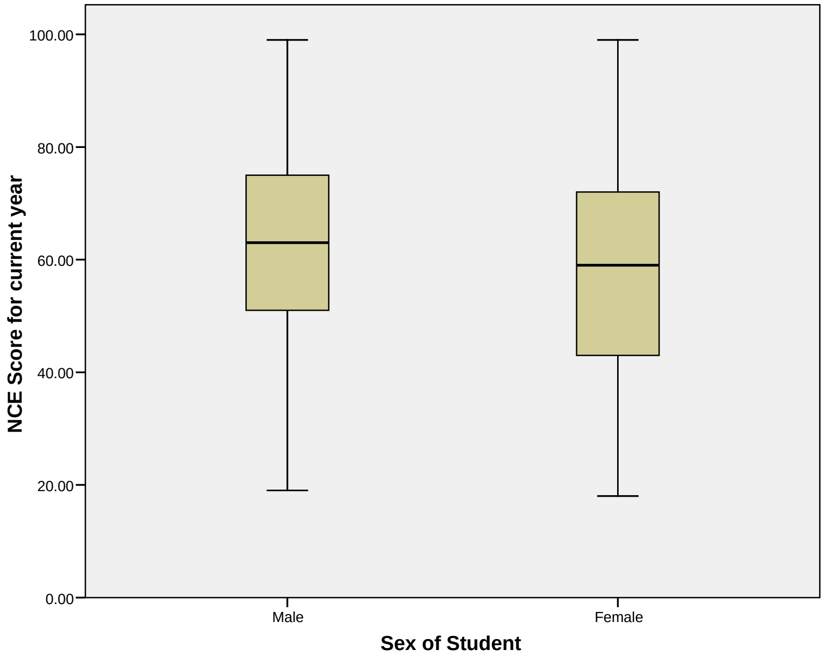

Figure 5. 2005-2006 through 2006-2007 (Fifth Grade Only) NCE Raw Scores From PreNCE to PostNCE for Males and Females

Research Question #5

For those students whose teachers attended ETSU summer science institute, is there a difference in mean net gain science NCE scores or a difference in NCE raw scores of students identified as lower socioeconomic status (as measured by free- and reduced-price meals status) and those students not classified as lower socioeconomic status?

$Ho5_1$: There is no difference in mean net gain science NCE scores of students identified as lower socioeconomic (as measured by free- and reduced-price meals status) or those students not classified as lower socioeconomic status for those students whose teachers attended ETSU summer science institute.

$Ho5_2$: There is no difference in NCE raw scores of students identified as lower socioeconomic (as measured by free- and reduced-price meals status) or those students not classified as lower socioeconomic status for those students whose teachers attended ETSU summer science institute.

Mean Net Gain Science Scores

A *t* test for independent samples was conducted to evaluate if a difference existed in mean net gain science scores (fifth grade only, students from years 2005-2006 through 2006-2007 only) of students who were classified as lower socioeconomic status (free- and reduced-price meals status) and those students who were not classified as lower socioeconomic status. The mean net gain of students was the test variable and the grouping variable was socioeconomic status. The test was not significant when using a mean net gain scores analysis, $t(258) = .663$, $p = .966$. Therefore, $Ho5_1$ was not rejected. The η^2 index was .01, which indicates a small effect size. There were little or no differences in students on the free- and reduced-price meals program mean net gain scores ($M = 3.03$, $SD = 12.16$) as compared to those who were not ($M = 4.04$, $SD = 12.09$). The 95% confidence interval for the difference in means was -4.01 to 2.00. Students who were on the free- and reduced-price meals program with teachers who attended a summer science institute performed about the same as those who were not on the program performed. Figure 6 shows the distribution for the two groups.

Figure 6 illustrates 2005-2006 through 2006-2007 (fifth grade only) mean net gain for lower socioeconomic status students.

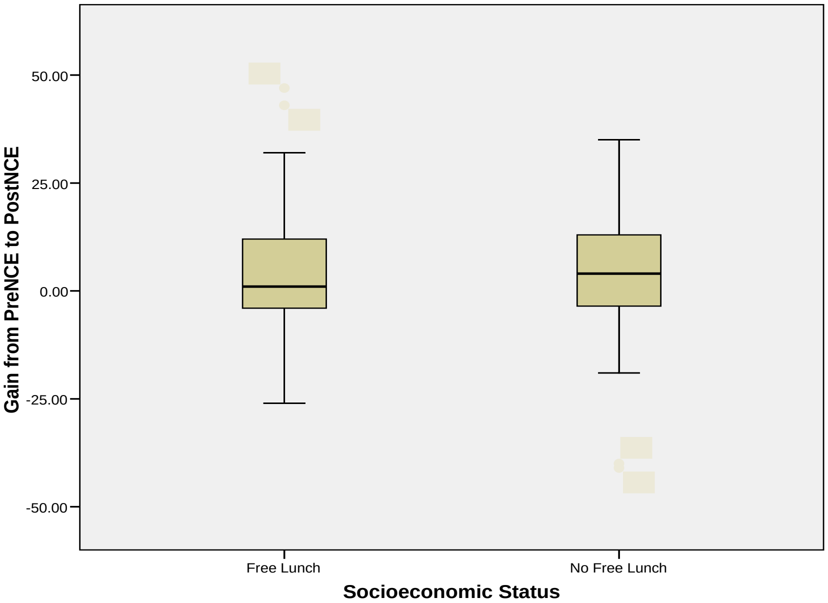

Figure 6. 2005-2006 Through 2006-2007 (Fifth Grade Only) Mean Net Gain for Lower-Socioeconomic Status Students

NCE Raw Scores

A *t* test for independent samples was conducted to evaluate if a difference existed in the NCE raw scores (fifth grade only, students from years 2005-2006 through 2006-2007 only) of students who were classified as lower socioeconomic status (free- and reduced-price meals status) and those students not classified as lower socioeconomic status. The NCE raw scores of students was a test variable and the grouping variable was lower socioeconomic status. The test was significant when using NCE raw scores, *t*(258) = 2.47, *p* = .044. Therefore, Ho5$_2$ was rejected. Students who were not classified as being lower socioeconomic status had NCE raw scores that were significantly higher (*M* = 64.09, *SD* = 17.88) than were the scores of students who were classified as lower socioeconomic status (*M* = 58.26, *SD* = 19.37). The 95% confidence interval for the difference in means was 10.46 to 1.19. The η^2 index was .02, which indicated a small effect size. As expected, students who did not receive free- and reduced-priced meals appeared to score better than did the students classified as lower socioeconomic status.

Figure 7 illustrates NCE raw scores for current year for lower socioeconomic students.

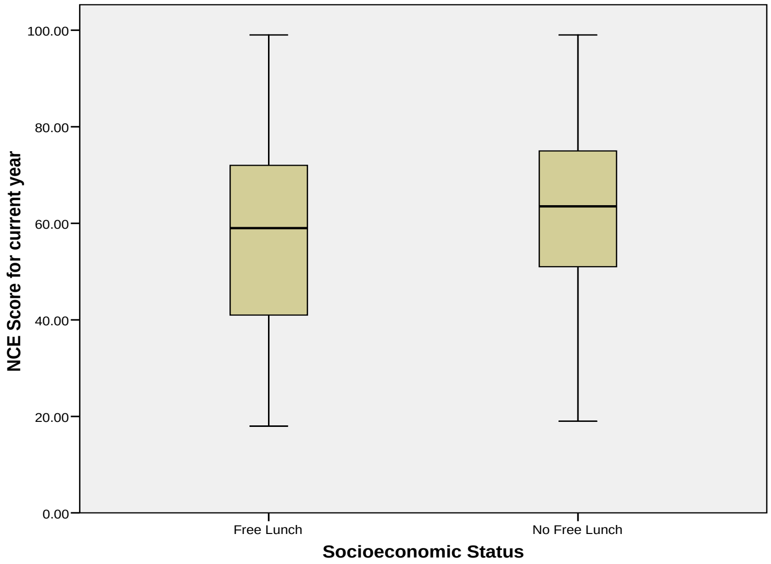

Figure 7. 2005-2006 Through 2006-2007 (Fifth Grade Only) NCE Raw Scores for Lower-Socioeconomic Status Students

Summary

Chapter 4 included a collection of data results and analyses to provide answers to five research questions and seven null hypotheses. For the first three research questions:

1. Is there a difference in students' science NCE scores (preparticipating year 2004 and postparticipating year 2005) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?
2. Is there a difference in students' science NCE scores (preparticipating year 2005 and postparticipating year 2006) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?
3. Is there a difference in students' science NCE scores (preparticipating year 2006 and postparticipating year 2007) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

A paired-samples *t* test was performed to determine if teacher participation in a summer science institute had any effect on students' achievement NCE scores. The test showed significant results for year 1 (2004-2005) and year 3 (2006-2007) and as result Ho1 and Ho3 were rejected. Whereas, data results and analysis for year 2 (2005-2006) showed no significance and Ho2 was not rejected.

For research questions 4 and 5 and null hypotheses 4_1, 4_2, 5_1, and 5_2, data analysis was performed by using a *t* test for independent samples.

4. For those students whose teachers attended ETSU summer science institute, is there a difference in mean net gain science NCE scores or a difference in NCE raw scores between males and females?
5. For those students whose teachers attended ETSU summer science institute, is there a difference in mean net gain science NCE scores or a difference in NCE raw scores of students identified as lower socioeconomic status (as measured by free- and reduced-price meals status) and those students not classified as lower socioeconomic status?

Research questions 4 and 5 used mean net gain analysis regarding $Ho4_1$ and $Ho5_1$. The results for $Ho4_1$ and $Ho5_1$ were found not to be significant and therefore not rejected. Whereas, when data analysis was performed on research questions 4 and 5 using NCE raw scores, the findings for $Ho4_2$ and $Ho5_2$ showed significance and as a result were rejected.

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

The purpose of this study was to determine the effectiveness of East Tennessee State University's summer science institute training through the effect on mean Normal Curve Equivalent (NCE) science test scores of students in a Northeast Tennessee school system whose teachers participated in the ETSU summer science institute training. Data were collected from 9 schools, 23 teachers, and 1,198 students over a 3-year period (2004-2005, 2005-2006, and 2006-2007). The data for all schools, teachers, and students used in this study were gathered from one school district located in Northeast Tennessee. Chapter 5 contains a summary of findings, conclusions, and recommendations to improve practice and suggestions for further research on this subject.

Research Question #1

Is there a difference in students' science NCE scores (preparticipating year 2004 and postparticipating year 2005) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

A paired-samples *t* test was used to evaluate if there was any difference in students' science NCE scores whose teachers participated in a summer science institute (2004-2005). The data analysis showed that there was a significant difference between preparticipation and postparticipation in students' science NCE scores. The average mean science NCE preparticipation pretest score was (M = 55.10) as compared to the average postparticipation posttest science score of (M = 60.44), which yielded a mean difference of 5.34. Therefore, Ho1 was rejected.

The results of findings for research question 1 (data analysis for 2004-2005) was in agreement with findings from a study conducted by Lawrenz (2003) to examine the relationship between different types of professional development; it was found that students' performance and teachers' instructional practice improved after teachers received quality professional development.. Data regarding teachers' instructional practices and the amount of professional development were collected using teacher surveys. Ninety-four middle-school science teachers and 104 middle- school mathematics teachers participated in the study (Lawrenz).

Research Question #2

Is there a difference in students' science NCE scores (preparticipating year 2005 and postparticipating year 2006) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

A paired-samples *t* test was used to evaluate if there was any difference in students' science NCE scores whose teachers participated in a summer science institute (2005-2006). The data analysis showed that there were no significant differences between preparticipation and postparticipation students' science NCE scores. The average mean science NCE preparticipation pretest score was (M = 54.00) as compared to the average postparticipation pretest science score of (M = 53.08), which yielded a mean difference of -.92. Therefore, Ho2 was not rejected.

Research Question #3

Is there a difference in students' science NCE scores (preparticipating year 2006 and postparticipating year 2007) between teachers who attended ETSU summer science institute and those who did not attend the summer science institute?

A paired-samples *t* test was used to evaluate if there was any differences in students' science NCE scores whose teacher participated in a summer science institute (2006-2007). The data analysis showed that there was a significant difference between preparticipation and postparticipation in students' science NCE scores. The mean science NCE preparticipation pretest score was (M = 60.53) as compared to the average postparticipation pretest science score of (M = 63.28), which yielded a mean difference of 2.75. Therefore, Ho3 was rejected.

Research Question #4

For those students whose teachers attended ETSU summer science institute, is there a difference in mean net gain science NCE scores or a difference in NCE raw scores between males and females?

Mean Net Gain Science Scores

A *t* test for independent samples was used to evaluate if there was any differences between mean net gain science scores for male and female students whose teachers participated in an ETSU summer science institute. Research question #4 focused on fifth grade only and combined 2 consecutive years (2005-2006 through 2006-2007) of the study to measure the gender question. The findings from the mean net gain analysis showed that there was no significant difference between males' (M = 3.50) and females' (M = 3.43) science mean net gain scores. The mean net gain difference was .07. Therefore, $Ho4_1$ for gender and mean net gain scores was not rejected.

The results of the finding for research question 4 (mean net gain analysis) yielded similar findings as reported in the PISA (2006) report that indicated 15-year-old males and females showed no differences in average science performance in a majority of countries including 22 of the 30 participating countries. In 12 countries, females outperformed males whereas males outperformed females in 8 countries. Most of these differences were small science gender differences (PISA).

NCE Raw Scores

A *t* test for independent samples was used to evaluate if there were any differences between male and female students' NCE raw scores for students whose teachers participated in a summer science institute. Research question#4 focused on fifth-grade only and combined two consecutive years (2005-2006 through 2006-2007) of the study to measure the gender question. The findings from the NCE raw score analysis showed that there were significant differences between males' (M = 63.05) and females' (M = 58.31) science NCE raw score average. The mean NCE difference was 4.74. Therefore, $Ho4_2$ for gender NCE raw scores was rejected.

The results of the finding for research question 4 (NCE raw scores analysis) showed similarities to a finding made by Lee (1998)

> Males were found to show higher motivation levels than females who were stereotyped as not having mathematical skills. The same results were found to be true in science as well, in terms of differences between male and female science achievement scores. (p. 7)

Research Question #5

For those students whose teachers attended ETSU summer science institute, was there a difference in mean net gain science NCE scores or a difference in NCE raw scores of students identified as lower socioeconomic status (as measured by free- and reduced-price meals status) and those students not classified as lower socioeconomic status?

Mean Net Gain Science Scores

A *t* test for independent samples was used to evaluate if there were any differences in science mean gain scores of students identified as lower socioeconomic status (as measured by free and reduced lunch status) as compared to those students not classified as lower-socioeconomic whose teachers participated in a summer science institute. Research question #5 focused on fifth grade only and combined two consecutive years (2005-2006 through 2006-2007) of the study to measure the socioeconomic question. The findings from the mean net gain score analysis showed that there was no significant differences in science mean net gain scores between those students on the free- and reduced-price meals program (M = 3.03) and those not on the program (M = 4.04). The mean net gain difference was 1.01; therefore, $Ho5_1$ for lower socioeconomic status mean net gain scores was not rejected.

NCE Raw Scores

A *t* test for independent samples was used to evaluate if there were any differences in NCE raw scores of student identified as lower socioeconomic status (as measured by free- and reduced-price meals status) and those students not classified as lower socioeconomic status whose teacher participated in a summer science institute. Research question #5 focused on fifth grade only and combined two consecutive years (2005-2006 through 2006-2007) of the study to measure the socioeconomic question. The findings from the NCE raw scores analysis showed that there were significant differences in science NCE raw scores between students on the free- and reduced-price meals program (M = 58.26) and those not on the program (64.09). The NCE raw score difference was 5.83. Therefore, $Ho5_2$ for lower socioeconomic status NCE raw scores was rejected.

The results of the finding for research question 5 (NCE-Raw scores analysis) was in agreement with the findings of a study conducted by Wilson (1997). Wilson found that a family's background perspective played a key role in students' science achievement and how well they performed on science tests. Wilson pointed out:

> Student's test scores are not determined by the size of their classrooms, the physical condition of their school buildings and number of volumes in their libraries or the amount of money their school districts spend per pupil. Rather, these scores are more strongly associated with the occupations, income, and levels of education of their parents and with the number of books and magazines in their homes. (p. 5)

To further support the findings for research question 5 (NCE-raw score analysis), the NAEP (2005) fourth- and eighth-grade reports, "uses students' eligibility for free- or reduced-price school meals as an indicator of socioeconomic status. Typically, eligible students are from low-income families and have average scores that are significantly below those of students from higher-income families. In fourth grade, "Austin, Texas, and Charlotte, North Carolina, were in the top tier, whereas Chicago, Illinois, and Los Angeles, California were in the lowest tier" (NAEP National Trends, 2005, p. 8).

Conclusions

This analysis focused on five research questions and seven null hypotheses. The student sample included 1,198 students from nine different schools. Research questions 1 and 3 showed significant differences and were supported by the findings in the literature review that teacher professional development does appear to help to increase students' science achievement scores. Research question 2 showed no significance and the null hypothesis was not rejected. Research questions 4 and 5 and null hypotheses $Ho4_1$, $Ho4_2$ and $Ho5_1$ and $Ho5_2$ were analyzed using two analyses for each research question and null hypothesis. The mean net gain analyses for $Ho4_1$ and $Ho5_1$ showed no significant difference. The second analyses performed were NCE raw score analyses. The findings for these two analyses showed a significant difference and were in agreement with the literature review findings as related to the affect that gender and socioeconomics had on student science achievement scores.

Table 4 provides a summary of whether the null hypotheses were rejected or not rejected.

Table 4

Summary of Research Questions and Hypotheses

Research Question	Null Hypothesis	Rejected or Not Rejected
Research Question #1 (2004-2005)	Ho1	Rejected
Research Question #2 (2005-2006)	Ho2	Not Rejected
Research Question #3 (2006-2007)	Ho3	Rejected
Research Question #4 (Gender)		
Mean Net Gain Score	$Ho4_1$	Not Rejected
NCE Raw Score	$Ho4_2$	Rejected
Research Question #5 (Socioeconomic Status)		
Mean Net Gain Score	$Ho5_1$	Not Rejected
NCE Raw Score	$Ho5_2$	Rejected

Recommendations for Practice

There appeared to be some significance in the findings of this study on teachers' participation in a summer science institute and its effect on students' science NCE scores. Based the research, the following are recommendations for practice:

1. Local school districts should continue to work with colleges and universities in order to provide professional development training opportunities to middle-school science teachers.
2. The communication between ETSU and local school systems should continue in order to enhance and improve future science training sessions.
3. School systems that are not currently participating in the summer science institute should consider doing so.

Recommendations for Further Research

1. This study should be replicated using a control group where different students from the same grade level could be used for comparison. This study used no true control group. The preparticipation and postparticipation science NCE scores were from the same group of students.
2. A study should be conducted using multiple school systems in order to look at system comparisons. This study focused on one school system located in rural northeast Tennessee.
3. This study should be replicated with a focus on participating teachers' tenure (years of experience) to see if experience teachers' students achievement is higher than that of inexperience teachers. This study consisted of a mixed group of experienced and inexperienced teachers.
4. A study should be conducted to compare city school systems to rural school systems. This study focused on a rural northeast Tennessee school system

5. A study should be conducted to examine other subgroups (special education, ethnicity, proficiency levels) within the population sample. This study focused on two subgroups: gender and socioeconomic status (free- and reduced-price meals status).
6. A study should be conducted with a focus on high school participants. This study was focused solely on middle school students.
7. A study should be conducted to see if gender grouping at the middle school level would have any type of an effect on student science achievement scores.

REFERENCES

AIP Bulletin for Science Policy News. (2002, May, 9). *FYI: Congressional efforts to increase funding for science education programs.* Retrieved June 14, 2007, from http://www.aip.org/fyi/2002/058.html

AIP Bulletin for Science Policy News. (2007, April 30). *FYI: Higher funding sought for math and science partnerships.* Retrieved June 14, 2007, from http://www.aip.org/fyi/2003/059.html

Alawiye, O. (2003). Constructivism and elementary preservice science teacher preparation: Knowledge to application. *College Student Journal, 37,* 334.

A Nation At Risk. (1993, April). *The imperative for educational reform: An open letter to American people.* Retrieved October 21, 2007, http://www.ed.gov/pubs/NatAtRisk/index.html

American Society for Information Science and Technology. (2008). *History of ASIS&T: 1970s--the move to online information.* Retrieved January 19, 2008, from http://www.asis.org/history.html

Banilower, E. R. (2006). *Report of the 2000 national survey of science and mathematics education.* Retrieved March 30, 2007, from http://2000survey.horizon-research.com/reports/status/complete.pdf

Berliner, D.C., & Biddle, B. J. (1995). *The manufactured crisis: Myths, fraud, and the attack on America's public schools.* Reading, MA: Addison-Wesley.

Bianchini, J. A., Cavazus, L. M., & Helms, J.V. (2000). From professional lives to inclusive practice: Science teachers and scientists views of gender and ethnicity in science education. *Journal of Research in Science Teaching, 37,* 516.

Bracey, G. W. (1997). Many visions, many aims, one test. *Phi Delta Kappan, 78*, 411.

Bryan, J. A. (2006). Assessment results following inquiry and traditional physics laboratory activities. *Journal Of College Science Teaching, 35,* 56-61.

BSCS: Curriculum Development. (2006). *BSCS biology: An ecological approach* (Green Version, 10th ed.). Dubuque, IA: Kendall Hunt.

BSCS: Projects and Partnership. (2007). *BSCS biology: A human approach program*. Retrieved June 12, 2007, from http://www.bscs.org/about/projects.html

Center of Excellence in Math and Science Education. (2007). *Reaching for excellence in middle and high school science teaching workshop* [Brochure]. Johnson City, TN: ETSU.

Chandra, M. V. (2003, October 17). Science piques imagination. *Denver Rocky Mountain News* [Online]. Retrieved June 10, 2007, from http://www.rockymountainnews.com/news/2003/oct/17/science-piques-imagination/

Clark, M., Dawkins, K., & Horne, C. (2006). Using science kits to construct content understandings in elementary schools. *Journal Of Elementary Science Education, 18,* 43.

Clough, M. (1992). Research is required reading. *The Science Teacher, 11,* 37.

Cochran, K. F. (1997). *Pedagogical content knowledge: Teachers' integration of subject matter pedagogy, students, and learning environment*. Retrieved March 31, 2007, from http://www.narst.org/publications/research/pck.cfm

Constructivist Theories. (2008). *From theories to practice*. Retrieved February 16, 2008, from http://starfsfolk.khi.is/solrunb/construc.htm

CTB/McGraw-Hill. (2007). *How is the normal curve equivalent (NCE) intended to be used?* Retrieved December 18, 2007, from http://writingroadmap.com/static/about_assessment/popup_faq5.jsp

Daston, L. (2005). Fear and loathing of the imagination in science. *Daedalus*, *134,* 16-30.

Dean, C. (2005, May, 4). *National academy of science elects 19 women, a new high. New York Times* [Online]. Retrieved July 6, 2007, from http://www.nytimes.com/2005/05/04/science/04women.html

Dickinson, D.K., & Neuman, S. B. (2006). *Handbook on early literacy research*. New York: Guilford Press.

Dwight D. Eisenhower Presidential Library. (n. d.). *Sputnik and the space race*. Retrieved December 27, 2007, from http://www.eisenhower.utexas.edu/dl/Sputnik/Sputnikdocuments.html

Ed.gov: MSP. (2007a). *Mathematics and science partnerships*. Retrieved February 11, 2008, from http://.ed.gov/programs/mathsci/index.html

Ed.gov: NCLB. (2007b). *No child left behind*. Retrieved February 16, 2008, from http://answers.ed.gov/cgi-bin/education.cfg/php/enduser/std_adp.php?p_faqid=4

Ed.gov: News. (2004). *U.S. students show improvement in international mathematics and science assessment*. Retrieved January 2, 2008, from, http://www.ed.gov/news/pressrelease/2004/12/12142004.html

Falling behind. (2000, December 12). *The Record* (Bergen County, NJ), p. 4.

Garet, M.S., Porter, A.C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38,* 934.

Gilbert, S. (1997). Status report on certification and accreditation in science education (CASE) project. *The Association for the Education of Teachers in Science Newsletter, 31*, 6.

Gulati, S. (2004). *Constructivism and emerging online learning pedagogy: A discussion for formal to acknowledge and promote the informal.* Retrieved February 17, 2008, from http://www.leeds.ac.uk/educol/documents/00003562.htm

Heady, J. E. (1997). Journey toward better teaching in introductory biology. *College Teaching, 45,* 123.

Hendricks, C. C. (2001). Teaching causal reasoning through cognitive apprenticeship: What are results from situated learning? *The Journal Of Educational Research, 94,* 302-311.

Herlinger, C. (2006). Between science and religion. Retrieved February 18, 2008, from http://www.pbs.org/wnet/religionandethics/week930/exclusive.html

Huitt, W., & Hummel, J. (2003). *Piaget's theory of cognitive development*. Educational Psychology Interactive. Valdosta State University (Georgia). Retrieved December 18, 2007, from http://chiron.valdosta.edu/whuitt/col/cogsys/piaget.html

Institutional Assessment and Studies. (2004). *Reports: Scientific reasoning competency*. Retrieved January 21, 2008, from http://www.web.virginia.edu/iaas/reports/subject/competencies/science.htm

Johnson, H.C. (1990). *How can the curriculum and evaluation standards for school science and mathematics be realized for all students? Best practice: Research and teacher practice.* Retrieved April, 12, 2007, from http://www.scimathmn.org/frameworks_science_2.pdf

Kelley, M. (2006, March 24). Report: U.S. missile science slumping. *USA Today*, p. A8.

Klein, P. S. (2004). Computers for cognitive development in early childhood: The teacher's role in the computer learning environment. *Information Technology In Childhood Education Annual,* 97-119.

Kulm, G., Capraro, R.M., & Capraro, M. M. (2007). Learning from the history of mathematics and science education. *School Science And Mathematics, 2*, 23-48.

Lawrenz, F. (2003). Relationship between professional development, teachers' instructional practices, and the achievement of students in science and mathematics. *School Science And Mathematics, 12,* 11.

Launius, R. D. (2007). *Sputnik and the origins of the space age*. Retrieved December 27, 2007, from http://history.nasa.gov?sputnik/sputorig.html

Lederman, N. G. (1992). Students and teachers conceptions of the nature of science: A review of the research. *Journal of Research in Science Teaching, 29,* 342.

Lee, M. M. (1998). Gender differences in young adolescents' mathematics and science achievement. *Childhood Education, 74*, 168.

Luna, D., Borjian, A., & Conrad, R. (2005). No child left behind: Who wins? Who loses? *Social Justice, 32,* 56.

Martin, M. O., Mullis, I. V. S., Gonzalez, E. J., & Chrostowski, S. J. (2004). *TIMSS 2003 international science report, trends in international mathematics and science study at the fourth and eighth grades*. Boston, MA: Boston College.

Margolis, J., & Fisher, A. (2003). *Unlocking the clubhouse: Women in computing*. Cambridge, MA: MIT Press.

Math and Science Partnership Program. (2008). *Program solicitation*. Retrieved January 21, 2008, from http://www.nsf.gov/pubs/2008/nsf08525.htm

McKenzie, J. (2003). Pedagogy does matter. *Education Technology, 13,* 1.

Michigan Department of Education. (2006). *Mathematics and science partnership program.* Retrieved October 22, 2007, from http://www.michigan.gov/mde/0,1607,7-140-5236-76544--,00.html

NAEP. (2005a). *Fourth grade: Overall, district performance is comparable to that of large central cities nationwide*. Retrieved December 18, 2007, from http://nces.ed.gov/nationsreportcard/pdf/dst2005/2007453_2.pdf

NAEP. (2005b). *Eighth grade: Many districts' overall performance similar to large central cities performance; some do better*. Retrieved December, 18, 2007, from http://nces.ed.gov/nationsreportcard/pdf/dst2005/2007453_4.pdf

NAEP. (2005c). *National trends: Average science scores in 2005 higher in 4th grade*. Retrieved December 17, 2007, from http://nationsreportcard.gov/science_2005/

NAEP. (2005d). *National trends: Average science scores in 2005 unchanged in 8th grade*. Retrieved December 19, 2007, from http://nationsreportcard.gov/science_2005/s0102.asp?tab_id=tab1&subtab_id=Tab_1&print

National Academies of Science. (2007). *About the national of academies of science.* Retrieved July 1, 2007, from http://www.nasonline.org/site/PageServer?pagename=ABOUT_main_page

National Science Education Standards. (2007). *Standards: Why national educational standards.* Retrieved July, 28, 2007, from http://www.nap.edu/readingroom/books/nses/1.html

National Science Foundation. (2002). *NAEP: Elementary and secondary education, trends in performance by sex*. Retrieved June, 21, 2007, from http://www.nsf.gov/statistics/seind02/c1/c1s1.htm

National Science Foundation. (2006). *Math and science partnership*. Retrieved March 5, 2007, from http://www.nsf.gov/pubs/2006/nsf06539/nsf06539.htm

National Science Foundation. (2008). *About the national science foundation*. Retrieved February 16, 2008, from http://www.nsf.gov/about/

Neu, T. W., Baum, S. M., & Cooper, C. R. (2004). Talent development in science: A unique tale of one student's journey. *Journal of Secondary Gifted Education, 16,* 19.

Pasley, J. (2002). The role of instructional materials in professional development: Lessons learned from the LSC community. Retrieved May 17, 2007, from http://www.horizonresearch.com/LSC/news/pasley2002.php

Pearl, J. (2002). Reasoning with cause-and-effect. *Al Magazine, 23*, 95–111.

Pearson Educational Measurement Group. (2008). *What is a scaled score, and what does it mean?* Retrieved February 11, 2008, from http://www.pearsonedmeasurement.com/research/faq_2e.htm

PISA. (2006). *Science competencies for tomorrow's world, executive summary.1*. Retrieved December 21, 2007, from http://www.oecd.org/dataoecd/15/13/39725224.pdf

Powell, K., & Wells, M. (2001). The effectiveness of three experiential teaching approaches on students' science learning in fifth-grade public school classrooms. *Journal Of Environmental Education, 33,* 33-38.

Project Wild. (2007). *Conserving wildlife through education: Linking students and wildlife*. Retrieved June 11, 2007, from http://www.projectwild.org/history.htm

Ravin, T., Kessenich, M., & Morrison, F. (2004). A mediation model of the association between socioeconomic status and three- year-old's language ability: The role of parenting factor. *Early Childhood Research Quarterly, 19,* 4.

Rhoton, J. (2001). School science reform: An overview and implications for the secondary school principal. *NASSP Bulletin, 85,* 16-17.

Root-Bernstein, R., & Root-Bernstein, M. (2001). *Sparks of genius: The 13 thinking tools of the world's most creative people.* New York: Houghton Mifflin.

Rozman, M., & Potter, W. (2004). Gender differences in learning constructs, shifts to learning constructs and their relationship to course achievement in a structured inquiry, year long college physics for life majors. *School Science and Mathematics, 104,* 288.

Ruby, A. (2006). *Improving science achievement at high-poverty urban middle schools* Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools.

Schaefer, D. L. (2002). Montaigne, Tocqueville, and the politics of skepticism. *Perspectives On Political Science, 31,* 204–212.

Schank, P., & Kozma, R. (2002). Learning chemistry through the use of a representation-based knowledge building environment. *Journal Of Computers And Mathematics And Science Teaching, 21*, 253–256.

Scientific Reasoning. (2008). MODULE: Scientific Reasoning. Retrieved January 21, 2008, from http://philosophy.hku

Shulman, L.S. (1996). Those who understand: Knowledge growth in teachers. *Educational Research, 15,* 8.

Tableman, B. (2004). Characteristics of effective elementary schools in poverty areas. *Best Practices Beliefs, 29,* 3.

Technical Education Research Center. (2007). *Educator and school system support*. Retrieved July 5, 2007, from http://www.terc.edu/ourwork/51.html

Tennessee Department of Education. (2008). *What is the tcap achievement test?* Retrieved February 16, 2008, from http://www.state.tn.us/education/assessment/tsachfaq.shtml

The White House. (2007). *Math and science partnerships: A quality teacher in every classroom*. Retrieved March, 25, 2007, from http://www.whitehouse.gov/infocus/education/teachers/sect2-5.html

TIMSS. (2007). *Science framework overview: Cognitive domain*. Retrieved December 21, 2007, from http://isc.bc.edu/TIMSS2007/about.html

Tindal, T., & Hamil, B. (2004). Gender disparity in science education: The cause, consequence, and solutions. *Journal of Education, 125,* 2.

TIP: Theories. (2007). *Social development theory: L. Vygotsky*. Retrieved December 19, 2007, from http://tip.psychology.org/vygotsky.html

Truman, L., Davis, F. L., & Thompson, K. (2000). Support for on-line teaching and learning. *Education Quarterly, 23,* 50.

Turner, S. L., Stewart, J.C., & Lapan, R. T. (2004). Family factors associated with sixth-grade adolescents' math and science career interests. *Career Development Quarterly, 53,* 41-52.

University of California: Lawrence Hall of Science. (2003). *FOSS: Science, curriculum-support, resources, and fun activities*. Retrieved June 9, 2007, from http://www.fossweb.com

U.S. Department of Agriculture. (n.d.). *National school lunch program*. Retrieved February 16, 2008, from http://www.fns.usda.gov/cnd/lunch/

U.S. Department of Education. (2007). *Mathematics and science partnerships*. Retrieved March 2, 2007, from http://www.ed.gov/programs/mathsci/index.html

Vergano, D. (2006, February 9). U.S. could fall behind in global ‘brain race’ initiatives aim to boost science, math education. *U.S.A. Today* [Online]. Retrieved December 18, 2007, from http://www.usatoday.com/educate/college/careers/Hot/2-9-06c.htm

Wheeler, G. (2006). Ten years of science education standards and the roadmap to success. *School Science And Mathematics, 106,* 169.

Widhalm, S. (2005, October 3). Female equations; math, science institutions confront male dominance. *The Washington Times*, p. A6..

Wilson, C. (1997). *Race, income, and test scores: A structure model of the determinants of test scores in Toledo elementary schools*. Newark, DE: Department of Political Science, Public Administration, and the Urban Affairs Center.

World Health Organization. (2008). *Gender*. Retrieved February 16, 2008, from http://www.who.int/topics/gender/en/

APPENDICES

APPENDIX A

Descriptive Statistics for Test Data 2004-2005

School Code-County/School 2004-2005

Code	Frequency	Percent	Valid Percent	Cumulative Percent
11.00	85	14.3	14.3	14.3
12.00	52	8.8	8.8	23.1
13.00	258	43.4	43.4	66.5
14.00	19	3.2	3.2	69.7
15.00	93	15.7	15.7	85.4
16.00	87	14.6	14.6	100.0
Total	594	100.0	100.0	

Teacher Code-County/School/Teacher 2004-2005

Code	Frequency	Percent	Valid Percent	Cumulative Percent
111.00	85	14.3	14.3	14.3
121.00	52	8.8	8.8	23.1
131.00	131	22.1	22.1	45.1
132.00	127	21.4	21.4	66.5
141.00	19	3.2	3.2	69.7
151.00	65	10.9	10.9	80.6
152.00	28	4.7	4.7	85.4
161.00	64	10.8	10.8	96.1
162.00	23	3.9	3.9	100.0
Total	594	100.0	100.0	

Actual Grade of Student 2004-2005

Grade	Frequency	Percent	Valid Percent	Cumulative Percent
4.00	75	12.6	12.6	12.6
5.00	85	14.3	14.3	26.9
6.00	83	14.0	14.0	40.9
7.00	196	33.0	33.0	73.9
8.00	127	21.4	21.4	95.3
9.00	28	4.7	4.7	100.0

Total	594	100.0	100.0	

NCE Test Statistics 2004-2005

N=594	NCE Score for preceding Spring	NCE Score for current year
Mean	55.10	60.44
Median	54.50	59.00
Mode	58.00	45.00(a)
Std. Deviation	17.87	20.16
Skewness	.181	-.059
Std. Error of Skewness	.100	.100
Kurtosis	-.242	-.139
Std. Error of Kurtosis	.200	.200
Range	91.00	98.00

a Multiple modes exist. The smallest value is shown

Proficiency on NCE Pretest 2004-2005

	Frequency	Percent	Valid Percent	Cumulative Percent
Not Proficient	135	22.7	22.7	22.7
Proficient	313	52.7	52.7	75.4
Advanced	146	24.6	24.6	100.0
Total	594	100.0	100.0	

Proficiency on Posttest 2004-2005

	Frequency	Percent	Valid Percent	Cumulative Percent
Not Proficient	78	13.1	13.1	13.1
Proficient	297	50.0	50.0	63.1
Advanced	219	36.9	36.9	100.0
Total	594	100.0	100.0	

Socioeconomic Status of Students 2004-2005

	Frequency	Percent	Valid Percent	Cumulative Percent
Free Lunch	369	62.1	62.1	62.1
No Free Lunch	225	37.9	37.9	100.0
Total	594	100.0	100.0	

Sex of Students 2004-2005

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	303	51.0	51.0	51.0
Female	291	49.0	49.0	100.0
Total	594	100.0	100.0	

English Proficiency of Students 2004-2005

	Frequency	Percent	Valid Percent	Cumulative Percent
Limited English	3	.5	.5	.5
Native English	591	99.5	99.5	100.0
Total	594	100.0	100.0	

Special Education (non-Gifted/Talented) 2004-2005

	Frequency	Percent	Valid Percent	Cumulative Percent
Special Ed Student	66	11.1	11.1	11.1
Non-SpecEd or Gifted/Talented	528	88.9	88.9	100.0
Total	594	100.0	100.0	

Ethnic Background of Student 2004-2005

Race	Frequency	Percent	Valid Percent	Cumulative Percent
White	581	97.8	97.8	97.8
Black	3	.5	.5	98.3
Hispanic	7	1.2	1.2	99.5
Native American	2	.3	.3	99.8
Other	1	.2	.2	100.0
Total	594	100.0	100.0	

APPENDIX B

Descriptive Statistics for Test Data 2005-2006

School Code-County/School 2005-2006

Code	Frequency	Percent	Valid Percent	Cumulative Percent
11.00	121	25.6	25.6	25.6
12.00	205	43.3	43.3	68.9
13.00	10	2.1	2.1	71.0
14.00	53	11.2	11.2	82.2
15.00	53	11.2	11.2	93.4
16.00	31	6.6	6.6	100.0
Total	473	100.0	100.0	

Teacher Code-County/School/Teacher 2005-2006

Code	Frequency	Percent	Valid Percent	Cumulative Percent
111.00	31	6.6	6.6	6.6
112.00	30	6.3	6.3	12.9
113.00	60	12.7	12.7	25.6
121.00	102	21.6	21.6	47.1
122.00	103	21.8	21.8	68.9
131.00	10	2.1	2.1	71.0
141.00	53	11.2	11.2	82.2
151.00	53	11.2	11.2	93.4
161.00	31	6.6	6.6	100.0
Total	473	100.0	100.0	

Actual Grade of Student 2005-2006

Grade	Frequency	Percent	Valid Percent	Cumulative Percent
5.00	156	33.0	33.0	33.0
6.00	112	23.7	23.7	56.7
7.00	61	12.9	12.9	69.6
8.00	144	30.4	30.4	100.0
Total	473	100.0	100.0	

NCE Test Statistics 2005-2006

N=473	NCE Score for preceding Spring	NCE Score for current year
Mean	54.00	53.08
Median	53.00	53.00
Mode	50.00	59.00
Std. Deviation	15.91	16.85
Skewness	.146	.281
Std. Error of Skewness	.112	.112
Kurtosis	.124	.138
Std. Error of Kurtosis	.224	.224
Range	98.00	98.00

Proficiency on Pretest 2005-2006

	Frequency	Percent	Valid Percent	Cumulative Percent
Not Proficient	67	14.2	14.2	14.2
Proficient	310	65.5	65.5	79.7
Advanced	96	20.3	20.3	100.0
Total	473	100.0	100.0	

Proficiency on Posttest 2005-2006

	Frequency	Percent	Valid Percent	Cumulative Percent
Not Proficient	86	18.2	18.2	18.2
Proficient	294	62.2	62.2	80.3
Advanced	93	19.7	19.7	100.0
Total	473	100.0	100.0	

Socioeconomic Status 2005-2006

	Frequency	Percent	Valid Percent	Cumulative Percent
Free Lunch	287	60.7	60.7	60.7
No Free Lunch	186	39.3	39.3	100.0
Total	473	100.0	100.0	

Sex of Students 2005-2006

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	243	51.4	51.4	51.4
Female	230	48.6	48.6	100.0
Total	473	100.0	100.0	

English Proficiency 2005-2006

	Frequency	Percent	Valid Percent	Cumulative Percent
Native English	473	100.0	100.0	100.0

Special Education (non-Gifted/Talented) 2005-2006

	Frequency	Percent	Valid Percent	Cumulative Percent
Special Ed Student	46	9.7	9.7	9.7
Non-SpecEd or Gifted/Talented	427	90.3	90.3	100.0
Total	473	100.0	100.0	

Ethnic Background of Student 2005-2006

Race	Frequency	Percent	Valid Percent	Cumulative Percent
White	461	97.5	97.5	97.5
Black	3	.6	.6	98.1
Hispanic	6	1.3	1.3	99.4
Native American	2	.4	.4	99.8
Other	1	.2	.2	100.0
Total	473	100.0	100.0	

APPENDIX C

Descriptive Statistics for Test Data 2006-2007

School Code-County/School 2006-2007

Code	Frequency	Percent	Valid Percent	Cumulative Percent
11.00	11	8.6	8.6	8.6
12.00	52	40.6	40.6	49.2
13.00	39	30.5	30.5	79.7
14.00	8	6.3	6.3	85.9
15.00	18	14.1	14.1	100.0
Total	128	100.0	100.0	

Teacher Code-County/School/Teacher 2006-2007

Code	Frequency	Percent	Valid Percent	Cumulative Percent
111.00	11	8.6	8.6	8.6
121.00	52	40.6	40.6	49.2
131.00	39	30.5	30.5	79.7
141.00	8	6.3	6.3	85.9
151.00	18	14.1	14.1	100.0
Total	128	100.0	100.0	

Actual Grade of Student 2006-2007

Grade	Frequency	Percent	Valid Percent	Cumulative Percent
5.00	102	79.7	79.7	79.7
6.00	18	14.1	14.1	93.8
8.00	8	6.3	6.3	100.0
Total	128	100.0	100.0	

NCE Test Statistics 2006-2007

N=128	NCE Score for preceding Spring	NCE Score for current year
Mean	60.53	63.28
Median	59.50	62.50
Mode	39.00(a)	58.00
Std. Deviation	18.01	20.23
Skewness	.180	-.180
Std. Error of Skewness	.214	.214
Kurtosis	-.501	-.505
Std. Error of Kurtosis	.425	.425
Range	75.00	88.00

a Multiple modes exist. The smallest value is shown

Proficiency on Pretest 2006-2007

	Frequency	Percent	Valid Percent	Cumulative Percent
Not Proficient	8	6.3	6.3	6.3
Proficient	71	55.5	55.5	61.7
Advanced	49	38.3	38.3	100.0
Total	128	100.0	100.0	

Proficiency on Posttest 2006-2007

	Frequency	Percent	Valid Percent	Cumulative Percent
Not Proficient	14	10.9	10.9	10.9
Proficient	57	44.5	44.5	55.5
Advanced	57	44.5	44.5	100.0
Total	128	100.0	100.0	

Socioeconomic Status 2006-2007

	Frequency	Percent	Valid Percent	Cumulative Percent
Free Lunch	78	60.9	60.9	60.9
No Free Lunch	50	39.1	39.1	100.0
Total	128	100.0	100.0	

Sex of Students 2006-2007

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	72	56.3	56.3	56.3
Female	56	43.8	43.8	100.0
Total	128	100.0	100.0	

English Proficiency 2006-2007

	Frequency	Percent	Valid Percent	Cumulative Percent
Native English	128	100.0	100.0	100.0

Special Education (non-Gifted/Talented) 2006-2007

	Frequency	Percent	Valid Percent	Cumulative Percent
Special Ed Student	9	7.0	7.0	7.0
Non-SpecEd or Gifted/Talented	119	93.0	93.0	100.0
Total	128	100.0	100.0	

Ethnic Background of Student 2006-2007

Race	Frequency	Percent	Valid Percent	Cumulative Percent
White	126	98.4	98.4	98.4
Hispanic	2	1.6	1.6	100.0
Total	128	100.0	100.0	

VITA

KEVIN WARD

Personal Data: Date of Birth: April 28, 1961
Place of Birth: Washington County, Tennessee
Marital Status: Married

Education: Milligan College, Johnson City, Tennessee;
Economics and Business Administration, B.S. Degree;
Psychology, Minor;
1983

East Tennessee State University, Johnson City, Tennessee;
Education Administration and Supervision, Masters Degree;
1996

East Tennessee State University, Johnson City, Tennessee;
Educational Leadership and Policy Analysis, Ed.D.;
2008

Professional Experience: Hampton High School, Hampton, Tennessee;
Teacher: Economics and Psychology;
1990 – 1996

Hampton Elementary School, Hampton, Tennessee;
Principal;
1996 – 1999

Carter County Board of Education, Elizabethton, Tennessee;
Middle Schools Supervisor;
1999 – 2007
Non-Certified Personnel Supervisor and Facilities Director;
2007 - Present