Abstract

BLUE, CARL NELSON. The Affects of Standards-based Communication Technology Education Units on the Achievement of Selected Standards for Technological Literacy by Middle and High School Students in Technology Education. (Under the direction of Richard E. Peterson.)

At a national level, new instructional units for the middle and high school Technology Education classroom were disseminated and field-tested by the TECH-know Project, the National Science Foundation funded program (NSF). North Carolina State University, the Technology Student Association (TSA), and the Departments of Public Instruction of North Carolina, Florida, Oklahoma, and Virginia were partnered to create, pilot, revise, and distribute student-centered instructional materials that are based on TSA activities. These activities and curriculum materials were correlated with the *Standards for Technological Literacy* as identified by the *Technology for All Americans Project* (ITEA, 2000). Core science, mathematic, and technology education concepts and principles were identified and embedded into these instructional units. An assessment was developed to determine the effects of standards based education on a purposeful sample of Technology Education classrooms. For the purpose of this study, research focused on the four TECH-know Project's communication technology education units of instruction. 1) *Cyberspace Pursuit* is a middle school unit that explores technologies related to the Internet and webpage developments. 2) *Digital Photography* is a middle school unit that explores the technologies and concepts behind electronic imaging. 3) *Desktop Publishing* is a high school unit that explores technologies related to digital printing. 4) *Film Technology* is a high school unit that explores the technology behind digital video and concepts for video production. These four instruments were measured by means of student pretest and posttest content knowledge.

Criterion-referenced tests (CRT) were developed within the course of the TECH-know Project's expert content development and pilot testing. Conclusions on inferential statistical methods on the administered CRT data provided positive results in regards to students' scores in science, mathematics, and technology content. An analysis of data ascertained the variables that influenced on student’s scores. Conclusions found that the TECH-know instructional materials, gender, and grade level had significant influence on student gains in knowledge of technology, mathematics, and science content. Descriptive statistical methods summarized data collected on student’s access to communication technologies outside the classroom. An analysis of data ascertained the variables that influenced on student’s scores. Conclusions based on analysis of variance for control pretest group in this study found that access to certain communication technologies had significant influence on specific student scores at the control pretest treatment stage and at posttest treatment stage based on grade level, gender, and material content.

THE AFFECTS OF STANDARDS-BASED COMMUNICATION TECHNOLOGY EDUCATION UNITS ON THE ACHIEVEMENT OF SELECTED STANDARDS FOR TECHNOLOGICAL LITERACY BY MIDDLE AND HIGH SCHOOL STUDENTS IN TECHNOLOGY EDUCATION

By

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DEDICATION

This dissertation is first dedicated to my parents, Georgie and Nelson Blue for providing me with the foundational values and nurturing my lifelong aspirations with their steadfast confidence and encouragement over the years. I additionally would like to thank my Chair, Richard Peterson and fellow members of my doctoral committee, Aaron Clark, Bill DeLuca, and Lisa Grable, as well as the departmental professors, and student colleagues for their support they have provided in this accomplishment in my professional development. And finally, I will like to offer much overdue appreciation to my all my earlier colleagues and professors who encouraged and supported my pursuit of my doctoral studies from Appalachian State University, especially Brenda Wey, Erin Kirby, and Jamie Goodman.

BIOGRAPHY

Born Carl Nelson Blue, January 3rd, 1962 in Pinehurst, North Carolina to his parents Georgie and Nelson Blue of West End, North Carolina. Carl attended Moore County public school until graduation in 1980 from Pinecrest High School where he concentrated studies in art, graphics, and communications. Carl attended Appalachian State University in Boone, NC, majoring in Communication Broadcasting and Graphic Design. He finished in 1985 with a BS in Communications and concentrating in Graphic Design and a minor in Sociology. After relocating and working three years in Charlotte, NC in newspaper graphics and television production, Carl relocated in early 1989 to Honduras, Central American as a US Peace Corps Volunteer in vocational education and small business development where he lived and worked in San Pedro Sula, Vale de Angeles, and Tegucigalpa. In 1991 he was relocated to Montevideo, Uruguay, South America with the Peace Corps to assist with the re-opening of the program after a nineteen-year closure along with five other volunteers. His responsibilities included working with the government ministries, and assisting the directors and staff in preparing the program for new volunteer arrivals later that year. In May of 1992 he returned to Charlotte, North Carolina. In September that same year he was hired as the Communications Specialist for the Virkler Company, an international textile chemical producer of products and systems for the apparel and hosiery industries. His major responsibilities included creation of marketing and sales literature; assisting in developing in-house communications and publications; and traveling and managing domestic and international industry textile trade shows. In 1997 he was relocated to Dominican Republic for the Virkler Company to establish and develop warehouse and distribution for textile products in the country's free zones. After launching Virkler, SA, hiring staff and achieving break-even business sales, in 1999 he returned to USA to pursue educational academic interests. In the fall of 1999 he returned to Appalachian State University (ASU) for Master of Arts in Industrial Technology. At ASU he was a teaching assistant in Graphic Arts and Imaging Technology program, and graduated in 2001 with a concentration in Technical Communications. That same year he was hired by ASU's Information Technology Services as the University Associate Webmaster for the goal of assisting in the redesign of the University's website as well as training and assisting in web design and use of communication technologies for campus departments and their faculty and staff. In 2003 he left ASU to pursue doctoral degree at North Carolina State University (NCSU) in the College of Education, Department of Math, Science and Technology Education. At NCSU he was a teaching assistant in communication technologies and a research assistant on the TECH-know Project, a National Science Foundation (NSF) funded project that developed 20 middle and high school instructional units based on Technology Student Association competitive events with the purpose of incorporating standards based co-curricular initiatives in science, math, and technological literacy. In addition, he also worked as research assistant on a second NSF project, the VisTE Project that developed middle and high school instructional units for the purpose of promoting scientific visualization and standards based co-curricular initiatives in science, math, and technological literacy. In May of 2006 he graduated from NCSU's College of Education Doctoral Program in Technology Education with a minor in Curriculum and Instruction.

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This research could not be accomplished with the acknowledgements that should include all the pilot study work done by Dr. Richard Peterson, Tom Shown and Dr. Jerianne Taylor, Jeremy Ernst and the entire TECH-know researchers, teachers, and writers. Appreciation includes, the North Carolina State University - College of Education and the Department of Math Science, and Technology Education for this opportunity, the Centre Pointe Learning Publishers for producing the finished materials, and the National Science Foundation for providing the grant's funding.

"The precursor to the pursuit of the holy grail of technological literacy is for technology education to take concrete steps to establish itself as an academic discipline… To become an academic discipline, technology education must specify four things. First, it will have to identify an intellectual domain consisting of a body of credible organized knowledge that is unique, is related to man's concerns in living, and is an array or ideas related in sequential fashion, Second, an academic discipline has a history of the organizing concepts that constitute its domain. Third, there must be a clear delineation of the modes of inquiry by which the discipline validates itself, creates new knowledge, and advances as a discipline. Finally, an academic discipline must be instructive; curriculum content must derive from its intellectual domain … It is not possible to define technological literacy, or measure it, in the absence of an agreed upon intellectual domain for technology education" (Waetjen, 1993, page 8).

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Introduction

The Twenty-First Century will require higher standards in education and greater accountability and achievement from teachers, schools, and their students beyond a minimal comprehension of reading, writing, and the ability to perform simple mathematics. These new requirements stem from recent U.S. Federal legislation. The 2002 Law, No Child Left Behind (2002) that has redirected educational thinking and put into place a set of standards and testing plans to ensure that higher standards are being met by 2014 (Meier & Wood, 2004). Because of these new standards, a proficiency in reading, mathematics, science and technology is considered one of America's fundamental concerns of accountability in our public schools. The primary goal of this research is to assess new co-curricular, standards-based materials developed for the 21st Century student with objectives for learning math, science and technology content.

In a 1991 Gallup Poll of American views on education, 68% polled favored a standardized national curriculum (Sykes, 1995). According to Charles Sykes' book, *Dumbing Down Our Kids*, the Gallup found that 77% polled favored schools in their communities to use national tests to measure academic achievement, and 85% favored to use standardized testing programs to measure student achievement in areas such as English, math, science, history, and geography to assess problem solving skills and writing skills (Sykes, 1995, and Ravitch 1995).

Standards

There is a long history of standards development in America, much of which is a result and response to changes in technologies, wars, and disasters. The history of standards is the histories of people agreeing on ways to improve materials, processes, and products as well as communicating that information to others. Over time standards have been accepted in many aspects of our lives. Standards govern construction, transportation, telecommunications, drinking water, food, air, medicine, and any profession that deals with their safety and standard of living (Ravitch, 1995).

Standards can refer to both the goals of what should be done, as well as the measurements of progress and quality toward that objective. Traditionally societies have developed methods (standards) of operation in order for its populace to live harmoniously within a society (Ravitch, 1995). "New members are made aware of codes of conduct deemed acceptable. Every society has a culture or a method of operating which is unique to it. To live harmoniously in a given culture, its members must be aware of the various codes of conduct that which are acceptable to that culture. It is through education that youth and new members are apprised of these facts." (Cummings, 1971, p.172)

In early nineteenth century America, the nation's diversity grew and community schools became the place of teaching a common language and civic values. It was considered society's responsibility to provide for the opportunities and objectives of an individual's education and assessment. It was the charge of schools to provide standards for college preparation, or develop a curriculum tailored and differentiated to meet the needs of the children (Ravitch, 1995).

Over time, the adoption and development of standards in education has been widely debated. Concerns include dispute over content taught as well as assessing the quality of teachers and instructional materials. The debate has been less over the need for standards and accountability, but rather what standards would best serve everyone (Ravitch, 1995).
Some scholars in education contend that standardization creates an environment where there is difficulty in holding people accountable or worse confounds the development of sound and useful standards (Ravitch, 1995). While others argue standards have significant promise for improving the quality of American public education. They defend that standards are considered critical in reducing educational inequalities where families have insufficient resources to support their children's education (Sykes, 1995).

The development of standards in education reflects the historical needs, as well as the politics of a nation. Historically, it is important to acknowledge those chronological influences in present-day educational standards-reform. Many of the standards that have been adopted by scholarly organizations of recent years were a result of a 1983 report, *A Nation at Risk,* prepared by the National Commission on Excellence in Education as requested by the US Secretary of Education (Peterson &West 2003). The National Council of Teachers of Mathematics (NCTM) as a response to the criticisms expressed in *A Nations At Risk* published national standards for math and science education in a goal to improve mathematic education for all students. Other scholarly associations followed this trend and developed and adopted standards in like response (Ravitch, 1995).

The American Association for the Advancement of Science (AAAS) in 1990 developed The *Benchmarks for Science Literacy- Project 2061*, which focused on these same educational reforms and recognized the importance of understanding technology.

Project 2061 identified certain technological abilities such as goals for all their students, and called for an understanding concepts and principals of technology that include design, control, and systems and also some important concepts about technology in specific areas such as materials, energy, and communication (Cajas, 2001).

In the 1990's, the International Technology Education Association (ITEA) developed a set of standards related to the study of technology (ITEA, 2000). Phase I was initiated through the development and publishing of *Technology for All Americans Project: A Rationale and Structure for the Study of Technology* (TfAAP, 1996). This consisted of the development of a rationale and structure for the study of technology and a process of developing the core of the standards followed.

In 2000, Phase II, the ITEA published the *Standards for Technological Literacy: Content for the Study of Technology* to promote a high level of achievement of technological literacy (ITEA, 2000).

In 2003, the final phase of TfAAP was completed with the release of Advancing Excellence in Technological Literacy (AETL): Student Assessment, Professional Development, and Program Standards (ITEA, 2003).

Technology Education

What is technology education, and why have standards been developed to address the needs for technological literacy? Technology education is the study of tools, processes, and systems by which humans modify nature to meet their needs and wants. "A study of technology provides an opportunity for students to learn about the processes and knowledge related to technology that are needed to solve problems and extend human capacities" (ITEA, 2000, p. 242).

Technological literacy encompasses the use of knowledge, ways of thinking and acting, and develops capabilities of using knowledge (NAE & NRC, 2002). "Technological literacy, like other forms of literacy, is what every person needs on order to be an informed and contributing citizen for the work of today and tomorrow "(ITEA, 2003, p. 10).

The Designed World

According to the ITEA's *Standards for Technological Literacy*, students will develop a better understanding of the social world around them. This Designed World includes all human-made systems that interrelate with one another (ITEA, 2000). In studying technology, students are provided with a classification system that sub-divides technology education into taxonomy of seven areas of study in Kindergarten through 12th grade (ITEA 2000).

1. Medical Technology: Students will develop an understanding of and be able to select and use medical technologies (ITEA, 2000, p. 141).
2. Agriculture and Biotechnologies: Students will develop an understanding of and be able to select and use agricultural and related biotechnologies (ITEA, 2000, p. 149).
3. Energy and Power Technologies: Students will develop an understanding of and be able to select and use energy and power technologies (ITEA, 2000, p. 158).
4. Transportation Technologies: Students will develop an understanding of and be able to select and use transportation technologies (ITEA, 2000, p. 175).
5. Manufacturing Technologies: Students will develop an understanding of and be able to select and use manufacturing technologies (ITEA, 2000, p. 182).
6. Construction Technologies: Students will develop an understanding of and be able to use and select construction technologies (ITEA, 2000, p. 191).

7. Communication Technologies: Students will develop an understanding and be able to use information and communication technologies (ITEA, 2000, p. 166).

Communication Technologies

The rationale in this study is focused on an evaluation of communication technology instructional materials and their objective of developing student's understanding and use of information and communication technologies. Communication technology as a curriculum has been consistently included in curriculum efforts of States that have adopted technology education–based programs (Robb and Jones 1990). The study of communication technology has been promoted, supported, and rationalized as part of technology education historically through numerous professional presentations, papers, workshops, meetings, and curriculum efforts (Robb and Jones 1990). It is important to research communication technologies curriculum's relevance and its acceptance by students as a valuable resource in preparing them for the future (Robb and Jones 1990). "Only sound, rational curriculum designs for technology education, has resulted from a focus on communication as one of the systems for human survival in the future" (Robb and Jones, p39). A well-developed technology education program is where students will develop an understanding and be able to use information and communication technologies (ITEA, 2000).

Relevance as Curriculum

Throughout the history of developing civilizations, technology is repeatedly cited as the key element to transformation and advancement. One of the unique ways in which technology has brought about social transformations is through revolutions in communications (Robb & Jones 1990). Communication systems have evolved since prehistoric times to serve the needs of new generations. While sophisticated modern

communication technology make it possible to communicate more efficiently, negative implications materialize and must be addressed and understood (Shanon 1990).
According to the Standards for Technological Literacy, “Because of the power of today’s technological processes, society and individuals need to decide what, how, and when to develop or use various technological systems. Since technological issues and problems have more than one available solution, decision-making should reflect the values of the people and help them reach their goals. Such decision making depends upon all citizens, both individually and collectively, acquiring a basic level of technological literacy– the ability to use, manage, and understand technology.” (TfAAP, 1996, STL, 2000, p.11)

A successful human society can be summed up in their capacity to communicate. How we communicate depends upon the creation of tools of communication so that people may communicate effectively and efficiently (Haynie & Peterson 1995). Communication technologies help us communicate and share information, thoughts and ideas (Sanders 1997). The use of technology has enhanced human communications and affects the numerous aspects of our daily lives, from enabling citizens to perform routine tasks, to requiring that they be able to make responsible, informed decisions that affect individuals, our society, and the environment (ITEA 2003).

The TECH-know Project

In 2001, North Carolina State University (NCSU) received a four-year grant from the National Science Foundation (NSF) for the TECH-know Project, a collaboration created from selected state departments, universities, and businesses, for the development of standards-based instructional materials centered on Technology Student Association (TSA) competitive activities. From 2001 until 2004, teachers from North Carolina, Virginia, Oklahoma, Pennsylvania, and Florida piloted and developed and selected TECH-know Units that were identified with the Standards for Technological Literacy, National Science Education Standards, Principles and Standards for School Mathematics, and TSA activities (Taylor, 2004). Initial research from pilot studies suggested that these materials showed an increase in students' understanding in science, technology and mathematics for virtually all populations as well as enhancing students' interest in these areas (Taylor, 2004).

In early 2005, twenty units (ten middle school and ten high school) were published and made commercially available through Centre Pointe Learning publishing. In Fall 2005 these materials were field-tested by a purposeful sample of twenty-two middle and high school technology education teachers from ten states (CO, CT, GA, KY, MS, NC, PA, SC, TN, WI). The model proposed that ten school districts would provide two field test sites. Selected teachers were required to field-test two units at the middle school or two at the high school level, during the fall of 2005. This field-test model necessitated at least twenty new TECH-know Project teachers were invited to participate in a professional develop workshop at NCSU during the summer of 2005. Those teachers selected for the field test had no prior exposure to the materials. For the purpose of future communication and assistance, an electronic forum was developed through the TECH-know website [www.ncsu.edu/techknow] to facilitate discussions between the new teachers, the state coordinators, and the experienced teachers and members of the TECH-know Project.

Professional Development in Technology Education

According to authors Bybee and Louks-Horsley in their article *Advancing technology education: the role of professional development*, "Professional development is a critical companion to, but not the same as the implementation of standards. Professional development will provide the opportunities for technology teachers and other educators to learn what they need to know and be able to do as they assist students in achieving the technological literacy standards." (Bybee & Louks-Horsley, 2000, pg 32).

It is important that teachers learn about and develop skills related to curriculum they are required to instruct. Teachers need opportunities to deepen their content knowledge and opportunities to learn about how to teach technology from advanced instructors. Teachers also need tools and opportunities to improve their own learning, and the motivation to do so (Bybee & Louks-Horsley, 2000).

Fernando Cajas discusses interactions of teaching science and technology and importance of professional development. Cajas stated, "To help students learn about technology, teachers will need resources and knowledge, high quality curriculum materials, professional development to improve their content and pedagogical knowledge, and opportunities to interact with other teachers. In addition, teachers will need to find ways to address the ideas and skills that make up technological literacy with the context of the subjects they teach. These interactions and collaborations will not take place until stakeholders recognize the importance of understanding technology" (Cajas, 2001, pg 726).

<u>TECH-know Units of Communication Technology</u>

Of the twenty units that have been developed for the TECH-know Project this study selected to focus on the four field-tested Communications Technology units because of an identified need to develop and research communications curriculum. Coursework in communication technology has been promoted, supported, and rationalized as part of technology education historically through numerous professional presentations, papers, workshops, meetings, and curriculum efforts (Robb and Jones 1990). It is important to research communication technologies curriculum's relevance and its acceptance by students as a valuable resource in preparing them for the future (Robb and Jones 1990).

The four field-tested units chosen incorporated both middle and high school classroom samples in five States (CO, CT, PA, SC, WI) four regions of the county in both rural and suburban settings. These four TECH-know units are:

1. *Cyberspace Pursuit*, a Middle School unit that explores technologies related to the Internet and webpage development.

2. *Desktop Publishing*, a High School unit that explores the technologies related to conventional and digital printing.

3. *Digital Photography*, a Middle School unit that explores the technologies and concepts behind electronic imaging.

4. *Film Technology*, a High School unit that explores the technology behind digital video and concepts for video production (Taylor, 2004).

These four areas of study encompass modern communication technologies. Since the invention of the printing in press in the early 20th Century along with language literacy programs, has allowed humankind to evolve and develop the more modern communication technologies of the computer and the Internet in the digital age of present day. This constant evolution of communication technologies enhances our capacity to understand their potential and ensure the success of a society is the cornerstone of mankind's future (Haynie & Peterson, 1995).

Statement of the Problem

A proficiency in reading, science, mathematics, and technology is considered one of America's fundamental concerns of accountability in our public schools (Wood, 2004). The Law, No Child Left Behind (2002) requires school programs, teachers and students to adhere to higher standards reading, science and mathematics by the year 2014 (Wood, 2004). Developing sound curriculum that promotes literacy in those areas is critical. Science and mathematics education are characterized as theoretical whereas technology education (TED) emphasizes constructive philosophies. The TECH-know Project developed co-curricular instructional materials that are closely aligned with foundational science and mathematics concepts. Their effectiveness will depend on marketing and dissemination nationally (Peterson, 2000).

It was the problem of this research to investigate the affects of standards-based communication technology education units on the achievement of selected standards for technological literacy by middle and high school students in technology education. This objective is consistent with the goals of No Child Left Behind (2002) and developing instructional materials that address America's fundamental concerns of accountability in our public schools.

An additional problem was to investigate whether access to communication technologies such as the Internet, video-computer games, and other digital equipment outside the classroom has any influence on a student's achievement in school. An investigation of research and literature in this area was essential to a better understanding of the role of communication technologies and the goals of education.

Rationale for Study

From 2001 until 2004, teachers from North Carolina, Virginia, Oklahoma, Pennsylvania, and Florida piloted and developed and selected TECH-know Units that were identified with the Standards for Technological Literacy, National Science Education Standards, Principles and Standards for School Mathematics, and TSA activities (Taylor, 2004).

According to Ernst, Taylor and Peterson in their 2005 article, *TECH-know: integrating engaging activities through standards based learning,* "Science, mathematics, and technology (SMT) literacy is vital to national interests, in particular to maintaining the economic health of the nation and the well being of its citizenry, making the success of SMT education especially important to everyone (Ernst, Taylor, & Peterson, 2005, pg 15).

Units	2002	2003
Cyberspace Pursuit	27%	36%
Desktop Publishing	20%	46%
Digital Photography	14%	54%
Film Technology	57%	82%

Figure 1.1 Percentage gains observed in overall scores in TECH-know pilot testing

During the pilot process, teachers administer pre-test, post-test, and student perception survey. The TECH-know Project collected data that supported the need for implementation and integration of these units in technology classroom across the country. Pre and post assessment by unit showed positive gains. Students also experienced positive gains in scientific, mathematical, and technological concepts in each TECH-know instructional unit (Ernst,Taylor, & Peterson, 2005). “Students were able to make connections to math, science and technology while enhancing their understanding of concepts embedding these activities (Ernst, Taylor, & Peterson, 2005, pg 17).

As shown in Figure 1.1, pilot testing results were considered favorable for field-testing the completed units. This research will determine if these results can be achieved with new teachers and students in a field test of completed Communication Technology units.

Questions to be answered

In this research on the affects of standards-based communication technology education units on the achievement of selected standards for technological literacy by student in middle and high technology education programs, there are five research questions that will be addressed.

1. Are students learning mathematics, science and technology content based on the pretest and posttest scores?
2. Does gender and grade level have an affect on students based on pretest and posttest scores?
3. Do teachers have an affect on students’ achievement based on pretest and posttest scores?
4. Do the communication technology units of instruction have an affect on students based on pretest and posttest scores?
5. Is there evidence that access to communication technologies outside the classroom has an affect on student pretest and posttest scores?

Research Methodology

It is essential to research communication technologies curriculum's relevance and its acceptance by students as a valuable resource in preparing them for the future (Robb and Jones 1990). The methodology for this study was comprised of an analysis of quantitative data collected from a stratified purposeful sample of technology education classrooms.
The four field-tested Communication Technology Units chosen incorporated both middle and high school classroom samples in five States (CO, CT, PA, SC, WI). These States are located in four distinct regions of the USA in primarily rural and suburban settings.

Pre-content knowledge was accessed through a twenty-five problem, criterion-referenced test (CRT), based on core science, mathematics, and technology concepts. The criterion-referenced tests (CRT) were developed within the course of the TECH-know Project's content development and pilot testing. Each CRT contained five science, five mathematics, and fifteen technology questions that were developed and reviewed by TECH-know's content experts.

The treatment was an application of the completed commercially available standards based curriculum TECH-know Units that had been developed over the past four years through a series of pilot testing and editing. The TECH-know Units have been identified with the Standards for Technological Literacy, National Science Education Standards, Principles and Standards for School Mathematics (Taylor, 2004).

A matching post-CRT followed to treatment to assess course content and related identified standards. This data was collected, retrieved and analyzed with a statistical significance set at an alpha [∂] of 95% confidence level and a probability P-value of 0.05

(Agresti & Finlay, 1997). The P-value probability was the primary reported result in this significant test.

In addition to the CRT data gathered from pretest and posttest scores, additional information was ascertained on student access to communication technologies outside of the classroom. ANOVA analyzes the relationship between the mean of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [α] of 95% confidence level and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests.

Research Methodology Overview

Population of Interest

The population of interest for this research includes students in middle school and high school Technology Education programs interested in Communication Technology Curriculum.

Sample

TECH-know materials were field-tested in 2005 by twenty-two middle and high school technology education classrooms from ten States (CO, CT, GA, KY, MS, NC, PA, TN, SC, WI). The selected field-test teachers had no prior exposure to the materials and were administered TECH-know training and participation in professional development workshop in Summer 2005.

Study's Sub-Sample for Research

Four Communication Technology field-tested units were chosen that incorporated both middle and high school classroom samples from five States (CO, CT, PA, SC, WI).

These classrooms are in four distinct regions of the county from both rural and suburban settings. These four TECH-know Communication Technologies Units were:

1. *Cyberspace Pursuit*, a Middle School unit that explores technologies related to the Internet and webpage development.
2. *Desktop Publishing*, a High School unit that explores the technologies related to conventional and digital printing.
3. *Digital Photography*, a Middle School unit that explores the technologies and concepts behind electronic imaging.
4. *Film Technology*, a High School unit that explores the technology behind digital video and concepts for video production.

<u>Research Rational</u>

A proficiency in reading, science, mathematics, and technology is considered one of America's fundamental concerns of accountability in our public schools (Wood, 2004). During the pilot process, teachers administered the pre-test, post-test, and student perception surveys. Pre and post assessments by unit showed positive gains. Students also experienced positive gains in scientific, mathematical, and technological concepts in each TECH-know instructional unit (Ernst, Taylor, & Peterson, 2005) The Law, No Child Left Behind (2002) requires school programs, teachers and students to adhere to higher standards reading, science and mathematics by the year 2014 (Wood, 2004).

<u>Treatment Rationale</u>

The TECH-know Project pilot phase collected data that supported the need for implementation and integration of these units in technology classrooms across the country (Ernst, Taylor, & Peterson, 2005). The treatment was an application of the completed commercially available standards based curriculum TECH-know Units that had been developed over the past four years through a series of pilot testing and editing. The TECH-know Units have been correlated with the Standards for Technological Literacy, National Science Education Standards, Principles and Standards for School Mathematics (Taylor, 2004).

Instruments

These CRT instruments were developed and validated individually by each unit's writers and developer's for content rationale and appropriateness, and altered only to reflect each unit's fruition during the piloting phase.

Process Questions For Communication Technology Units

- What are the overall student scores from each or the four pretest, and posttest instruments used for student's assessments?
- Was there evidence some units did better than others in overall student gains?
- Are there any comparable results in the different student subgroups (gender and grade level) per unit and or for the overall units?
- What are some of the teacher's demographics?
- What are some of the school's demographics?
- What are the student's demographics?
- What variables have statistical significance?

Statistics

To answer the research questions, quantitative data from the sample's pretest and posttest content will be analyzed through a series of paired and two-sample T-test statistics. In testing the null hypothesis, this research compared within-group variation for paired differences by using a t-test to examine errors in the before and after treatments looking for no effect at an alpha [α] of 95% confidence level and a probability with a P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in this significant test. A P-value found greater than 0.05, the null hypothesis is plausible and cannot reject. A P-value smaller than 0.05 constitutes rejecting the null hypothesis of no effect and concluding a variable had an affect on the outcome.

Additional quantitative and descriptive data was collected for subgroup evaluations on the affect of communication technology outside the classroom on student scores. In testing the null hypothesis, an analysis of variance [ANOVA] which analyzes the relationship between the mean of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [α] 95% confidence level and a probability with a P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests.

Limitations

The samples were limited to Technology Education middle and high school classrooms participating in the TECH-know Project's Communication Technology Education Units. These instructional units required classrooms and labs with access communication technologies: (i.e.) computers, access to the Internet, digital imaging and displaying equipment, printers, scanners, and associated materials.

Definition of Terms

ANOVA: a statistical method for making simultaneous comparisons between two or more means; a statistical method that yields values that can be tested to determine whether a significant relation exists between variables, analysis of variance. (Agresti & Finlay, 1997).

Communication Technology: (From Technology Education's Perspective) Communication technologies are the technological tools present within a society for people to communicate effectively and efficiently (ITEA, 2000).

No Child Left Behind Act (2002): An act of law passed by Congress and signed by President Bush in 2000 as a new education initiative to promote a yearly testing regime that leads to every child being proficient in reading, math, and science by 2014. The law sets new standards for students, teachers, and schools and boosts funding to help meet the new requirements. (Ravitch, 1995)

Standards: (From Technology Education's Perspective) a written statement that specifies the knowledge (what students should know) and the processes (what students should be able to do) students should possess in order to be technologically literate (ITEA, 2000, p. 242).

TECH-know Project: In 2001, North Carolina State University received a four-year grant from the National Science Foundation for the TECH-know Project, a collaboration created from selected state departments, universities, and businesses, for the development of standards-based instructional materials centered on Technology Student Association competitive activities. (Taylor, 2004)

Technological Literacy: (From Technology Education's Perspective) The ability to use, manage, understand, and assess technology as represented thought the standards and benchmarks in the document *Standards for Technological Literacy* (ITEA, 2000, p. 242).

Technology Education: A study of technology, which provides an opportunity for students to learn about the processes and knowledge related to technology that is need to solve problems and extend human capacities (ITEA, 2000, p. 242).

Technology: 1) Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capacities. 2) The innovation, change, or modification of the natural environment to satisfy the perceived human needs and wants (ITEA, 2000, p. 242).

Variables: Likely to change or vary; subject to variation; changeable. [1] (Dependent) The observed variable in an experiment or study whose changes are determined by the presence or degree of one or more independent variables; [2] (Independent) A manipulated variable in an experiment or study whose presence or degree determines the change in the dependent variable. (Agresti & Finlay, 1997).

Chapter One Summary

This chapter introduced the topic of research of an assessment of a selection of Communication Technology Units from the TECH-know Project, a National Science Foundation funded collaboration of co-curricular standards-based instructional materials centered on Technology Student Association competitive activities. The subsequent entries presented the problems and questions that are to be addressed in this research that include quantitative analysis of pretest and posttest scores, and characteristics of teachers, students, classrooms and access to communication technologies. The chapter also outlined the method of research that included proposed review of literature that includes a history of standards in education, communication technology education curriculum perspectives; available research on access to communication technology; and available literature on defining technological literacy. This chapter also outlined the purposeful collection of quantitative data from the field test sites on those selected communication units for the statistical analysis of pretest and posttest scores, and those evaluation and conclusions based on the characteristics of the teacher, students, grade level, and access to communication technologies outside the classroom. This chapter also provided a list of vocabulary terms on the selected statistical analysis, as well as academic terminology from Technology Education's perspective.

CHAPTER TWO

Introduction

This review of literature begins with a history of standards development in America. A history that is reflected in ordered developments that lead to current standards based curriculum research. Many disciplines within education embraced standards reform. Mathematics, Science, and Technology Education and their scholarly associations support similar missions to implement standards and promote technological literacy.

This review of literature continues with a focus on defining Technology Education's classification of technological systems. "The Designed World" is a classification of technological systems sub-divided into taxonomy of seven areas of study (ITEA, 2000). The review concentrates on the area of Communication Technology's curriculum development, classroom characteristics, and issues and concerns of access to communication technologies. This review of literature also examines several comparative studies of research on access to communication technologies in educational settings published by the University of Alabama (1997, & 2000), and Ohio University (1997). These reports investigated and surmised observations and concerns on the access to communication technologies' relationship to state and national academic goals, teachers' professional development, and defining curriculum integration in the schools and classrooms.

Review of Literature

History of Standards in Society

What are standards? A dictionary definition suggests two meanings derived from a mixture of English, French and German. Standards refer to a banner or an emblem of an army or fleet. Standards also refer to anything serving as a rule or basis of judgment, as well as a criterion that is authorized to measure quality or quantity (Random House, 1980, & Ravitch, 1995). The word standard refers to both the goals of what should be done and a measure of progress toward that goal (Ravitch 1995).

According to Diane Ravitech's book, National Standards in American Education: A Citizen's Guide, the author discussed that the first function of any standard is to transmit information from those who have the knowledge to those who need and use that knowledge (Ravitch, 1995). The history of standards is a history of people agreeing on ways to improve materials, processes, and products as well as communicating that information to people who need to know it (Ravitch, 1995). Much of the development in standards is a result and response to changes in technologies, wars, and disasters.

Standards that have been created for construction, transportation, telecommunications, drinking water, food, air, medicine, and any profession that deals with their safety and standards of living (Ravitch, 1995). Standards are created and perfected because they improve the quality of life. There is global trend to extend the reach of standards to facilitate communication and trade among societies (Ravitch, 1995).
There are several types of standards. Standards may be mandatory, as required by law, voluntary, as those set by private and professional organizations, or in effect, acting or existing in fact but without legal sanction and generally accepted by custom or convention (Ravitch 1995).

In education is it agreed upon that a standard is neither, useful or meaningful unless there is a means to measure whether a standard is reached. Ensuring that all children have access to schools that offer education of similar, high quality has been the initial motivation for the establishment of standards. Over the years standards have promoted various degrees of similarity in the quality of schooling. Standards are used in development of identical or similar textbooks, the specification of requirements for high school graduation or college entrance. Standards are utilized in achievement tests for promotions or college admissions, requirements in curriculum coursework, and the quality of teacher training (Ravitch 1995).

According to Bybee and Louks-Horsley in a article for advancing technology education and professional development, "Standards cannot directly change behavior or beliefs, but they can point the way by defining desirable goals, stimulating movement toward the goals, reducing the conflicts among the polices under which educators at each level labor." Standards create images of the different components of an educational system and how to align the system with the desired outcomes for students (Bybee & Louks-Horsley, 2000, page 31).

History of Standards in American Education

The development of public school education in America in the Nineteenth Century coincided with the influx of large immigrant populations from Ireland, Germany, and others European countries. As the nation's diversity grew, the schools became the place for teaching a common language and sharing civic values. Horace Mann, Secretary of Massachusetts's Board of Education promoted and championed the public's responsibility to provide an equal opportunity education. To accomplish Mann's vision the State had to play the greater role of monitoring access and quality. The effort to ensure equal access for all to a good education inevitably required the adoption of standards (Ravitch 1995).

After the American Revolution, Webster's "Blue-backed" speller provided the early nineteenth century classroom and many adult learners with a national standard-like resource for spelling and pronunciation. Soon thereafter, other competing textbooks were available in a variety of subjects. The uniformity found in many of these reading materials extended to classroom methods of teaching. American schools for the most part had content standards because of this uniformity of available materials. These classrooms even adopted a common vocabulary in which to gauge student performance though scales that ranged from A to F or 100 to 60 (Ravitch 1995).

At this time in history, no state or national testing system had yet been developed to ascertain student performance. College admission requirements provided the only reliable external standard for student performance in early America. The first admission requirements to Harvard in 1642 required the ability to read, write and speak fluent Latin and Greek verse and prose. The only significant addition to college curriculum for entrance requirements in colonial America was arithmetic for admissions to Yale in 1745 (Ravitch 1995).

The entrance requirements for college admissions varied enough to provide gratuitous dissatisfaction for the leaders of academies and secondary schools. Headmasters complained of a lack of standard requirements for students to learn specific texts or orations that were demanded by the colleges of their choice. By the late 19^{th} century, several associations were formed to promote closer relationships among the schools and colleges regarding unification of admission requirements (Ravitch 1995).

In 1892, the Committee of Ten was the first national panel established by the National Education Association to study the curriculum of high schools to establish new curriculum standards for high schools and alter the standards for admissions to colleges. The Committee contemplated four difficult issues that included an ongoing debate between classical curriculum and modern academic subjects such as science, history, and modern foreign languages. The Committee also considered ways to promote uniformity in preparing students for college. The Committee had to address the demands of educators to include practical courses such as manual training. And finally the Committee contemplated different course offerings for those students college bound from those who were not (Ravitch 1995). The results of the findings by the Committee of Ten's report ultimately prompted the creation of the College-Entrance Requirements as established by the National Educational Association (NAE). The NAE's mission and goals were to formulate a common framework for college preparation with proposals for high schools to adopt constraints or units to provide uniform measures for all courses of study (Ravitch, 1995)

A secondary movement in the 1890's sponsored by Harvard University sought to establish uniform standards for high school graduation and college entry. The result of their effort was the formulation of the College Entrance Examination Board (Board). The purpose of the Board was to create a universal examination system for college admissions. A problem that confronted the Board was reviewing standards in different subject areas and disciplines with a lack of interest amongst the various scholarly associations involved with secondary school teaching. The Board resolved to create its own committee of review for establishing requirements for the examination in each subject area. As a result, secondary schools were aware of what they needed to teach and their students needed to learn in order to prepare them for college entrance examinations (Ravitch, 1995).

The College Board provided a standard for college preparation, but many educators objected to the college domination. The result was the Commission on the Reorganization of Secondary Education (CRSE) sponsored by the National Education Association (NAE). The CRSE's 1918 report established a pattern of standards that ran counter to the academic emphasis of the Committee of Ten and the College Board. The CRSE members were drawn mainly from the world of professional education and colleges of education. The CRSE established committees for academic subjects, and also for industrial arts, household arts, vocational guidance, agriculture, and other non-academic concerns. The goal of these new standards was social efficiency rather than the intellectual development of all adolescents. Additionally there was a lack of commitment to the ideal of liberal learning. The report supported differentiated curriculums, including agriculture, business, clerical, industrial, fine arts, and household arts. The report also legitimized the practice of curricular tracking and diverting students into vocational programs and keeping them out of college preparatory programs (Ravitch 1995).

The reports of the Committee of Ten and the CRSE each claimed to be based on principles of a democratic society. The Committee of Ten believed all children should have equal access to of a common academic curriculum regardless of ancestry or intended vocation. The CRSE believed that curriculum should be tailored and differentiated to meet the needs of a society and the children. Eventually a compromise ensued that the principles of the Committee of Ten be applied to the academic track and the principles of the CRSE governed the vocational and general education tracks. In reality the CRSE's ideas won, not so much because of act of persuasion, but rather they provided a better fit for the difficulties facing the schools, the problems of mass education and of educating large numbers of poor and non-English speaking student populace. Teaching academic subjects to the academically inclined student was easier than rethinking and redesigning the academic curriculum so all students could learn college track materials. A distinct minority of college-bound students had the advantage of advanced courses in foreign languages, mathematics, science, and history (Ravitch 1995).

College admission requirements defined the standards that were applied to the academic curriculum during most of the twentieth century. Major steps towards more precise measurements of cognitive ability performance were from tests developed by the military in search of the best American soldier (Peterson & West 2003).

In the years following World War I, the College Board took an interest in a new movement of intelligence testing which claimed to test a student's innate intelligence, or capabilities. In 1926 the first Scholastic Aptitude Test (SAT) was given to over 8000 candidates applying to Ivy League colleges. Although the SAT did not fully replace established written entrance examinations until the Second World War, the College Board immediately understood its value. The SAT tested linguistic and mathematical ability with no connection to any specific secondary education curriculums.

With required literature curriculum requirements being abandoned by college entrance examinations in favor of using the SAT, secondary schools began teaching whatever literature they preferred. By 1941 the SAT became the college entrance examination for the American's most prestigious colleges (Ravitch 1995).

The College Board claimed that the SAT was never intended to influence standards but rather assist in the selection of students ready for college. Yet over time students and parents soon learned that scores could be improved upon by attending coaching sessions to improve test-taking skills. By the 1970s, the SAT was considered the guardian of college entrance standards, a role for which it was never intended or designed (Ravitch 1995).

Before WWI, many secondary schools were administering standardized achievement tests in spelling, mathematics, and reading coupled with intelligence testing. By the 1960' market driven criticisms of the CRSE as an advocate of mass-marketed standardized tests, textbooks, and intelligence testing for general use centered of their use to allocate students according to their presumed abilities into different kinds of educational opportunities. At the same time widespread adoption of standardized testing alleviated state and local governments' need to set their own academic standards. The passage of the Elementary and Secondary Education Act of 1965 for standardized achievement testing became a mandated element in the program of most public schools. Statewide testing by the 1970's introduced the minimum competency movement that demanded that students had mastered basic skills before graduation from high school. The major concern was whether these standardized materials and instruments were based on assumptions of research worth knowing, or were they derived from market research on what sells (Ravitch 1995).

A nation in danger of falling behind in education became the outcry in the late 1970s as the College Board announced that SAT scores had fallen sharply since the early 1960s. Explanations from the Board included criticisms of changes in curricula, a decline of high school enrollment in college bound courses, and a diversification of the pool of test-takers caused the decline in test scores. Concerns of low achievement produced national concerns for action against complacency and mediocrity (Ravitch 1995).

In 1983, A Nation at Risk (NCEEA, 1983), a report prepared by the National Commission on Excellence in Education complained that Americans were content with low expectations in education, and that Americans did not attempt to achieve excellence or push to meet high standards. The report stated that the high school curriculum had become verbose and students wandered from college bound courses to non-challenging general track courses. The Commission recommended higher standards for high school education, longer school days and academic year, and higher salaries for teachers. As a result form the report, state-level task forces were assembled to address educational issues concerning the raising of standards, improving textbooks, lengthening school attendance, and improving the teaching profession (Ravitch 1995). A Nation at Risk (NCEEA, 1983) moved the U.S. further toward notions of accountability by raising educational issues higher on state political agendas (Peterson & West 2003).

Before SAT scores began to decline, most Americans thought their school systems were some of the best in the world. The United States was the first country to achieve universal elementary education, expanded secondary education programs, and one of the earliest to create comprehensive schools for students from all backgrounds. Americans were not only proud of their school's accomplishments but Americans also viewed their schools as a solution to almost all the country's problems. Americans expected their schools to solve problems associated with civil rights, poverty, immigration, crime and teenage drug use (Peterson & West 2003).

Concerns over America's schools intensified when citizens learned that the United States (US) lagged behind other industrial nations of the world. Well-regarded international surveys revealed that the educational achievements of American students fell far below their peers abroad. The surveys concluded that State and test scores declined from age 9 until high school graduation. These trends required political clear action and consequences (Peterson & West 2003).

In 1989, when many states grappled with the difficult process of defining standards for accessing student achievement, two events prepared the path for a debate and movement toward national standards. The National Council of Teachers of Mathematics (NCTM) as a response to the criticisms expressed in A Nation at Risk (NCEEA, 1983), published national standards for mathematic and science education in a goal to improve mathematic education for all students, not those just college bound. The second event came from the White House with an agreement with the National Governor's Association for educational goals for voluntary national standards in education. The result was the National Education Goals, and more questions than answers. The logic of the goals implied new arrangements and opened political debate for national standards, voluntary or mandated, but the great question that was raised, could they be established without creating an intrusive federal bureaucracy? (Ravitch 1995).

In a 1991 Gallup Poll of American views on education, 68% favored a standardized national curriculum, 77% favored schools in their communities to use national tests to measure academic achievement, and 85% favored the use of standardized testing programs to measure student achievement in areas such as English, mathematics, science, history, and geography to assess problem solving skills and writing skills (Ravitch 1995).

In 1991, Congress was persuaded to establish a bipartisan body called the National Council on Educational Standards and Testing (NCEST) with the purpose to advise on the desirability and feasibility of national standards and tests as well as recommend protocols for setting voluntary educational standards and appropriate systems of testing. NCEST visualized that States, districts, commercial publishers and all others involved would independently develop new assessments based on common standards with comparable results. The NCEST proposed the creation of National Educational Standards and Assessment Council (NESAC) to oversee the certification of content and performance standards. Because of great divisions among governors, concerned groups, and the White House over the content of the NCEST, no legislation was passed in 1992 concerning national standards (Ravitch 1995).

In 1994 a new bill called Goals 2000 included changes and compromises on how standards were to be delivered. Congress passed legislation based on NCEST suggestions and created the National Educational Standards and Improvement Council (NESIC) This action downgraded the importance of assessment and allowed each State to develop its own tests based on its own standards which may or may not be approved by the NESIC (Ravitch 1995).

The NCEST had recommended that any new standards be national, not federal, voluntary and non-mandated. Historically, education in the US has been almost exclusively State and local functions. There was fear of federal control from the onset of national education goals from as early as 1989 because the NESIC was designed to be a classical federal agency, whose functions and powers could be redefined and expanded in its future years by Congress. With the passage of the Goals 2000, Congress and the executive branch assumed the control of the standard-setting process (Ravitch 1995).

Goals 2000 and Counterreformation

"Goals 2000, which seeks to create national education 'goals' is essentially a continuation of the educationist counterrevolution," according to Charles Sykes in *Dumbing Down Our Kids* (Sykes, 1995 p. 261). Though the legislation focuses on "goals", the law's most important attribute may be the creation of new national standards for spending levels, teacher salaries, and other items under the cause of "opportunity to learn standards" (Sykes, 1995 p.261).

Goals 2000 describes the new standards as voluntary, but States will most likely abide by the new rules because of ties to federal education funding that encourages States and localities to equalize their spending. Goals 2000 forbids States from testing student achievement until they can satisfy federal mandates that they have equalized opportunities to learn with regards to student spending and teacher salaries. "Unless States want to forgo federal aid, this provision effectively reverses the movement toward measuring student performance and holding 'educationalists' accountable" (Sykes, 1995 p. 262).

"The focus of accountability has turned upward toward the bureaucracies rather than downward toward the student and their parents"(Sykes, 1995 p. 267). Schools are now required to follow standards set at the federal level versus satisfying the needs of their primary customer. Instead of meeting the needs of the parents and taxpayers of their own communities, schools are now accountable to constituencies in the education establishment (Sykes, 1995).

No Child Left Behind (2002)

In 2002 No Child Left Behind (2002) [NCLB], U.S. Federal legislation redirected educational thinking. Under the terms of NCLB (2002), every state, to receive federal aid, must put into place a set of standards along with a specified testing plan to ensure the standards are being met. Students at schools that fail to measure up have the option to leave for other schools within a district. A school that steadily fails to make acceptable progress towards proficiency becomes subject to penalty (Peterson & West, 2003).

Standards Based Education Reform: An Alternate View

The current standards based reform movement in America began in 1983 in response to a view that the US was at extreme economic risks. In an earlier era, A Nation at Risk (NCEEA, 1983) launched an attack on, “dumb teachers, uncaring mothers, social promotion, and general academic permissiveness” (Meier 2000, p.9). Teachers and “educationists” were the enemy, according to critics, and needed to be brought under the control of experts. School reformers argued that the fault lied either in the nature of public schooling itself or in the overindulgence of local authorities (Meier 2000). The claim today, “ our once-great public (educational) system is no longer performing well, and that its weaknesses were undermining America’s economy” (Meier, 2000, p.10).

According to Deborah Meier’s, Educating a Democracy, Standards based reform is centered around four interconnected mechanisms:

1) An official document or framework is produced by experts within that field that outlines what kids should know and be able to do at a particular grade level in different subjects.
2) The classroom curricula, textbooks and program are expected to convey an agreed upon body of information.
3) The assessment tools (tests) should measure whether the child has achieved the goals of the specified within the framework.
4) A method of rewards and penalties directed at the school, the system, and the child who has failed to meet the standards as measured by the test (Meier, 2000).

In addition to the four interconnected mechanism of standards based reform, Meier stated that there are six assumptions that lie beneath the some of the current state and national standards programs. These assumptions included:

a. What will be the goals of the standards?

b. Defining the well-educated authority and their ability to operate within a system of checks and balances.

c. Assessments, and will they be able to provide a standardized system of uniform measures for all schools?

d. Enforcement of standards, will it be centralized by local community?

e. Equity requires introducing a system of standards rapidly with a concentration of allocation of resources especially to the under-funded communities.

f. Effective learning with clear-cut expectations accompanied with justified rewards and sanctions. (Meier, 2000).

The debate is not over the need for standards or accountability, but rather what kind of standards would best serves everyone's needs. It can be argued that standardization would make it more difficult to hold people accountable. Standard could even more make it more difficult to develop new sound and useful standards. "The intellectual demands of the twenty-first century, as well as, the demands of democratic life, are best met by preserving plural definitions of a good education, local decision making, and respect for ordinary human judgments" (Meier, 2000, p. 29).

A Case for Standards

Standards have significant promise for improving the quality of American public education and that they are critical to reducing educational inequalities in the cases of families with insufficient resources to support their children's education. America's children could be better served by adopting standards-based reform versus scrapping the project based on criticisms of current versions of reforms (Murname, 2000).

R. J. Murname, in an essay, The Case for Standards (Murname, 2000), stated that the earnings of 30-year-old American male high school graduates are twenty percent lower than the earnings of the same group twenty years ago. This is based in part on changes in the economy that have made some skills more advantageous than they were in the past. Though the skills are no different today than twenty years ago, they are not sufficient enough to meet the needs of today's high wage employers (Murname, 2000).

Employers will on average bypass the high school graduate in favor of college graduates. In an economy that places high values on skills, students with only a high school diploma are at a vast disadvantage when competing for jobs. This could be viewed as a "significant threat to the stability of our democracy" (Murname, 2000, p. 58).

Modern standards-based education reform is a new phenomenon in America. It was preceded by 20 years of States legislating alternatives to the financing local public education programs with little interference with their local control. In many cases, local property taxes were cut when these communities substituted State funding for local school funding. The net result was a greater equalization of property taxes rather than paying for local educational funding. If these communities had kept their local funding for education, the net effect would have been a greater equalization of per student spending. "The constituency for high-quality education has become smaller relative to the constituency for tax relief" (Murname, 2000 p. 59). The disappointing effects of conventional school financing led States to develop initiatives in standards-based educational reforms with goals that focused on student achievement rather than providing funding for education at the local level. Evidence suggests and "supports the notion that standards-based reforms can result in improved teaching and greater student learning" (Murname, 2000 p. 60).

Murname concluded, "The enormous inequality in American education has been largely a legacy of local control" (Murname, 2000 p. 62). Inequalities have been reduced to some extent through grants from the State to the local level without local controls. Persevering standards-based reform works if the accountability systems penalize schools that continue to provide low quality instruction to low income children and minority groups. That same system should recognize distinguished educators for creating and sustaining schools that provide an outstanding education (Murname, 2000).

Standards Based Education Reform and Technology Education

Program Standards

"Program refers to everything that affects student learning, including content, professional development, curricula, instruction, student assessment, and the learning environment, implemented across grade levels. Users of the program standards should recognize that thoughtful design and implementation of programs for the study of technology are necessary to provide comprehensive and coordinated experiences for all students across grade levels and disciplines" (ITEA, 2000, p5).

Technological Literacy

What is technology? Standards of Technological Literacy (STL) defines technology as the innovation, change or modification of the natural environment in order to satisfy perceived human wants and needs" (ITEA, 2000a, p. 242). "What is technology? Technology is the process by which humans modify nature to meet their needs and wants" (NAE & NRC, 2002, p2). "Technological Literacy encompasses three interdependent dimensions – knowledge, ways of thinking and acting, and capabilities" (NAE & NRC, 2002, p.3). Technological literacy, like other forms of literacy, is what every person needs in order to be an informed and contributing citizen for the work of today and tomorrow. Technical competency is what people need to be prepared to be successful in a technical career. The study of technology is any formal or informal education about human innovation, change, or modification of the natural environment (ITEA, 2003).

In the 1990's, the International Technology Education Association (ITEA) developed a set of standards related to the study of technology. Phase I was initiated through its Technology for All Americans Project (TfAAP) project. This consisted of the development of a rationale and structure for the study of technology and a process of developing the core of the standards followed. In 2000, the ITEA published the Standards for Technological Literacy, to promote a high level of achievement of technological literacy (TL) (ITEA, 2000). In 2003, the final phase of TfAAP was completed with the release of Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards (ITEA, 2003).

In 2001, P. B. Newberry, stated in an article on Technology Education in the United States that, “Several states reported that with the publication of the *Standards for Technological Literacy* (STL), they have a document that adds support to their State and local efforts and provides them with corroboration and the needed support to continue to make the case for all students to be technologically literate. All States and Territories are working to position technology education as a means for preparing their youth as future citizens who live in the technological world, who will also be producers and consumers of new technologies of the future. If the vision of STL is to be realized, the momentum must continue” (Newberry, 2001, page 6).

Technological literacy (TL) involves knowledge and comprehension of technology and its uses; skills, including tool skills as well as evaluation skills; and attitudes about new technologies and their application. There are three components to technological literacy: the technology of making things; the technology of organization; and the technology of using information (Waetjen 1993).

Characteristics of a technology literate student includes: Abilities to make decisions about technology; possession of basic literacy skills required to solve technological problems; ability to make wise decisions about the uses of technology; ability to apply knowledge, tools and skills for the benefit of society; and ability to describe the basic technological systems of society (Waetjen 1993).

Technological literacy improves individual decision-making related to technology and the citizens, as a whole would also benefit greatly from a higher level of technological literacy, to be better prepared to make well-informed decisions on matters that affect, or are affected by technology. Technological literacy would not determine an individual's opinion but rather ensure that they would be better informed (NAS, 2000).

Technological Literacy within Science and Mathematics Disciplines

Many disciplines within education embraced standards reform. Mathematics, Science, and Technology Education and their scholarly associations support similar missions standards by implementing standard that promote technological literacy.

Science Literacy

The Benchmarks for Science Literacy (AAAS, 1993), the National Science Education Standards (NRC, 1996), the Standard for Technological Literacy (ITEA, 2000), and the Innovations in Science and Technology Education series (UNESCO 1984), have different definitions of technology education, but are in consensus on what everybody should know about technology and be able to do as a result of their technological studies. These reform movements all urge an education that will enable an understanding of the key concepts and principles of technology such as 'design, control, and systems,' as well as, of the key ideas about technology in specific areas such as materials, energy, manufacturing, and information. "One relative and recent notion is that science literacy intrinsically includes understanding technology" (Cajas, 2001, p715-716).

"Together these have established a consensus on what is important to understand about technology, including the relationship between science and technology, the side effects of technology, and the nature of design and control… a common set of ideas and skills that form the core of literacy in technology" (Cajas, 2001, p 719).

Why is Design Important? The Standards for Technological Literacy (STL) promotes the idea that design is regarded as the core problem-solving process for technological literacy, in as much the same way as inquiry is important to science, and reading is to language studies. Literacy in the design process involves acquiring the cognitive and procedural knowledge needed to create design, and the processes by which design is applied to creating a product or system (STL, 2000).

The STL suggests that in preparing students for a Technological World, it should be understood that people modify the natural world to suit their own purposes by means of a diverse collection of processes and knowledge that extends human abilities to satisfy human convictions (STL, 2000). The tremendous advances in science and technology throughout the last century and into the new millennium led to Project 2061 (AAAS, 1990), a set of recommendation for scientific literacy compiled from a three-year collaboration of members of the scientific community, educators, technology experts, and members of the liberal arts community (American Association for the Advancement of Science, 1990, 1993). Project 2061 (AAAS, 1990) was published to set goals and benchmarks for scientific literacy for all students with benchmarks for student progress in science, mathematics, and technology at grades 2, 5, 8, and 12. The National Science Education Standards (National Research Council, 1996), like Project 2061(AAAS, 1990), was the result of contributions from educators, scientists, and other experts across the US. The National Science Education

Standards not only describe reasonable benchmarks for what students should understand and be able to do, but also provided guidelines of exemplary teaching practices and school system reform. In addition, the National Science Education Standards reflected the principle of inquiry-based learning as the research-based format for exemplary science teaching (Sundberg, 2000, p1&2).

Mathematics Literacy

Disciplines including Mathematics Education and their scholarly associations promote technological literacy. “Understanding mathematics in the present social contexts means understanding how the world is increasingly shaped by complex technological systems” (Yasukawa, 2002, p1).

“Math Literacy is the ability to situate, interpret, critique and perhaps even create mathematics in context, taking into account all the mathematical as well as social and human complexities which come with that process… to better equip people to challenge the world around them, and to act on those injustices that they see” (Yasukawa, 2002, p1). “The goal is to understand technological literacy in relation both to social justice and to mathematical knowledge or education ” (Yasukawa, 2002, p2).

A critical aspect of a technological system is that interactions between the numerous components are interdependent and work towards a common system goal. If one component is removed or changes, then the rest of the system is affected. Technological literacy includes an awareness of the humans and non-human components of the system and their interdependencies. It is an appreciation of where humans and non-human components are positioned with or in relation to the technological systems, and an appreciation of how the system is shaping the social fabric and the nature of the environment around them (Yasukawa, 2002).

Technology Education Overview

What is technology education, and why have standards been developed to address the needs for technological literacy?

Technology education is the study of tools, processes, and systems by which humans modify nature to meet their needs and wants. “A study of technology provides an opportunity for students to learn about the processes and knowledge related to technology that are needed to solve problems and extend human capacities” (ITEA, 2000, p. 242).

For the purposes of studying technology, students are provided with a classification system that sub-divides technology education into taxonomy of seven areas of study (ITEA 2003):

- Medical Technology
- Agriculture and Biotechnologies
- Energy and Power Technologies
- Transportation Technologies
- Manufacturing Technologies
- Construction Technologies, and
- Communication Technologies

Communication Technology has been consistently included in the curriculum efforts of states that have adopted technology education–based programs. The study of communication technology has been historically promoted, supported, and rationalized as part of technology education through numerous professional presentations, papers, workshops, meetings, and curriculum efforts (Robb and Jones, 1990). It is important to research communication technologies curriculum's relevance and its acceptance by students as a valuable resource in preparing them for tomorrow. A sound, rational curriculum design for technology education must include a focus on communication as one of the systems for human survival in the future (Robb and Jones, 1990).

What is communication technology? It refers to the tools, techniques, knowledge, choices, and decisions associated with sending and receiving information (Sharon 1990). In defining communication technology, first we need to define what is communications? In Technology Education we learn there are specific elements of a process or system that are needed in order to conduct communication (Haynie and Peterson 1995, Sanders 1997, Sharon 1990, Shannon and Weaver 1949). The action (agency) of communication begins when an agent (human, animal, or machine) transmits or sends a message to another agent (human, animal, or machine). The transmission is the agency and the agents in the system are the senders and receivers. The sending of the message alone is not the totality of successful communication (Bonsipe 1996). Complete communication requires reaction, understanding and comprehension (feedback) from a sender to receiver. When there is difficulty in communication between agents, the obstacle or difficulty that blocks or impedes communication is called interference (noise) in the system. The final element in the communications process is the feedback, an evaluated response agency from the receiver agent back to sender agent for the achieving successful communication and completing the cycle (Haynie and Peterson 1995, Sanders 1997, Sharon 1990, Shannon and Weaver 1949).

The terms agent and agency are critical to communication. Once the cycle of sender-receiver communication exists both roles are shared in the action of communication. Bonsipe defined Agent and Agency in <u>Interface: An Approach to Design</u>, "Agent: One that acts or has the power to act, a means by which something is done or caused, a force that causes change. Agency: The condition of being in action, operation." (Bonsipe 1996 p.83). In defining the roles of sender-receiver as agents in the agency of communication, they are identified based on the totality of successful communication.

Communication Technology

Throughout the history of developing civilizations, technology is repeatedly identified as the key element in the transformation and advancement of society. One of the unique ways in which technology has brought about social transformations is through revolutions in communications (Robb & Jones 1990). Communication systems have evolved since prehistoric times to serve new generations and their inherit needs. While sophisticated modern communication technology makes it possible to communicate more efficiently, unintended consequences can occur and must be addressed and understood (Shanon 1990).

According to the Standards for Technological Literacy, "Because of the power of today's technological processes, society and individuals need to decide what, how, and when to develop or use various technological systems. Since technological issues and problems have more than one available solution, decision-making should reflect the values of the people and help them reach their goals. Such decision making depends upon all citizens, both individually and collectively, acquiring a basic level of technological literacy– the ability to use, manage, and understand technology." (STL, 2000, p.11)

A successful human society can be summed up in their capacity to communicate. How we communicate depends upon the creation of tools of communication so that people may communicate effectively and efficiently (Haynie & Peterson 1995). Communication technologies help us communicate and share information, thoughts and ideas (Sanders 1997).

The use of technology has enhanced human communications and affects the numerous aspects of our daily lives, from enabling citizens to perform routine tasks, to requiring that they be able to make responsible, informed decisions that affect individuals, our society, and the environment (ITEA 2003).

Defining Communication Technology

In Science Education, Communication Technology is defined as a type of distance learning that includes the Internet, email, video conferencing, telephone, compact disks, and teleconferencing to converse with individuals around the world (Sundberg, 2000).

In a study of the potential of New Communication Technologies and Sub-Saharan African Development: Perceptions of Academic and African Government and Business Officials, "New Communication technologies are the hardware, equipment, organizational structures and social values by which individuals collect, process, and exchange information with other individuals" (Domatob, 1997, p8).

According to Frank Trocki in *Communication systems in business, industry and government: corporate and government communications systems,* "Communication is vital to the success of business, industry or government. Sociologists define communication as involving a behavioral situation in which someone transmits a message to someone else with a conscious intent to affect the latter's behavior. It involves a source, a receiver, and a message, and includes a prospect of control" (Trocki 1990, p20). Control is both reception and perception, it's a great asset for the corporate communicator; neglecting this control can cause great liability (Trocki 1990).

Dr. James Paul Gee, Professor of Literacy at University of Wisconsin-Madison, and author of What Video Games Have to Teach Us About Learning and Literacy (2003), promotes a notion of ‘active learning’ as in the case of video games that is contrary to passive learning of content. Gee explains learning as social practices where content is generated, debated and transferred via certain distinctive ways of thinking, talking, valuing, acting, and, often writing and reading. Gee states that a young gamer learns resources for future problem solving within this semiotic domain of game playing (Gee, 2003). According to Gee, video games encourage good principles of learning and makes individual learning powerful. An assessment of access to particular communication technologies such as video games and comparing sample’s CRT scores and characteristics would make data available for analysis of variability.

In Bolt and Crawford's book, Digital divide: computers and our children's future (2000), the authors report that schools across the country are involved in a technological revolution with results uneven and inadequate. Access to technology is a complex challenge facing school districts that are already strapped for resources. Yet incorporating technology into the classroom is imperative to prepare students for their lives in the twenty first century. According to Bolt and Crawford, the digital divide is real; an assessment of access to particular communication technologies such as computer and the Internet and comparing sample’s CRT scores and characteristics would make data available for analysis of variability.

United States of America Statistics 2005

According to the Internet site, www.internetworldstats.com, the US population is approximately 296,208,476 million inhabitants with a gross national income (GNI) approximately US$41,400 per household according to statistics by the (2004) World Bank. In the US there are approximately 203,576,811 Internet users as of Oct/05, 68.7% penetration, Nielsen//NetRatings. There are 69,431,802 broadband subscribers as of Dec/04 - 7,000 ISP (2002) (Miniwatts, 2005)

The Umbrella Perspective on Communication Technology, by Dr. A.E. Grant states, “Communication technologies are the nervous system of contemporary society, transmitting and distributing sensory and control information and interconnecting a myriad of interdependent units. Because these technologies are vital to commerce, control, and even interpersonal relationships, any change in communication technologies has the potential for profound impacts on virtually every area of society” (Grant, 2004, p1).

“One of the most important [communication technology issues] is the emerging trend toward media convergence… to generate an understanding of the larger role that media convergence is playing in the adoption and evolution of these [communication] technologies. The four trends include: “Technological convergence, organizational convergence, convergent journalism, and media usage convergence” (Grant, 2004, p349).

“What is communication technology? It refers to the tools, techniques, knowledge, choices, and decisions associated with sending and receiving information” (Sharon A 1990, p8). The communication process is frequently portrayed as a model first introduced by Shannon and Weaver (1949) as shown in Figure 2.1.

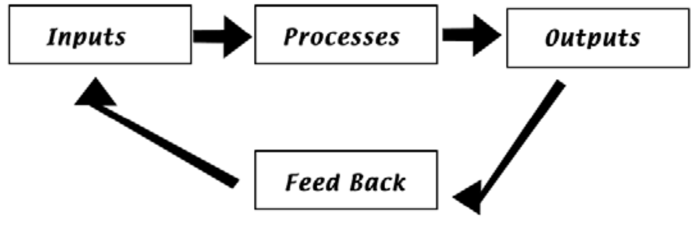

Figure 2.1 Communications Systems Model (Shannon & Weaver, 1949).

The communication system, (Thomas 1979) is a system that includes a structure of interacting, inter-communicating components that, as a group, act or operate individually and jointly to achieve a common goal through the concerted activity of the individual parts. The systems approach to communication makes it possible to design each individual component as a critical system element. If any component is defective, deficient, or unsatisfactory, it not only causes communication inadequacies, but it also potentially influences a multitude of other systems and constituencies (Sharon A 1990, p13).

Communication is an essential part of technology and should be recognized as a essential link in a technological society. It [technology] is itself a social system driven by specialized knowledge and involving all institutions of our society and their communication linkages, as a social process, technology deals with people, with values, with political choice in democratic governance, and with connections between all three (Sharon A 1990, p 12).

The Communication Technology Classroom

Communication technology is a dynamic curriculum area that enables the development of problem solving and critical thinking skills. It is an appropriate vehicle for the inclusion of mathematics and science applications, as well as reading and writing skills (Jones & Robb, 1990). "An understanding of communication technology and the positive and negative impacts of communication is an integral part of developing a technological literate population" (Jones & Robb, 1990, p46).

With slight variations in the naming, communication technology has been consistently included in the curriculum efforts of states that have adopted technology –based programs. Variations include: visual communications, graphic communications, communication systems, industrial communication, electronic communication, and technical communications. Regardless of the names, the content reflects early research on communication technologies. (Jones & Robb, 1990).

"Throughout the literature on history and developing of civilization, technology is repeated cited as the key element to transformation and advancement. One of the unique ways in which technology has brought about social transformations is through revolutions in communications" (Jones & Robb, 1990, p40). The history of communication content in technology education has been included, promoted, supported, and rationalized as part of technology education during numerous professional presentations, papers, workshops, meetings, and curriculum efforts. A review of literature concerned with the study of technology indicated that predominate organizational themes authors used was systems that included communications (Jones & Robb, 1990).

Communication is the transfer of information, via technological means, and communication technology is the study of the transfer of information within a technological system. Sociologists and anthropologists point out the importance of communication, and curriculum developers have suggested that a study of communication should be included in the study of technology. Students have readily accepted the study of communication systems as a relevant area of learning to help prepare them for tomorrow. (Jones & Robb, 1990).

Conceptual models have been developed for communication in technology education programs at the elementary, middle school, and junior high levels (Trautman 1990). "Because of the special relationships between culture and technology, the elementary school must include technology education as part of the preparation of students to be successful in their culture and where an essential understanding of technology should begin" (Trautman 1990, p50).

It is at the elementary and middle school levels that the goals and objectives of technology education can begin to be promoted. Communication technology is an integral aspect of the study of technology and the elementary and middle schools provide the appropriate atmosphere for its awareness and exploration. (Trautman 1990, p51). Communication systems can be taught at the early grade levels as long as there is an adherence to appropriate vocabulary lists, reading assignments, social studies and mathematic skills. Young imaginative and creative minds can be guided through lecture and activity to become aware of and experiment with communication technologies. (Trautman 1990, p54)

At these formative levels of education students begin to learn about the social, cultural, and technological world. They can begin to observe and integrate how all subjects are related though a multi- and inter-disciplinary approach to teaching about technology as well as a study of impacts that changing communication systems will have on their lives (Trautman 1990, p60).

Technology Education: Communication Curriculum Time Line

Curriculum efforts of the 1960s provided the first concentrated inclusion of communication into major curriculum efforts. They include: (Jones & Robb, 1990, p42-47).

- American Industry Project (an analysis of industry revealed 13 common concept areas that were prevalent throughout industry, these included communication).
- Georgia Plan for Industrial Arts (adoption of a program by DOE which included curriculum efforts to help prepare individuals to meet the requirements of our technological culture which included courses including others communications for

the purpose of students to become familiar with the role of people in using technology in the basic industries.

- Orchestrated Systems Approach (to develop in the individual those societal competencies essential to understand and participate in the production and consumption of goods and services… part of the program focused on industrial-technical communication.
- Galaxy plan for Career Preparation (attempted to form an exploratory analysis of occupations that included visual communications.
- Occupational, Vocational and Technological Program OVT (program developed in schools to provide experiences related to the world of work that included communications.
- Alberta Plan (based on the premise of making industrial arts a synthesizing educational process in a multiple-activity environment which included a study of graphic communications as well as a focus on industrial situations that include communications.
- Industrial Arts: A study of Industry and Technology (The Maryland Plan) developed a method of organizing special classes in industrial education based upon research and experimentation focused on units of instruction in several areas including communication.
- 28th Yearbook of the American Council on Industrial Arts Teacher Education: contained a series of reviews of curriculum efforts form 1960-70s. One in particular proposed as an alternative to industrial arts for initial experiences designed to provide broad, exploratory occupational experiences in visual communications.

<u>1980's - Landmarks</u>

- Jackson's Mill Industrial Arts Curriculum Theory: Early efforts identified four systems that included communications as a direction for technology education.
- The Illinois Plan: This project emphasized technology education programs kindergarten to adult based on a study of technology utilizing the technological systems, which included courses in communications that focused on the resources, processes, applications, and impacts of the technologies
- New York Futuring Project: A curriculum effort for changing and influencing legislation to mandate the study of technology where communication was recognized, as an important component of the statewide curriculum adoption.
- Standards for Technology Education: DOE funded project at the VA Polytechnic and State University developed the Standards for Technological Literacy. The content area of communication was included among the standards for evaluating programs.
- Industry and Technology Education: Document produced by a group that had studied the Jackson Mill and chose to focus on the term industrial technology but continued to utilize the organizers such as common to communication technology education as the basis for their models.
- Implementing Technology Education: (1986) Yearbook that focused on technology education at all levels k-graduate level programs that included communication.
- Communication textbooks: The inclusion of the study of communication systems into technology into the technology curriculum created a need for textbooks. Some of those titles include:

- *Getting the message: the technology of communications,* (Duval, Maughan, & Berger, 1981)
- *Discovering Technology: communications*, (Jones and Robb, 1986)
- *Exploring communication,* (Seymour, Ritz, & Cloghessy, 1987)
- *The technology of communication: drawing, photographic and optical systems, print, and electronic media,* (Haynie & Peterson, 1995).
- *Communication technology: today and tomorrow,* (Sanders, 1997).
- Communication technology update: 9th Edition, (Grant & Meadows, 2004).

Future of Communication Technology Classroom

"Since prehistoric times, communication systems have evolved to serve new generations and the inherit needs of the population. While the sophistication of modern communication technology makes it possible to communicate more efficiently, negative repercussions emerge and must be address" (Sharon A 1990, p17). "It is the responsibility of people to understand technological communications and play a determining role in its future" (Sharon A 1990, p18).

Tomorrow, we should expect more technology, not less. To better understand that future we need to acquire this sharper image of technology as more than a technique or products, it entails a complexity of familiar social processes, communication networks, and institutions, along with natural processes and technical facilities, a blend of science and human values (Sharon A 1990).

Bolt and Crawford's *Digital Divide* looks at the role which computers are playing in widening socio-economic and educational gaps throughout our society. The reality is that the majority of American youths are not up to date with digital tools, and their options may be few (Bolt & Crawford, 2000).

There are many issues associate with the 'digital divide' that educators and community activists will find make for authoritative debate. One reality is that the salary gap between the highest- and lowest-skilled workers is increasing. Data from the U.S. Census and Department of Labor have shown constant-dollar earnings for low-skilled male workers have dropped consistently, while earnings at the top have increased. Jobs at the bottom are disappearing at a phenomenal rate, either being automated or shipped overseas (Bolt & Crawford, 2000).

Another reality is the information/communication gap… nearly 45 percent of U.S. homes have computers, studies by the Census Bureau have shown that computer access is strongly correlated to household income… 70 percent of homes with a combined income of $70,000 or higher have computers, and 10 percent of homes with a combined income of $10,000 have computers in them (Bolt & Crawford, 2000). The digital divide is real, and the financial have-nots are also informational have-nots; this gap can produce a permanent underclass and further expand the gap (Bolt & Crawford, 2000).

Unlike the Internet, which is doubling in size every year, the World Wide Web, the portion of the Internet generally used by the public – is doubling in size every ninety days. In 1996 the US Mail delivered 185 billion pieces of first class mail… that same year the Internet handled about 1 trillion emails (Bolt & Crawford, 2000).

The impact of the web on education and in every aspect of our communities is profound. The Internet is already being used to give students access to the latest breakthroughs in scientific discovery years before they are likely to appear in textbooks.

Huge variances exist in the quality and quantity of computer education in our public schools. Schools across the country are trying to step up to the technological revolution, but the results have been uneven and, in many cases, inadequate (Bolt & Crawford, 2000). Technology education is a complex challenge facing school districts that are already strapped for resources. Yet incorporating technology into the classroom is imperative to prepare students for their lives in the twenty first century (Bolt & Crawford, 2000).

Comparative Research in Access to Communication Technologies

In comparative research into the value of access to communication technology as an enhancement to curriculum and quality of life, three subsequent studies were explored and evaluated. The first study looked at the learning environments and examined access to technology for the success of integrated science programs (Love, 1997). The second study involved using communication and technology to support professional development in teaching science (Sundberg 2000). And the third study examined quality of life issues and it depends on the implementation of new communication technologies and their widespread use throughout the developed world (Domatob, 1997). Each of these studies address aspects of the research questions outlined in Chapter One:

<u>Study One</u>

In the first study from University of Alabama, 1997, Curtis Love, this study attempted to determine the impact of the absence or presence of key components of communication technologies in an integrated science classroom. The goal of this research, learning environments like school and classroom characteristics, as well as the locality were investigated by a qualified evaluation team that was instructed to observe contrasts between schools in affluent and poor communities. The team visited many sites that ranged from a recently remodeled, state-of-the-art facility; to the oldest schools, whose facilities were in an advanced state deterioration. In the newer well-funded schools, it was observed that teachers were appreciative of their environments while in the older schools, many teachers adapted as best they could (Love, 1997).

The teams observed, that despite the vast difference in the learning environments, the type of facility did not appear to have substantial impact on the education experience of the students nor on the commitment and motivation of the teachers. Quite often, teachers who worked in adverse conditions were some of the most dynamic and resourceful people the observers encountered (Love, 1997).

In conclusion, this study identified several key variables that may affect the success of the Integrated Science program in a particular classroom. The human element assumed prominent position in the model with goals that were student centered and teacher playing a crucial role. Some of the available communication technologies such as email, faxes, Internet did not appear to have a major impact on the success of Integrated Science in meeting its goals: to revive student interest in science, keep students enrolled in science for more years, and produce more scientifically literate students. The presence of new technologies did not change schools. But the available communication technology, if integrated into effective teaching and learning practices, can help restructure the classroom according to the study's findings. (Love, 1997).

These findings suggested that using communication technologies to deliver instruction does not preclude the need for skilled teachers and facilitators. The teacher, not the technology, is the essential component (Love, 1997). "But if the skilled teacher learns to utilize the professionally prepared curriculum materials and videos of the teacher-enhancement science-education program successfully, the ultimate outcome can be much better prepared and more highly motivated science student. The ends are certainly worth the extra effort" (Love, 1997, p 59).

Study Two

In the second study, also from the University of Alabama, produced by Cheryl White Sundberg in 2000, the researcher focused on using communication and technology to support professional development in teaching science. The central purpose of this study focused on the following question, “Does communication technology provide an effective medium to address the special professional development needs of teachers in underserved or rural areas, and meet the time and space convenience of educators?” (Sundberg, 2000, p 8). In other words, does the access to communication technologies provide educators with optimal opportunities to learn from colleagues? (Sundberg, 2000).

The focus of this study was to determine the appropriateness of utilizing communication technologies as a distance [learning] vehicle to reinforce face-to-face professional development in energy education (Sundberg, 2000). According to this researcher, Communication Technology is defined as a type of distance learning that includes Internet, email, video conferencing, telephone, compact disks, and teleconferencing to converse with individuals around the world. (Sundberg, 2000, p 11). According to this study:

- All participants had access to the Internet either at home or at school, yet only about half of the participants (47%) used the Internet for instruction. The primary use of the Internet was for web searches (Sundberg, 2000, p144).
- The majority of the group had email (94%), over half (59%) did not use email in instruction. (Sundberg, 2000, p144).
- The schools had the capacity to send faxes (82%), but most of the teachers surveyed noted they did not use the fax in instruction (65%)” (Sundberg, 2000, p144).

- Digital camera and scanners were not widely available to the teachers, only two thirds of the participants (65%) did have a digital camera available and almost half (59%) had a scanner they could use. Yet if the technology was available, the technology was not used during instruction. Digital cameras were not used in instruction. Only (6%) of the respondents indicated they used a digital camera in the classroom (Sundberg, 2000, p152).
- Almost a third of the participants did not use a computer in instruction and (42%), nearly half used the Internet for instruction and (41%) used email for instructional purposes (Sundberg, 2000, p156).
- Adequate Internet access was problematic. While teachers had the necessary computer equipment to go online, access was undependable in rural and under-served areas as well as a lack of technical skills could negatively impacted the use of the Internet (Sundberg, 2000, p160).
- "Recommendations for further research: the research should focus on the extent of the typical availability of the technology at school and the types of professional development activities that can be conducted online" (Sundberg, 2000, p162).
- "Environmental factors, for example building age or inadequate Internet server appears to negatively impact the use of communication technology. The actual typical availability of communication technologies to the teacher is less than is often reported by administrators (Sundberg, 2000, p163).

In this study the research found that access to the Internet was more problematic for rural and under-served teachers. These environmental factors of inadequate server access and upgrades of hardware and wiring of older buildings were problematic for those teachers in those rural and underserved areas. Though this study was performed in the same state of Alabama as in Love's research, the focus was to determine the appropriateness of utilizing communication technologies as a distance vehicle to reinforce face-to-face professional development in energy education and provides an alternative view towards access to communication technologies in the science classroom. This study did reaffirm the need of professional develop for integration of available technologies.

Study Three

In the third study conducted in 1993, the researcher, Jerry Komia Domatob, from Ohio University examined the perceptions of African academic, and government and business officials on new communication technologies for development of Sub-Saharan Africa. The author proposed, "Any attempt to foster development and enhance the region's overall quality of life partly depends on communication. Information was s most efficiently compiled, transmitted and interpreted though the new communication technologies in widespread use throughout the developed world. Thanks to new communication technologies, shortcuts to development exist today and are within the reach of everyone" (Domatob, 1997, p5). According to this researcher, new communication technologies are defined as the hardware and equipment that enhance organizational structures and social values so that individuals can collect, process, and exchange information with other individuals" (Domatob, 1997, p8).

Domatob explained that new communication technologies are appropriate and important in the developmental process of the Sub-Saharan region that lacks them. The author stated, proponents would argue that new communication technologies would widen the gap between elites and the masses, and noted that historically under broadcasting systems both rich and poor had access to the same information and entertainment material. Yet when costs are involved, the rich are able to acquire more than the poor. When new communication technologies provide information at a fee, the rich will be wealthier in access to information than the poor (Domatob, 1997).

Many in the Sub-Sahara region, according to Domatob, perceive new technologies as a key component to access to the larger global economic system. This perception enforces domination of emerging developing nations. New communication technologies are conceptualized as yet another stage of the world capitalist system's development and expansion (Domatob, 1997).

Some of the perceived impacts of new communication technologies by academics, and government and business according to the researcher are observations that include:

- Both groups remain highly optimistic of the positive impact of new communication technologies on training and education.
- 85% of government and business had positive views and,
- 78% of academics felt if will be helpful in education and training
- Both groups felt shared the perception that new communication technologies will help in rural development (Domatob, 1997, p64).

According to Domatob observations, new communication technologies capacity to make people's work easier was received more positively by the government and business group than by the academic group. The government and business group perceived new communication technologies as less harmful overall than academics. Education was reported to be an area where new communication technologies would play a greater role in the development process and major educational tool (Domatob, 1997).

Some of the concerns noted by Domatob were that “New communication technologies are a phenomenon of our times. In the developed countries, they permeate most facets of life and society so thoroughly the some writers and analysts describe this period as the information era” (Domatob, 1997, p114). The greater irony and contrast according to Domatob’s research, was an observation that not only do these developing nations lack access to new communication technologies, neither are they manufactured or assembled there, they must be imported.

Comparatively, research in communication and in new communication technologies is at an early stage in most developing nations. Yet it is important to compare the views of access to communication technologies in developing nations to the concerns of accessibility in the first two studies. In Domatob’s study, business and government perceptions on new communication technologies are more positive than the perceptions of academics. Comparatively the first two studies also showed diverging concerns over accessibility to communication technologies in the classroom, yet agreed the need for professional development opportunities. Love’s study found that despite the availability of technology in the learning environment, it was not sufficient. The human element was also important and assumed prominent position with goals that were student centered and promoted the integrated use of technology. In Sundberg’s study, the availability and quality of the access to communication technologies was relevant to the teacher’s performance and professional development. Yet it is also important to note that what was available was not utilized efficiently in integrating its use in classroom instruction. All three studies concluded that subsequent research should focus on access to communication technologies.

In comparing these findings to questions in this research on access to technology outside of the classroom, observations in this research offer an opportunity to investigate that relationship. Would positive observations on access to technology and student learning influence academic views? Just as two these studies promoted professional development and a student centered learning environment, questions in this research inquire on how teachers make a difference in student learning. Would positive observations in this research offer an association with student and learning and their teachers prove beneficial? These three studies offer qualitative insights to access to communication technologies. The goal of this research is to address similar concerns and quantify its findings.

Access to Communication Technologies

In these selected studies of comparative research in access to communication technologies provided by University of Alabama (1997, & 2000) and Ohio University (1997) those preceding reports investigated and surmised observations and concerns on access to communication technologies' overall relationship to academic goals, teacher professional development, and curriculum integration. All three studies concluded that subsequent research should focus on specific needs and access to communication technologies.

Review of Chapter Two

This review of literature begins with a history of standards development in America and how that history is reflected in developments that lead to current standards based curriculum research. Many disciplines within education embraced standards reform. Mathematics, Science, and Technology Education scholarly associations have similar missions that lead to standards adoption and the promotion of technological literacy.
The review of literature next focuses on Technology Education, and the classification system that sub-divides technology education into taxonomy of seven areas of study including Communications. This study concentrates on the area of Communication Technology's curriculum development, classroom characteristics, and access to communication technologies.

The review of literature also examines three selected studies of comparative research in access to communication technologies provided by University of Alabama (1997, & 2000) and Ohio University (1997). Those reports investigated concerns related to access to communication technologies and the relationship between academic goals, teacher professional development, and curriculum integration. Additional literature review addresses concerns in access to technology and creating a digital divide, and how computer games over some insight to learning. The literature review finishes with a rationale for teacher professional development.

CHAPTER THREE

Procedures and Methods Used in the Study

Population Of Interest

This study's population of interest includes the students and teachers in middle and high School Technology Education public school classrooms in the United States. Technology Education is the study of technology. Technology Education provides students with an opportunity to learn about the processes and knowledge related to technology that are needed to solve problems and extend human capabilities (ITEA, 2000, p. 242). It is the interest of this study to expand on the canon of knowledge on Technological Literacy: the ability to use, manage, understand, and assess technology as represented through standards and benchmarks in the document *Standards for Technological Literacy* (ITEA, 2000, p. 242). Technological literacy encompasses the use of knowledge, ways of thinking and acting, and develops capabilities of using knowledge (NAE & NRC, 2002). "Technological literacy, like other forms of literacy, is what every person needs on order to be an informed and contributing citizen for the work of today and tomorrow "(ITEA, 2003, p. 10).

In studying technology, students are provided with a classification system that sub-divides technology education into taxonomy of seven areas of study in Kindergarten through 12th grade (ITEA 2000).

1. Medical Technology: Students will develop an understanding of and be able to select and use medical technologies (ITEA, 2000, p. 141).
2. Agriculture and Biotechnologies: Students will develop an understanding of and be able to select and use agricultural and related biotechnologies (ITEA, 2000, p. 149).

3. Energy and Power Technologies: Students will develop an understanding of and be able to select and use energy and power technologies (ITEA, 2000, p. 158).
4. Transportation Technologies: Students will develop an understanding of and be able to select and use transportation technologies (ITEA, 2000, p. 175).
5. Manufacturing Technologies: Students will develop an understanding of and be able to select and use manufacturing technologies (ITEA, 2000, p. 182).
6. Construction Technologies: Students will develop an understanding of and be able to use and select construction technologies (ITEA, 2000, p. 191).
7. Communication Technologies: Students will develop an understanding and be able to use information and communication technologies (ITEA, 2000, p. 166).

Sub-population of Interest

A well-developed technology education program is where students will develop an understanding and be able to use information and communication technologies (ITEA, 2000). Communication technology as a curriculum has been consistently included in curriculum efforts of States that have adopted technology education–based programs (Robb and Jones 1990). The study of communication technology has been promoted, supported, and rationalized as part of technology education historically through numerous professional presentations, papers, workshops, meetings, and curriculum efforts (Robb and Jones 1990). It is the goal of this research to investigate the affects of standards-based communication technology units on student achievement as they relate to selected standards for Technological Literacy by a purpose sample of middle and high school students in Technology Education programs.

Sample Description

In 2001, North Carolina State University (NCSU) received a four-year grant from the National Science Foundation (NSF) for the TECH-know Project, a collaboration created from selected state departments, universities, and businesses, for the development of standards-based instructional materials (Taylor 2004). In early 2005, twenty units (ten middle school and ten high school) were published and made commercially available through Centre Pointe Learning publishers. In Fall 2005 these materials were field-tested by a purposeful sample of twenty-two middle and high school technology education teachers from ten states (CO, CT, GA, KY, MS, NC, PA, SC, TN, WI). This field-test model necessitated at least twenty new TECH-know Project teachers were invited to participate in a professional develop workshop at NCSU during the summer of 2005. Those teachers selected for the field test had no prior exposure to the materials. The TECH-know Units were identified with the Standards for Technological Literacy, National Science Education Standards, Principles and Standards for School Mathematics (Taylor, 2004).

Sample

Of the twenty units that have been developed for the TECH-know Project this study selected to focus on four field-tested TECH-know Communications Technology Units because of an identified need to develop and research communications curriculum.
The four field-tested units chosen incorporated both middle and high school classroom samples in six States (CO, CT, PA, SC, TN, WI) in four regions of the county from both rural and suburban settings. The samples were designed to have six technology education teachers, one in each State, with three middle school and three high school technology education classrooms, with each teacher field-testing two TECH-know Communication

Technology Units, with at least 30 students per classroom. The sample was designed to observe what variables such as gender, grade level, teacher, and unit of instruction would have on the pretest and posttest assessments of the treatments.

Treatments

From 2001 until 2004, teachers from North Carolina, Virginia, Oklahoma, Pennsylvania, and Florida piloted and developed TECH-know Units that were identified with the Standards for Technological Literacy, National Science Education Standards, Principles and Standards for School Mathematics (Taylor, 2004). Four TECH-know units were chosen based on an identified need to develop and research communications curriculum due to their relevance and acceptance by students as a valuable resource in preparing them for the future (Robb and Jones 1990).

1. *Cyberspace Pursuit*, a Middle School unit that explores technologies related to the Internet and webpage development. Two instructors were chosen from a middle school Technology Education program to participate in the professional development course. These instructors needed the available technologies to proceed with the treatment.
2. *Desktop Publishing*, a High School unit that explores the technologies related to conventional and digital printing. Two instructors were chosen from a high school Technology Education program to participate in the professional development course. These instructors needed the available technologies to proceed with the treatment.
3. *Digital Photography*, a Middle School unit that explores the technologies and concepts behind electronic imaging. Two instructors were chosen from a middle school Technology Education program to participate in the professional development

course. These instructors needed the available technologies to proceed with the treatment.

4. *Film Technology*, a High School unit that explores the technology behind digital video and concepts for video production. Two instructors were chosen from a middle school Technology Education program to participate in the professional development course. These instructors needed the available technologies to proceed with the treatment.

Assessments

An assessment (Appendix 2, 3, 4, and 5) for each of the Communication Technology Units on student's pre-content knowledge through criterion-referenced tests (CRT) based on core science, mathematic, and technology education concepts and principles identified and embedded into those instructional units. These criterion-referenced tests (CRT) were developed within the course of the TECH-know Project's expert content development and pilot testing. A matching post-CRT (Appendix 2, 3, 4, and 5) followed treatment to assess course content and related identified standards.

Instrument

In addition to the CRT data that provided gender and grade level data, a questionnaire (Appendix 1) was designed to assess descriptive statistics to access communication technologies outside of the classroom. There were fifteen questions with ordinal responses to ascertain access to technologies at home that included personal computers, Internet access, video games, digital cameras, and editing software. Questions also addressed the about amount of time spent online and/or playing video games. The responses could be identified to the student pretest and posttest scores. In this stage of the study the pretest group would be treated as the control group and the posttest group as the treatment group for quantitative ANOVA analysis of variance in mean scores to frequencies counts on ordinal data collected from the participating student surveys.

Collection of Data

CRT's pretest and posttest assessments, questionnaire, and demographics were scored on a General Purpose Pearson NCS Answer Sheets (NCS, 2002). Selected field-test teachers were instructed to code their sample's answer sheets and administer pretest prior to treatments. Collection of survey questionnaire data was advised to be collected either at pre-test or post test assessments. At the end of the instructional unit and treatment was terminated, the CRT post assessment was administered. The collected answer sheets were returned to TECH-know Project for data collection and analysis. This data was scanned and imported into electronic spreadsheets for comparison analysis.

- The collected data was compiled to ascertain individual pretest/posttest scores, and differences to develop group pretest/posttest mean scores and mean differences to test for variables of influence as related to the research questions.
- Sub-group analysis of the four treatments was analyzed with comparisons mean scores to content-knowledge of mathematics, science, and technology by converting correct responses to a yes/no format to ascertain scores within each individual's pretest and posttest assessment. Sub-group mean scores and mean differences provided the ability to significance test variables of influence as they are related to the research questions.
- Additional sub-group analysis of mean scores for analysis of variance and frequencies counts on ordinal data was utilized to assess survey responses to access to

communication technologies outside the classroom. In this stage of the study, pretest group was the control group, and posttest group was the treatment.

Statistical Procedures

For the purpose of analysis of field CRT pretest and posttest data, in testing the research questions, for the null hypothesis [Ho], this study compared within-group variation for paired differences by using a t-test to examine errors in the before and after treatments looking for no effect at an alpha [a] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in this significant test.

In ANOVA, the goal is determine the reliability of mean group differences. ANOVA is an analysis of variance for comparing means of categories of a single qualitative variable. ANOVA: a statistical method for making simultaneous comparisons between two or more means; a statistical method that yields values that can be tested to determine whether a significant relation exists between variables, analysis of variance (Agresti & Finlay, 1997).

In testing the null hypothesis in an analysis of variance, [ANOVA] which analyzes the relationship between the mean of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [α] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests.

Research Question 1: Are students learning mathematics, science and technology content based on the pre and posttest scores?

Each selected TECH-know Unit of study has been developed and correlated with the Standards for Technological Literacy, National Science Education Standards, Principles and

Standards for School Mathematics. Initial research from pilot studies suggested that these materials showed an increase in students' understanding in science, technology and math for virtually all populations as well as enhancing students' interest in these areas (Taylor, 2004).

Plan for addressing the question:

Within the assessment exists an identifiable questions developed to assess science, mathematics and technology content within the unit of instruction. In the analysis of those paired differences of the pretest and posttest measures, the paired differences should be normally distributed, then this *t*-test can exclude the entire part of variation in the data sets that results for unequal base levels of individual subjects. For addressing this question, this study will test for the null hypothesis of no effect at an alpha [a] confidence level of 95% and a probability P-value of 0.05. The P-value probability was the primary reported result in this significant test.

Question 2: Does gender and grade level have an affect on student's pretest and posttest scores? Plan for addressing question:

In testing the null hypothesis, this research compared within-group variation for paired differences by using a t-test to examine errors in the before and after treatments looking for no effect at an alpha [α] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). In addition for testing this null hypothesis, an analysis of variance [ANOVA] which analyzes the relationship between the mean of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [α] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests.

In comparing the sample's pretest and posttest scores, if the null hypothesis was true, student gender and grade level has no affect on comprehension of the selected communication units' content. Producing a p-level greater than alpha [α] confidence level of 95% and a probability P-value of 0.05, the null hypothesis [Ho] was plausible, and the differences in pretest and posttest scores and within group variation were too close to be statistically significant and could not reject the null hypothesis [Ho] (Agresti & Finlay, 1997). A small P-value was evidence against the null hypothesis [Ho] of no effect providing stronger evidence in favor of the alternative hypothesis [Ha] (Agresti & Finlay, 1997), that gender and grade level had an affect on student comprehension of content.

<u>Question 3: Do teachers have an affect in student achievement based on pretest and posttest scores? Plan for addressing question:</u>

In testing this hypothesis, this research compared within-group variation for paired differences by using a t-test to examine errors in the before and after treatments looking for no effect at an alpha [a] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). In addition for testing this hypothesis, an analysis of variance [ANOVA] analyzes the relationship between the mean of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [a] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests.

<u>Do the communication technology units of instruction have an affect on student mean pretest and posttest scores? Plan for addressing question:</u>

Analysis of Variance, ANOVA: a statistical method for making simultaneous comparisons between two or more means; a statistical method that yields values that can be tested to determine whether a significant relation exists between variables. An analysis of variance [ANOVA], which analyzes the relationship between the mean of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [a] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests.

<u>Is there evidence that access to communication technologies outside the classroom have an affect in student pretest and posttest scores? Plan for addressing this question.</u>

Frequency data were compiled concerning the participants' responses to the Technology Access Student Survey. This information was referenced to the sample's assessment data to determine the significance of access to communication technologies outside of the classroom. For the purpose of this study, the pretest scores served as the control group and the posttest scores served as the treatment group. In the analysis of variance [ANOVA] analyzes the relationship between the means of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [α] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests.

<u>Limitations</u>

The samples were limited to Technology Education middle and high school classrooms participating in the TECH-know Project's Communication Technology Education Units. These instructional units required classrooms and labs with access communication technologies: (i.e.) computers, access to the Internet, digital imaging and displaying equipment, printers, scanners, and associated materials.

Chapter Three Summary

During the summer of 2005, twenty middle and high school technology education teachers from nine states were provided an intensive one-week workshop on the methodologies and contents of the TECH-know instructional materials. Those teachers that were selected had no prior exposure to the materials. These activities and curriculum materials were derived from the *Standards for Technological Literacy* as identified by the Technology for All Americans Project, ensuring that the core Science Math and Technology concepts and principles embedded in the activities will be aligned with those standards. The treatments in the field test phase were an application of standards based curriculum that has been developed over the past four years through a series of pilot testing and editing by the TECH-know Project.

In the field test phase of the TECH-know Project, at a national level, new instructional materials were disseminated and field-tested. Representative states expressed interested in the field test included: NC, CO, CT, GA, MS, PA, SC, TN, & WI.

An assessment was developed to determine the effects of Standards Based Instruction on Technological Literacy in Technology Education in regards to the impacts of the finished Tech-know Units (Communication Units) on students and teachers and presented that data concerning the overall scores in science, mathematics, and technological literacy. These CRT instruments were developed and validated individually by each unit's writers and developer's for content rationale and appropriateness, and altered only to reflect each unit's fruition during the piloting phase.

Of the twenty units that have been developed for the TECH-know Project this research will focus on four communications units that are being field-tested:

Cyberspace Pursuit, Desktop Publishing, Digital Photography, and Film Technology Quantitative data will be analyzed through a statistics software package for analysis of Pre – Post Content and Process Skills. Additional quantitative and descriptive data was available for subgroup evaluations: An alpha level for statistical significance will be set at: [$\partial = 0.05$]. It is the goal of this research was to investigate the affects of standards-based communication technology units on student achievement as they relate to selected standards for Technological Literacy by middle and high school students in Technology Education programs. A subgroup research intends to investigate is an analysis of available research on access to communication technologies outside the classroom. Access to communication technologies such as the Internet, video/computer games, and other digital equipment outside the classroom may or may not have any influence on a student's achievements in school.

The methodology for this research was an assessment of quantitative data collected from a stratified purposeful population of technology education classrooms in both middle and high school settings. The process began with a student assessment of their pre-content knowledge of Communication Technology Units through criterion-referenced tests (CRT) based on standards for technological literacy and course rationale developed during the pilot study phase. The treatments were an application of standards based curriculum that has been developed over the past four years through a series of pilot testing and editing. It will be followed by a post-CRT on the content for each unit's content. These CRT instruments were developed and validated individually by each unit's writers and developer's for their content rationale and appropriateness, and only altered to reflect each unit's fruition during the piloting phase.

In addition to the CRT scores collected, subgroup quantitative and descriptive information was gathered on student, teacher, and school demographics regarding access to communication technologies in and outside of the classroom.

Questions to be answered

1. Are students learning mathematics, science and technology content based on the pretest and posttest scores?
2. Does gender and grade level have an affect on students based on pretest and posttest scores?
3. Do teachers have an affect on students' achievement based on pretest and posttest scores?
4. Do the communication technology units of instruction have an affect on students based on pretest and posttest scores?
5. Is there evidence that access to communication technologies outside the classroom has an affect on student pretest and posttest scores?

CHAPTER FOUR

Presentation and Analysis of Data

This chapter presents the findings and the analysis of the data collected from the application of the TECH-know Communication Technology Units. The four field-tested units chosen incorporated both middle and high school classroom samples in five States (CO, CT, PA, SC, WI) and four regions of the county in both rural and suburban settings. The sample included five technology teachers, four males and one female, and total of 220 middle and high school technology education students. In all there were eight classrooms that included five high school and three middle school groups with an average of 27 students per classroom.

The students in this sample were comprised of 149 male and 71 female members. The total number of middle school students in this sample was 105 and comprised of 64 males and 31 females. The total number of high school students was 115 and comprised of 85 males and 30 females.

The sample was comprised of four units of instruction with two developed for middle school and two developed high school technology education classroom. Each unit had an average of 55 students per unit for observation.

The samples were limited to Technology Education middle and high school classrooms participating in the TECH-know Project's Communication Technology Education Units. These instructional units required classrooms and labs with access communication technologies: (i.e.) computers, access to the Internet, digital imaging and displaying equipment, printers, scanners, and associated materials.

<u>Sample and Teacher Demographics by Units</u>

Cyberspace Pursuit, a middle school unit that explores technologies related to the Internet and webpage development. A total of 40 students, 24 males and 16 females participated in this treatment.

- One instructor completed this unit:
- Instructor [A] is a 53 year-old female with sixteen years of classroom teaching experience including eight years of teaching Technology Education curriculum.
- Instructor [A] has a Masters Degree in Education.
- Instructor [A] participated in TECH-know Professional Development, in Summer 2005.
- This sample's classroom is located in rural SC school with the population base reporting at a low socio-economic level.
- This sample consisted of 40 middle school students, 24 males and 16 females.
- Instructor [A] also delivered the Digital Photography Unit.
- This sample in Cyberspace Pursuit is the same group that participated in the Digital Photography Unit.
- A second unit was assigned to Instructor [B] in TN, that data was unavailable at the time of reporting.
- Instructor [B] did not participated in TECH-know Professional Development, Summer 2005.

Desktop Publishing, a High School unit that explores technologies related to conventional and digital printing. A total of 48 students, 24 males and 14 females participated in this treatment.

- Two instructors in two States completed this unit, both male with diverse demographics.
- Instructor [C], age 24 and has a Bachelor of Science in Education and three years of classroom teaching experience.
- Instructor [C] participated in TECH-know Professional Development, Summer 2005.
- This sample's classroom is located in rural PA and consisted of 23 high school students, 14 males and 9 females.
- Instructor [C] was chosen to field test the Film Technology Unit.
- This Desktop Publishing sample is the same group that participated in the Film Technology Unit.
- Instructor [D], age 52 and has a Masters in Education (ABD) and 29 years experience in classroom teaching.
- Instructor [D] participated in TECH-know Professional Development, Summer 2005.
- This sample's classroom is located in MA in upper-middle class suburbia and consisted of 25 high school students, 20 males and 5 females.
- It should be noted that Instructor [D] reported that in error [this teacher] administered the Desktop Publishing pilot-test assessments rather than the Desktop Publishing field-test assessments at pre and post treatment. The pilot assessment key was used to perform assessments of the sample's treatment. The differences in the two

assessments were minimal, yet an accurate assessment of the Desktop Publishing field-test was unavailable.

Digital Photography, a Middle School unit that explores the technologies and concepts behind electronic imaging. A total of 65 students, 30 males and 25 females participated in this treatment.

- Two instructors delivered this unit: one male and one female.
- The female Instructor [A] also completed the Cyberspace Pursuit Unit.
- This sample's classroom was located in rural SC school with the population base reporting at a low socio-economic level.
- This sample consisted of 40 middle school students, 24 males and 16 females.
- Instructor [E] is male. The sample's classroom is located in rural WI.
- Instructor [E] participated in TECH-know Professional Development, Summer 2005.
- The sample consisted of 25 middle school students with 16 males and 9 females.

Film Technology, a High School unit that explores the technology behind digital video and concepts for video production. A total of 66 students, 50 males and 16 females participated in this treatment.

- Three instructors delivered this unit: all male and with diverse demographics.
- Two of the instructors [C and D] also delivered the Desktop Publishing Unit.
- Instructor [C]'s Film Technology sample was the same group of high school students that participated in the Desktop Publishing Unit treatment.
- This sample is a different group from Instructor [D]'s previous Desktop Publishing Unit sample.

- Instructor [D]'s sample's classroom consisted of 26 high school students, 19 males and 7 females.
- It should be noted that Instructor [D] reported that in error [this teacher] administered the Film Technology pilot-test assessments rather than the Film Technology field-test assessments at pre and post treatment. The pilot assessment key was used to perform assessments of the sample's treatment. The differences in the two assessments were minimal, yet an accurate assessment of the Film Technology field-test was unavailable.
- Instructor [F] is male.
- Instructor [F] did not participated in TECH-know Professional Development, Summer 2005.
- The sample's classroom is located rural southeastern CO and consisted of 17 high school male students.

<u>School and Classroom Demographics</u>

The field test teachers were instructed to provide an assessment of school and classroom demographics. Teachers [A], [C], and [D] completed and returned this information. Teachers [B], [E], and [F] school and classroom demographics were unavailable. An assessment of school and classroom characteristics as a variable was unavailable due to a non-response by all participating classroom instructors across all units of instruction.

Teacher [A]'s middle school has a 22:1 teacher-to-student ratio on average with an overall population of 584 seventh and eighth graders from low wealth socio economic rural SC. Teacher [A] had 40 students participating in this project from the 137 students taught per semester. Teacher [A]'s technology lab has 10 Personal Computers (PC), all with access to the Internet. Teacher [A]'s technology lab has (8) digital picture cameras, (4) digital video cameras, (3) scanners, (3) color printers, and (4) VCR/DVD players.

Teacher [C]'s high school has a 20:1 teacher-to-student ratio on average with an overall population of 1356 ninth to twelfth grade students from rural PA. Teacher [C] had 24 students participating in this project from the 100 students taught overall. Teacher [C]'s technology lab has (6) Macintosh (Apple) Computers and (22) PC's all with Internet access. Teacher [C]'s technology lab has (2) digital picture cameras, (2) digital video cameras, (4) scanners, (1) color and (2) black and white printers, and (2) VCR/DVD players. In addition, Teacher [C]'s technology lab has a poster printer, photo printer, and laminator.

Teacher [D]'s high school has a 20:1 teacher-to-student ratio on average with an overall population of ninth to twelfth grade students from upper class New England suburbs. Teacher [D] 28 students participating in this project from the 100 students taught overall. Teacher [D]'s technology lab has (14) Apple Computers all with access to the Internet. Teacher [D]'s technology lab has access to digital picture and video cameras, scanners, color printers, VCR/DVD players, and a digital projector (no quantities reported).

In a comparison from these teacher's classrooms filled with communication technologies in this study, in a research study from the University of Alabama, produced by Cheryl White Sundberg in 2000, the researcher found in classrooms observed for teaching science curriculum in rural Alabama:

- Digital camera and scanners were not widely available to the teachers, only two thirds of the participants (65%) did have a digital camera available and almost half (59%) had a scanner they could use. Yet if the technology was available, the technology was not used during instruction. Digital cameras were not used in instruction. Only (6%) of the respondents indicated they used a digital camera in the classroom (Sundberg, 2000, p152).

- Almost a third of the participants did not use a computer in instruction and (42%), nearly half used the Internet for instruction and (41%) used email for instructional purposes (Sundberg, 2000, p156).
- Adequate Internet access was problematic. While teachers had the necessary computer equipment to go online, access was undependable in rural and under-served areas as well as a lack of technical skills could negatively impacted the use of the Internet (Sundberg, 2000, p160).

Though this study was conducted in the year 2000, there was clearly a lack of access to communication technologies in the observed classrooms.

Research Questions

In this research on the affects of standards-based communication technology education units on the achievement of selected standards for technological literacy by student in middle and high technology education programs, there are five research questions that were addressed:

1. Are students learning mathematics, science and technology content based on the pretest and posttest scores?
2. Does gender and grade level have an affect on students based on pretest and posttest scores?
3. Do teachers have an affect on students' achievement based on pretest and posttest scores?

4. Do the communication technology units of instruction have an affect on students based on pretest and posttest scores?
5. Is there evidence that access to communication technologies outside the classroom has an affect on student pretest and posttest scores?

Assessment Data

The first question to address: Are students learning mathematics, science and technology content based on the pretest and posttest scores? In testing this research question, for the null hypothesis [Ho], this study compared within-group variation for paired differences by using a t-test to examine errors in the before and after treatments looking for no effect at an alpha [α] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in this significant test.

In comparing the sample's pretest and posttest scores for the first research question, if the null hypothesis was true, students did not learn mathematics, science and technology content. Producing a P-level greater than 0.05, the null hypothesis [Ho] was plausible, and the differences in pretest and posttest scores and within group variation were too close to be statistically significant and could not reject the null hypothesis [Ho] (Agresti & Finlay, 1997). A small P-value was evidence against the null hypothesis [Ho] of no effect providing stronger evidence in favor or the alternative hypothesis [Ha] (Agresti & Finlay, 1997), that students did learn mathematics, science and technology content.

Assessments of the four units of instruction

The data provided in Table 4.1 presents an overall summary of statistics of the sample's scores as grouped by each communication unit.

Table 4.1 Pretest and post test overall content sample scores distribution of summary statistics grouped by Communication Units

UNIT	n	Mean	Variance	Std. Dev.	Std. Err.	Median	Range	Min	Max	Q1	Q3
CP-Pretest	40	36.7	118.88	10.90	1.72	36	44	16	60	28	44
CP-Posttest	40	80.1	248.19	15.75	2.49	82	52	48	100	66	92
DTP- Pretest	47	39.31	373.78	19.33	2.82	36	68	12	80	24	56
DTP-Posttest	47	61.10	375.44	19.37	2.82	60	84	12	96	48	76
DP-Pretest	65	48.73	236.94	15.39	1.90	48	64	12	76	36	60
DP-Posttest	65	78.03	207.56	14.40	1.78	80	64	36	100	72	88
FT-Pretest	67	33.55	134.76	11.60	1.41	32	52	12	64	28	40
FT-Posttest	67	62.14	699.31	26.44	3.23	60	84	16	100	36	92

CP= Cyberspace Pursuit, DTP= Desktop Publishing, DP= Digital Photography, and FT= Film Technology

An improvement in the overall posttest mean scores from the pretest mean scores is shown to be significant as presented in Table 4.2. The P-value of the paired t-test statistics for the pretest and posttest scores of the sample's overall content of knowledge in each of the Communication Units is smaller 0.05 (CP < 0.0001, DTP < 0.0001, DP < 0.0001, FT <0.0001) rejecting the null hypothesis of no effect. The treatments in the Communication Units had an affect on student scores.

Table 4.2 Paired T statistics for pretest and posttest overall content sample scores distribution of summary statistics grouped by Communication Units.

UNIT	Diff.	Std. Err.	DF	T-Stat	P-value
CP	43.40	1.82	39	23.76	<0.0001
DTP	21.78	4.36	46	04.99	<0.0001
DP	29.29	1.73	64	16.9	<0.0001
FT	28.59	3.60	66	07.92	<0.0001

Alpha [α] confidence level of 95% and a probability P-value of 0.05
Hypothesis test: $H_0 : \mu_1 - \mu_2 = 0$, $H_A : \mu_1 - \mu_2 \neq 0$
CP= Cyberspace Pursuit, DTP= Desktop Publishing, DP= Digital Photography, and FT= Film Technology

The data provided in Table 4.3 presents and overall summary of statistics for Cyberspace Pursuit's pretest and posttest scores based on technology, mathematics and science content.

Table 4.3 Pretest and post test for the Cyberspace Pursuit Unit (CP) distribution of summary statistics for content scores grouped by technology [TEC1/TEC2], mathematics [MAT1/MAT2], and science [SCI1/SCI2]

CP-UNIT	n	Mean	Variance	Std. Dev.	Std. Err.	Median	Range	Min	Max	Q1	Q3
TEC1	40	5.67	3.04	1.74	0.27	6	7	2	9	4	7
TEC2	40	11.82	6.81	2.61	0.41	12	9	6	15	9.5	14
MAT1	40	1.7	1.24	1.11	0.17	2	4	0	4	1	2
MAT2	40	3.87	0.98	0.99	0.15	4	4	1	5	3	5
SCI1	40	1.8	1.24	1.11	0.17	2	4	0	4	1	2.5
SCI2	40	4.32	0.68	0.82	0.13	5	3	2	5	4	5

TEC1= Pretest Technology TEC2 = Posttest Technology, MAT1= Pretest Mathematics, MAT2 = Posttest Mathematics, SCI 1= Pretest Science, and SCI2= Posttest Science

An improvement in the overall posttest mean scores from the pretest mean scores is shown to be significant as presented in Table 4.4. The P-value of the paired t-test statistics for the pretest and posttest scores of the sample's overall knowledge in each content area of technology, mathematics and science a smaller than 0.05 (Technology < 0.0001, Mathematics < 0.0001, Science < 0.0001) rejecting the null hypothesis of no effect. The treatment in the Cyberspace Pursuit had an affect on student scores in technology, mathematics and science.

Table 4.4 Paired T statistics for pretest and posttest for the Cyberspace Pursuit Unit sample scores grouped by technology, mathematics, and science

CP	Diff.	Std. Err.	DF	T-Stat	P-value
Technology	6.15	0.35	39	17.39	<0.0001
Mathematics	2.17	0.18	39	11.71	<0.0001
Science	2.52	0.2	39	12	<0.0001

Alpha [α] confidence level of 95% and a probability P-value of 0.05
Hypothesis test: H0: _1 - _2 = 0, HA: _1 - _2 ≠ 0

The data provided in Table 4.5 presents and overall summary of statistics for Desktop Publishing's pretest and posttest scores based on technology, mathematics and science content.

Table 4.5 Pretest and post test for Desktop Publishing Unit (DTP) distribution of summary statistics for content scores grouped by technology [TEC1/TEC2], mathematics [MAT1/MAT2], and science [SCI1/SCI2]

DTP-Unit	n	Mean	Variance	Std. Dev.	Std. Err.	Median	Range	Min	Max	Q1	Q3
TEC1	47	6.23	9.87	3.14	0.45	6	12	2	14	4	8
TEC2	47	9.51	7.9	2.81	0.41	10	12	2	14	8	11
MAT1	47	2	2.17	1.47	0.21	2	5	0	5	1	3
MAT2	47	2.93	2.49	1.57	0.23	3	5	0	5	2	5
SCI1	47	1.59	0.98	0.99	0.14	2	4	0	4	1	2
SCI2	47	2.82	2.44	1.56	0.22	3	5	0	5	2	4

TEC1= Pretest Technology TEC2 = Posttest Technology, MAT1= Pretest Mathematics, MAT2 = Posttest Mathematics, SCI 1= Pretest Science, and SCI2= Posttest Science

An improvement in the overall posttest mean scores from the pretest mean scores is shown to be significant as presented in Table 4.6. The P-value of the paired t-test statistics for the pretest and posttest scores of the sample's overall knowledge in each content area of technology, mathematics and science a smaller than 0.05 (Technology < 0.0001, Mathematics < 0.0138, Science < 0.0001) rejecting the null hypothesis of no effect. The treatment in the Desktop Publishing had an affect on student scores in technology, mathematics and science.

Table 4.6 Paired T statistics for pretest and posttest for the Desktop Publishing Unit sample scores grouped by technology, mathematics, and science

DTP	Diff.	Std. Err.	DF	T-Stat	P-value
Technology	3.27	0.64	46	5.04	<0.0001
Mathematics	0.93	0.36	46	2.56	0.0138
Science	1.23	0.27	46	4.44	<0.0001

Alpha [α] confidence level of 95% and a probability P-value of 0.05
Hypothesis test: H0: _1 - _2 = 0, HA: _1 - _2 ≠ 0

The data provided in Table 4.7 presents and overall summary of statistics for Digital Photography's pretest and posttest scores based on technology, mathematics and science content.

Table 4.7 Pretest and posttest for Digital Photography Unit (DTP) distribution of summary statistics for content scores grouped by technology [TEC1/TEC2], mathematics [MAT1/MAT2], and science [SCI1/SCI2]

DP - Unit	n	Mean	Variance	Std. Dev.	Std. Err.	Median	Range	Min	Max	Q1	Q3
TEC1	65	6.80	5.25	2.29	0.28	7	10	2	12	5	8
TEC2	65	11.16	5.92	2.43	0.3	11	11	4	15	9	13
MAT1	65	2.18	1.59	1.26	0.15	2	5	0	5	1	3
MAT2	65	4.06	1.08	1.04	0.12	4	4	1	5	3	5
SCI1	65	3.20	2.03	1.42	0.17	4	5	0	5	2	4
SCI2	65	4.27	0.76	0.87	0.1	5	3	2	5	4	5

TEC1= Pretest Technology TEC2 = Posttest Technology, MAT1= Pretest Mathematics, MAT2 = Posttest Mathematics, SCI 1= Pretest Science, and SCI2= Posttest Science

An improvement in the overall posttest mean scores from the pretest mean scores is shown to be significant as presented in Table 4.8. The P-value of the paired t-test statistics for the pretest and posttest scores of the sample's overall knowledge in each content area of technology, mathematics and science a smaller than 0.05 (Technology < 0.0001, Mathematics < 0.0001, Science < 0.0001) rejecting the null hypothesis of no effect. The treatment in the Digital Photography had an affect on student scores in technology, mathematics and science.

Table 4.8 Paired T statistics for pretest and posttest for the Digital Photography Unit sample scores grouped by technology, mathematics, and science

Content	Diff.	Std. Err.	DF	T-Stat	P-value
Technology	4.36	0.31	64	13.73	<0.0001
Mathematics	1.87	0.15	64	12.16	<0.0001
Science	1.07	0.16	64	6.72	<0.0001

alpha [α] confidence level of 95% and a probability P-value of 0.05
Hypothesis test: H0 : _1 - _2 = 0 , HA : _1 - _2 ≠ 0

The data provided in Table 4.9 presents and overall summary of statistics for Film Technology's pretest and posttest scores based on technology, mathematics and science content.

Table 4.9 Pretest and post test for Film Technology Unit (DTP) distribution of summary statistics for content scores grouped by technology [TEC1/TEC2], mathematics [MAT1/MAT2], and science [SCI1/SCI2]

FT-Unit	n	Mean	Variance	Std. Dev.	Std. Err.	Median	Range	Min	Max	Q1	Q3
TEC1	67	5.02	3.96	1.99	0.24	5	8	2	10	4	7
TEC2	67	9.32	18.04	4.24	0.51	9	13	2	15	5	14
MAT1	67	1.56	1.15	1.07	0.13	2	4	0	4	1	2
MAT2	67	3.04	2.13	1.46	0.17	3	5	0	5	2	4
SCI1	67	1.79	1.25	1.12	0.13	2	4	0	4	1	3
SCI2	67	3.16	2.62	1.61	0.19	3	5	0	5	2	5

TEC1= Pretest Technology TEC2 = Posttest Technology, MAT1= Pretest Mathematics, MAT2 = Posttest Mathematics, SCI 1= Pretest Science, and SCI2= Posttest Science

An improvement in the overall posttest mean scores from the pretest mean scores is shown to significant increase as presented in Table 4.10. The P-value of the paired t-test statistics for the pretest and posttest scores of the sample's overall knowledge in each content area of technology, mathematics and science a smaller than 0.05 (Technology < 0.0001, Mathematics < 0.0001, Science < 0.0001) rejecting the null hypothesis of no effect. The treatment in the Film Technology had an affect on student scores in technology, mathematics and science.

Table 4.10 Paired T statistics for pretest and posttest for the Film Technology Unit sample scores grouped by technology, mathematics, and science

Content	Diff.	Std. Err.	DF	T-Stat	P-value
Technology	4.29	0.59	66	7.16	<0.0001
Mathematics	1.47	0.22	66	6.52	<0.0001
Science	1.37	0.23	66	5.84	<0.0001

alpha [α] confidence level of 95% and a probability P-value of 0.05
Hypothesis test: H0 : _1 - _2 = 0 , HA : _1 - _2 ≠ 0

According to these findings, all four Communication Units of instruction had a significant affect on student's scores in communication technology, mathematics and science content. A proficiency in reading, science, mathematics, and technology is considered one of America's fundamental concerns of accountability in our public schools (Wood, 2004). The Law, No Child Left Behind (2002) requires school programs, teachers and students to adhere to higher standards reading, science and mathematics by the year 2014 (Wood, 2004). Developing sound curriculum that promotes literacy in those areas is critical. Science and mathematics education are characterized as theoretical whereas technology education (TED) emphasizes constructive philosophies. The TECH-know Project developed co-curricular instructional materials that are closely aligned with foundational science and mathematics concepts. Their effectiveness will depend on marketing and dissemination nationally (Peterson, 2000).

Assessment of variables of influence: Gender

The second question to address: Does gender and grade level have an affect on students based on pretest and posttest scores? In testing this null hypothesis, gender and grade level have no affect on students based on pretest and posttest scores, this research compared within-group variation for paired differences by using a t-test to examine errors in the before and after treatments looking for no effect at an alpha [α] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997).

In comparing the sample's pretest and posttest scores, producing a p-level greater than alpha [α] confidence level of 95% and a probability P-value of 0.05, the null hypothesis [Ho] was plausible, and the differences in pretest and posttest scores and within group variation were too close to be statistically significant and could not reject the null hypothesis [Ho] (Agresti & Finlay, 1997).

A small P-value was evidence against the null hypothesis [Ho] of no effect providing stronger evidence in favor of the alternative hypothesis [Ha] (Agresti & Finlay, 1997), that gender and grade level had an affect on student comprehension of content.

The data provided in Tables 4.11 and 4.12 presents the overall pretest and posttest summaries of statistics for male and female students grouped by the four units.

Table 4.11 Column statistics grouped by units for male students' pretest and posttest scores

UNITS	n	Mean	Variance	Std. Dev.	Std. Err.	Median	Range	Min	Max	Q1	Q3
CP-Pretest	24	34.16	86.23	9.28	1.89	32	36	16	52	28	40
CP-Posttest	24	77.16	251.1	15.84	3.23	76	48	52	100	60	92
DTP-Pretest	33	39.63	370.36	19.24	3.35	36	68	12	80	24	56
DTP-Posttest	33	58.78	283.48	16.83	2.93	56	64	32	96	48	68
DP-Pretest	40	47.4	223.63	14.95	2.36	48	56	20	76	36	56
DP-Posttest	40	76.4	234.50	15.31	2.42	80	64	36	100	66	86
FT-Pretest	51	33.64	145.39	12.05	1.68	32	52	12	64	28	40
FT-Posttest	51	61.96	704.87	26.54	3.71	64	80	20	100	36	92

Table 4.12 Column statistics grouped by units for female students' pretest and posttest scores

UNIT	n	Mean	Variance	Std. Dev.	Std. Err.	Median	Range	Min	Max	Q1	Q3
CP-Pretest	16	40.50	151.20	12.29	3.07	40	36	24	60	30	48
CP-Posttest	16	84.50	225.86	15.02	3.75	86	52	48	100	80	96
DTP-Pretest	14	38.57	410.10	20.25	5.41	32	60	16	76	24	52
DTP-Posttest	14	66.57	584.87	24.18	6.46	68	84	12	96	56	88
DP-Pretest	25	50.88	260.69	16.14	3.22	56	64	12	76	36	60
DP-Posttest	25	80.64	160.90	12.68	2.53	80	44	56	100	72	96
FT-Pretest	16	33.25	108.20	10.4	2.60	32	36	16	52	26	40
FT-Posttest	16	62.75	726.86	26.96	6.74	54	84	16	100	40	90

CP= Cyberspace Pursuit, DTP= Desktop Publishing, DP= Digital Photography, and FT= Film Technology

An improvement in the overall posttest mean scores from the pretest mean scores is shown to have significant increase as presented in Tables 4.13 and 4.14. The P-value of the paired t-test statistics for the pretest and posttest scores of the sample's overall knowledge in each unit of instruction is smaller than 0.05 (Male: CP < 0.0001, DTP < 0.0002, DP < 0.0001, FT <0.0001; Female: CP < 0.0001, DTP < 0.0152, DP < 0.0001, FT <0.0001)

rejecting the null hypothesis of no effect. These findings showed that gender had an affect on student scores. The Desktop Publishing Unit had a slightly higher P-value for both genders, but was smaller than 0.05 and still significant.

Table 4.13 Paired T statistics for pretest and posttest for the male student scores grouped by communication units

UNIT	Diff.	Std. Err.	DF	T-Stat	P-value
CP	43.00	2.17	23	19.81	<0.0001
DTP	19.15	4.58	32	4.17	0.0002
DP	29.00	2.3	39	12.58	<0.0001
FT	28.31	4.06	50	6.95	<0.0001

alpha [α] confidence level of 95% and a probability P-value of 0.05
Hypothesis test: $H0 : \mu1 - \mu2 = 0$, $HA : \mu1 - \mu2 \neq 0$
CP= Cyberspace Pursuit, DTP= Desktop Publishing, DP= Digital Photography, and FT= Film Technology

Table 4.14 Paired T statistics for pretest and posttest for the female student scores grouped by communication units

UNIT	Diff.	Std. Err.	DF	T-Stat	P-value
CP	44.00	3.28	15	13.38	<0.0001
DTP	28.00	10.01	13	2.79	0.0152
DP	29.76	2.64	24	11.25	<0.0001
FT	29.50	7.99	15	3.68	0.0022

alpha [α] confidence level of 95% and a probability P-value of 0.05
Hypothesis test: $H0 : \mu1 - \mu2 = 0$, $HA : \mu1 - \mu2 \neq 0$
CP= Cyberspace Pursuit, DTP= Desktop Publishing, DP= Digital Photography, and FT= Film Technology

In Table 4.15 the mean score gains for the males and females in a side-by-side analysis for each separate unit of instruction provides a comparison of mean score gains by gender. These means show variation gender to gender as well as from unit to unit. Additional analysis for these differences would provide areas for additional research.

Table 4.15 One Sample T-statistic where units are grouped by gender and mean gains

Gender/Unit	Mean	Std. Err.	DF	T-Stat	P-value
FT					
F	37.33	9.69	11	3.85	0.0027
M	36.41	4.43	38	8.2	<0.0001
DTP					
F	28.00	10.01	13	2.79	0.0152
M	23.68	5.57	24	4.25	0.0003
CP					
F	45.77	4.52	8	10.11	<0.0001
M	41.66	3.13	11	13.3	<0.0001
DP					
F	30.66	3.39	8	9.02	<0.0001
M	33.33	4.07	11	8.18	<0.0001

$H_0 : \mu = 0$, $H_A : \mu \neq 0$. CP= Cyberspace Pursuit, DTP= Desktop Publishing, DP= Digital Photography, and FT= Film Technology

Assessment of variables of influence: Grade level

The data provided in Table 4.16 presents the overall summary statistics for middle school, and high school units.

Table 4.16 Column summary statistics for middle school and high school units.

Summary statistics for High School Units

	n	Mean	Variance	Std. Dev.	Std. Err.	Median	Range	Min	Max	Q1	Q3
Pretest	114	35.92	239.0	15.5	1.4	32	68	12	80	24	44
Posttest	114	61.71	561.5	23.7	2.2	60	88	12	100	40	84
Difference	114	25.78	885.5	29.8	2.8	20	120	-36	84	4	48

Summary statistics for Middle School Units

	n	Mean	Variance	Std. Dev.	Std. Err.	Median	Range	Min	Max	Q1	Q3
Pretest	105	44.15	224.9	15.0	1.5	40	64	12	76	32	56
Posttest	105	78.81	221.8	14.9	1.5	80	64	36	100	72	92
Difference	105	34.66	217.4	14.7	1.4	36	68	-4	64	24	48

An improvement in the overall posttest mean scores from the pretest mean scores is shown to have significant increase in both middle school and high school units as presented in Table 4.17. The P-value of the paired t-test statistics for the pretest and posttest scores of the sample's overall knowledge is smaller than 0.05 (HS-DTP < 0.0001, HS-FT < 0.0001, MS-CP < 0.0001, MS-DP < 0.0001) rejecting the null hypothesis of no effect. Overall the student's in each grade level performed well.

Table 4.17 Paired T statistics of the paired difference between SCORE1 and SCORE2 each Unit

UNITS	Sample Diff.	Std. Err.	DF	T-Stat	P-value
HS - DTP	21.78	4.36	46	4.99	<0.0001
HS - FT	28.59	3.60	66	7.92	<0.0001
MS - CP	43.40	1.82	39	23.76	<0.0001
MS - DP	29.29	1.73	64	16.9	<0.0001

alpha [α] confidence level of 95% and a probability P-value of 0.05
CP= Cyberspace Pursuit, DTP= Desktop Publishing, DP= Digital Photography, and FT= Film Technology

Assessment of variables of influence: Teachers

The third question to address, do teachers have an affect on students' achievement based on pretest and posttest scores? In testing this hypothesis, this research compared within-group variation for paired differences by using a t-test to examine errors in the before and after treatments looking for no effect at an alpha [α] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). In addition for testing this hypothesis, an analysis of variance [ANOVA] analyzes the relationship between the mean of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [α] confidence level of 95% and a probability P-value of

0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests.

The data provided in Table 4.18 presents a Paired T statistics for mean of paired differences in pretest and posttest scores as group by teachers. For teachers [A], [C], [E], and [F], the P-values of the paired t-test statistics for the pretest and posttest scores of the sample's overall knowledge is smaller than 0.05 (A < 0.0001, C < 0.0001, E < 0.0001, F < 0.0001) rejecting the null hypothesis of no effect. Overall the treatments in these teachers' classrooms had an affect on student scores.

For teacher [D] in Table 4.18, the P-value of this high school sample is greater than 0.05 (0.5465) and cannot reject the null hypothesis of no effect. Though the same units of instruction performed well by other teachers in the group as presented in Table 4.19, Teacher [D]'s influence on the student's scores had no affect.

Table 4.18 Paired T statistics for mean of paired differences in pretest and posttest scores, group by teachers

Teacher	Diff.	Std. Err.	DF	T-Stat	P-value
A	38.10	1.58	79	23.99	<0.0001
C	45.65	3.27	45	13.95	<0.0001
D	-1.25	2.06	50	-0.60	0.5465
E	23.68	2.12	24	11.12	<0.0001
F	45.64	6.49	16	7.03	<0.0001

alpha [α] confidence level of 95% and a probability P-value of 0.05
Hypothesis test results: $H0 : \mu1 - \mu2 = 0$, $HA : \mu1 - \mu2 \neq 0$

The data provided in Table 4.19 presents the Paired T statistics of the means of paired difference between pretest and posttest as group by units of instruction and teacher. For teachers [A], [C], [E], and [F], the P-values of the paired t-test statistics for the pretest and posttest scores of their units of instruction knowledge is smaller than 0.05 (A: CP < 0.0001, DP <0.0001, C: DTP < 0.0001, FT <0.0001, E: DP < 0.0001, F: FT < 0.0001) rejecting the null hypothesis of no effect. Overall the treatments by these teachers' units of instruction had an affect on student scores.

Teachers [A], [C], and [E] participated in the TECH-know 2005 Summer workshop for professional development, while Teacher [F] field-tested the Film Technology Unit without participating in professional development workshop. No assessment was available to ascertain significance of participating in the professional development workshop, yet all four teachers' treatments had an affect on student scores.

Table 4.19 Paired T statistics of mean of the paired difference between pretest and posttest group by units of instruction and teacher

Unit	Teacher	Diff.	Std. Err.	DF	T-Stat	P-value
DTP	D	-0.64	3.2	24	-0.19	0.8438
FT	D	3.07	2.6	25	-1.16	0.2544
DTP	C	47.27	4.2	21	11.25	<0.0001
FT	C	44.16	5.0	23	8.80	<0.0001
CP	A	43.40	1.8	39	23.76	<0.0001
DP	A	32.80	2.3	39	14.06	<0.0001
DP	E	23.68	2.1	24	11.12	<0.0001
FT	F	45.64	6.5	16	7.03	<0.0001

alpha [α] confidence level of 95% and a probability P-value of 0.05
Hypothesis test: $H0 : \mu1 - \mu2 = 0$, $HA : \mu1 - \mu2 \neq 0$ CP= Cyberspace Pursuit,
DTP= Desktop Publishing, DP= Digital Photography, and
FT= Film Technology

For teacher [D] in Table 4.19, the P-value of this high school sample scores for the units of instruction is greater than 0.05 (DTP: 0.8438, FT: 0.2544) and cannot reject the null hypothesis of no effect. The differences in the mean scores in this teacher's units of instruction are not different enough to be significant.

It should be noted that Instructor [D] reported that the pilot-test assessments were used instead of the field-test assessments at pre and post treatment. The pilot assessment key was used to perform assessments of the sample's treatment. The differences between these two assessments were minimal. It should be noted this error in assessment could account for the greater P-value.

The data provided in Tables 4.20 and 4.21 presents the ANOVA - Analysis of Variance results for responses stored in differences in mean scores and factors in teachers for females, and the ANOVA - Analysis of Variance results for responses stored in differences in mean scores and factors in teachers for males. The ANOVA produces a single P-value across the paired mean scores. The P-value in each gender comparison where teacher are a factor is less than 0.05 (females < 0.0001, males < 0.0001) rejecting the null hypothesis of no effect. Their scores are different enough to be significant. According to this analysis, overall for both males and females the teacher had an affect on their differences in mean scores.

Table 4.20 ANOVA - Analysis of Variance results for responses stored in differences in mean scores and factors in teachers for females

Factor means

Teachers	n	Mean	Std. Error
A	32	38.375	2.4617026
C	18	48.666668	6.4777145
D	12	-1	4.802146
E	9	24.444445	4.39416

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	3	19859.742	6619.914	19.047476	<0.0001
Error	67	23285.723	347.5481		
Total	70	43145.465			

alpha [α] confidence level of 95% and a probability P-value of 0.05

Table 4.21 ANOVA - Analysis of Variance results for responses stored in differences in mean scores and factors in teachers for males

Factor means

Teachers	n	Mean	Std. Error
A	48	37.916668	2.0969062
C	28	43.714287	3.4606087
D	39	1.948718	2.2900207
E	16	23.25	2.3443193
F	17	45.64706	6.490344

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	4	43653.95	10913.487	39.48743	<0.0001
Error	143	39522.16	276.378		
Total	147	83176.11			

alpha [α] confidence level of 95% and a probability P-value of 0.05

Assessment of variables of influence: Units of Instruction

To address question four: Do the school demographics and classroom characteristics have an affect on student comprehensions and achievement based on mean pretest and posttest scores? The data provided in Tables 4.22 and 4.23 presents the ANOVA - Analysis of Variance results for responses stored in differences in mean scores and factors in treatments for females and males. The ANOVA produces a single P-value across the paired mean scores. The P-value in Table 4.22 for the male sample, where treatments are a factor, is less than 0.05 (0.0023) rejecting the null hypothesis of no effect. Their scores are different enough to be significant. For males the treatment had an affect on their differences in mean scores. The P-value in Table 4.23 for female sample, where treatments are a factor, is greater than 0.05 (0.0023) and cannot reject the null hypothesis of no effect. Their scores are not different enough to be significant. For females the treatment had no affect on their differences in mean scores. According to this analysis, the units of instruction had greater influence on males' scores than on females' scores. To account for this difference additional research is recommended.

Table 4.22 ANOVA - Analysis of Variance results for responses stored in differences in mean scores and factors in treatments for males

Factor means

Treatments	n	Mean	Std. Error
CP	24	43	2.170287
DTP	33	19.151516	4.581774
DP	40	29	2.303843
FT	51	28.313726	4.0681925

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	3	7924.88	2641.6284	5.054994	0.0023
Error	144	75251.23	522.57794		
Total	147	83176.11			

alpha [α] confidence level of 95% and a probability P-value of 0.05

Table 4.23 ANOVA - Analysis of Variance results for responses stored in differences in mean scores and factors in treatments for females

Factor means

Treatments	n	Mean	Std. Error
CP	16	44	3.286335
DTP	14	28	10.019761
DP	25	29.76	2.644037
FT	16	29.5	7.998958

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	3	2730.904	910.3016	1.5091147	0.2202
Error	67	40414.56	603.2024		
Total	70	43145.46			

alpha [α] confidence level of 95% and a probability P-value of 0.05

Instrument Data: Access to Communication Technology

Frequency data were compiled concerning the participants' responses from the Technology Access Student Survey 2005 (Appendix 5, page 180). This information was referenced to the sample's assessment data to determine the significance of access to communication technologies outside of the classroom. The fifth question to address: Is there evidence that access to communication technologies outside the classroom has an affect on student pretest and posttest scores? For the purpose of this study, the pretest scores served as the control group and the posttest scores served as the treatment group. In the analysis of variance [ANOVA] analyzes the relationship between the means of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [α] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests. From the sample's 220 middle and high school technology education students, a sub-group of 132 students participated in the survey, 90 high school students and 42 middle school students (Table 4.24).

Table 4.24 Student survey results for grade level

Grade Level	Frequency	Relative Frequency
High School	90	0.68
Middle School	42	0.32

Table 4.25 provides the results of the number of participants from each treatment group. There were 44 females and 88 males within the sub-group of respondents (Table 4.26). Tables providing survey frequency counts to the 15 survey questions, the relative

frequency equals the percentage of the points scored (Relative frequency x 100 = percentage).

Table 4.25 Student survey results for treatment

Units	Frequency	Relative Frequency
Cyberspace Pursuit	21	0.16
Desktop Publishing	39	0.29
Digital Photography	21	0.16
Film Technology	51	0.39

Table 4.26 Student survey results for gender

Gender	Frequency	Relative Frequency
Female	44	0.33
Male	88	0.66

Survey Question 1

In Survey Question 1 (Table 4.27), do you have the use of a computer where you live? Nearly 85% of the respondents stated they either had access to or use of a personal computer. Bolt and Crawford's *Digital Divide* looks at the role which computers are playing in widening socio-economic and educational gaps throughout our society. The reality is that the majority of American youths are not up to date with digital tools, and their options may be few (Bolt & Crawford, 2000).

Table 4.27 Results for SURVEY Q1

Q1: Do you have the use of a computer where you live?	Frequency	Relative Frequency
1. There is no computer where I live	13	0.09
2. There is a computer where I live but I don't get to use it	7	0.05
3. I use a computer that is shared by other family members	64	0.48
4. I have my own personal computer	48	0.36

In Table 4.28 for the male control pretest group sample, where pretest treatment was the factor, the P-value is 0.05 (0.0133) rejecting the null hypothesis of no effect.

Table 4.28 ANOVA male control group of Analysis of Variance results: Responses stored in pretest score. Factors stored in SURVEY Q1.

Factor means

SURVEY Q1	n	Mean	Std. Error
1	11	32	2.0889318
2	6	32.66	6.565905
3	39	30.76	2.1251218
4	32	41.12	2.5604584

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	3	2027.3345	675.77814	3.7920034	0.0133
Error	84	14969.757	178.21138		
Total	87	16997.092			

alpha [α] confidence level of 95% and a probability P-value of 0.05

Their scores are different enough to be significant. For males, the question to access to computers had an influence on their differences in mean scores at the pretest stage. At the post-treatment, the P-value is greater than 0.05 (0.5654) and cannot reject the null hypothesis of no effect. Access to computers no longer had an influence on the males' post-treatment scores. At the pretest control stage, access to computers for males had a significant influence on their knowledge at the start of the program and by the end of the treatment there was no longer an influence to access to the computers.

The ANOVA test for the female sub-sample for Survey Question 1 provided a non-applicable number (NaN) meaning that in anyone of the response categories, one or no response were provided causing the ANOVA to return a “No numbers available” to process a quantifiable P-value.

Survey Question 2

For survey question two, (Table 4.29), can you go online and surf the Internet where you live? Nearly 75% of the respondents reported to have access to the Internet where they live. These percentages are higher than the national average as 68.7% percent of Internet users in the United States according to Nielsen//NetRatings reporting as of October 2005 as noted in Chapter Two (Miniwatts, 2005).

Table 4.29 Results for SURVEY Q2:

Q2: Can you go online and surf the Internet where you live?	Frequency	Relative Frequency
1. There is no computer and I cannot go online where I live	16	0.12
2. There is a computer but it is not online to the Internet where I live	17	0.12
3. There is a computer that is online to the Internet where I live	50	0.38
4. I have my own personal computer and can go online where I live	49	0.37

In an analysis for the relationship between the mean of the pretest control sample’s quantitative response variables and qualitative explanatory variables within the survey, where access to the Internet is a factor, the P-value for total sub-sample, is greater 0.05 and cannot reject the null hypothesis of no effect. This question’s content had no influence on their pre-treatment knowledge.

Survey Question 3

For survey question three, (Table 4.30), do you know how the computer where you live is connected to the Internet? Nearly a third of the respondents reported to have high-speed access to the Internet. This percentage is consistent with the percentage of broadband subscribers in the United States, December 2004, according to Nielsen//NetRatings and noted in Chapter Two (Miniwatts, 2005).

Table 4.30 Results for SURVEY Q3:

Q3. Do you know how the computer where you live is hooked up to the Internet?	Frequency	Relative Frequency
1. I do not have a computer where I live.	19	0.14
2. The computer is online but I do not know how the computer is connected to the Internet where I live	9	0.07
3. The computer is connected to the Internet by a dial up connection	38	0.28
4. The computer is connected to the Internet by high-speed access	38	0.29
5. The computer is connected up to the Internet by wireless connection	27	0.20

In an analysis for the relationship between the mean of the pretest control sample's quantitative response variables and qualitative explanatory variables within the survey, how they are connected to the Internet is a factor, the P-value for total sub-sample, is greater 0.05 and cannot reject the null hypothesis of no effect.

Survey Question 4

For survey question four, (Table 4.31), how many hours on average in a day do you go online at school? Respondents reported 16% do not go online at school, 63% went online less than one hour, 12% spent 1-2 hours online, and 6% spent 2-4 hours online a day on average during school hours.

Table 4.31 Results for SURVEY Q4:

Q4. How many hours on average in a day do you go online connecting to the Internet at your school?	Frequency	Relative Frequency
1. I do not go online at school.	22	0.16
2. Less than 1 hour	84	0.64
3. 1-2 hours	16	0.12
4. 2-3 hours	5	0.03
5. 3-4 hours	5	0.03

In an analysis for the relationship between the mean of the pretest control sample's quantitative response variables and qualitative explanatory variables within the survey, how much time spent at school on the Internet is a factor, the P-value for total sub-sample, is greater 0.05 and cannot reject the null hypothesis of no effect.

Survey Question 5

For survey question five, (Table 4.32), how many hours on average in a day while NOT in school do you go online connecting to the Internet where you live from Sunday through Thursday? Respondents reported that 19% did not go online, 15% spent less than one hour, 28% spent 1-2 hours, 17% spent 2-4 hours, and 20% spent 4-6 hours online.

Table 4.32 Results for SURVEY Q5:

Q5. How many hours on average in a day while NOT in school do you go online connecting to the Internet where you live from Sunday through Thursday? (School nights)	Frequency	Relative Frequency
1. I do not go online where I live	26	0.19
2. Less than 1 hour	20	0.15
3. 1-2 hours	37	0.28
4. 2-4 hours	23	0.17
5. 4-6 hours	26	0.2

In Table 4.33 for the high school control pretest group sample, where pretest treatment was the factor, the P-value is 0.05 (0.0183) rejecting the null hypothesis of no effect. Their scores are different enough to be significant. For high school, the question of the amount of time spent online at home on school days had an influence on their differences in mean scores at the pretest stage.

Table 4.33 ANOVA high school pre-treatment group of Analysis of Variance results: Responses stored in pretest score. Factors stored in SURVEY Q5

Factor means

SURVEY Q5	n	Mean	Std. Error
1	16	25.75	2.1281838
2	12	33	3.8807998
3	23	36.347828	2.833041
4	17	43.294117	4.8656697
5	22	33.636364	3.0766158

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	4	2659.16	664.79	3.1482	0.0183
Error	85	17948.83	211.16		
Total	89	20608			

alpha [α] confidence level of 95% and a probability P-value of 0.05

At the post-treatment, the P-value is greater than 0.05 and cannot reject the null hypothesis of no effect. Amount of time spent online no longer had an influence on the high school group post-treatment scores. At the pretest control stage, amount of time spent online had a significant influence on their knowledge at the start of the program and by the end of the treatment there was no longer an influence.

Survey Question 6

For survey question six, (Table 34) do you like playing computer video games? Respondents reported that 53% do like to play video games, 28% sometimes like to play video games, and 18% either do not like or never play video games.

Table 4.34 Results for SURVEY Q6:

Q6. Do you like playing computer video games?	Frequency	Relative Frequency
1. I do like playing video games	70	0.53
2. I sometimes like playing video games	37	0.28
3. I don’t like playing video games	3	0.02
4. I never play video games	22	0.16

The ANOVA test for the sub-samples responses for Survey Question 6 provided a non-applicable number (NaN) meaning their frequencies were not significant enough to provide a quantifiable P-value.

Survey Question 7

For survey question seven, (Table 35) do you play video games where you live? Respondents reported that over 60% play video games where they live, while 40% no.

Table 4.35 Results for SURVEY Q7:

Q7. Do you play computer video games where you live?	Frequency	Relative Frequency
1. I don’t play computer video games where I live	43	0.32
2. I don’t play computer video games where I live but I do play them away from home	9	0.06
3. I play computer and video games where I live and away from home	61	0.46
4. I only play computer and video games where I live	19	0.14

In an analysis for the relationship between the mean of the pretest control sample's quantitative response variables and qualitative explanatory variables within the survey, playing video games is a factor, the P-value for total sub-sample, is greater 0.05 and cannot reject the null hypothesis of no effect.

Survey Question 8

For survey question eight, (Table 4.36) on what do you play most of your computer video games where you live? Respondents reported that 25% play games online with other players and 40% play games on a TV/DVD game player station.

Table 4.36 Results for SURVEY Q8:

Q8. On what do you play MOST of computer video games where you live?	Frequency	Relative Frequency
1. I don't have any way to play computer video games	21	0.16
2. Portable electronic game player	3	0.02
3. Online Internet games with other players	34	0.26
4. Interactive games on a computer.	20	0.15
5. TV-DVD Game Player station.	53	0.40

The ANOVA test for the sub-samples responses for Survey Question 6 provided a non-applicable number (NaN) meaning their frequencies were not significant enough to provide a quantifiable P-value.

Survey Question 9

For survey question nine, (Table 4.37), how many hours on average in a day while NOT in school do you play computer video games where you live from Sunday through Thursday? Respondents reported that 19% do not play video games, 41% stated less than one hour, 23% played 1-2 hours, 15% played more than 2 hours a day.

Table 4.37 Results for SURVEY Q9:

Q9. How many hours on average in a day while NOT in school do you play computer video games where you live from Sun. through Thursday?	Frequency	Relative Frequency
1. I do not play computer video games where I live.	26	0.20
2. Less than 1 hour	54	0.41
3. 1-2 hours	30	0.23
4. 2-4 hours	12	0.09
5. 4-6 hours	9	0.06

Dr. James Paul Gee, Professor of Literacy at University of Wisconsin-Madison, and author of What Video Games Have to Teach Us About Learning and Literacy (2003), promotes a notion of 'active learning' as in the case of video games that is contrary to passive learning of content. Gee stated that a young gamer learns resources for future problem solving within this semiotic domain of game playing. According to Gee, video games encourage good principles of learning and makes individual learning powerful (Gee, 2003).

In Table 4.38 for the high school control pretest group sample, where pretest treatment was the factor, the P-value is 0.05 (0.0447) rejecting the null hypothesis of no effect. Their scores are different enough to be significant. For high school, the question of the amount of time spent playing video games at home on school days had an influence on their differences in mean scores at the pretest stage.

Table 4.38 ANOVA for High School and Pre Content Analysis of Variance results: Responses stored in SCORE1. Factors stored in SURVEY Q9.

Factor means

SURVEY Q9	n	Mean	Std. Error
1	24	34.166668	3.0831864
2	36	29.666666	2.2275333
3	12	44	4.1778636
4	8	38	5.4510813
5	9	39.11111	6.1744194

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	4	2216.0024	554.0006	2.55521	0.0447
Error	84	18212.223	216.81216		
Total	88	20428.225			

alpha [α] confidence level of 95% and a probability P-value of 0.05

At the post-treatment, the P-value is greater than 0.05 and cannot reject the null hypothesis of no effect. Amount of time spent playing video games no longer had an influence on the high school group post-treatment scores. At the pretest control stage, the question on the amount of time spent playing video games had an influence on their knowledge at the start of the program and by the end of the treatment, the question on the amount of time spent playing video games was no longer an influence.

In Table 4.39 for the middle school control pretest group sample, where pretest treatment was the factor, the P-value is 0.05 (0.0505) rejecting the null hypothesis of no effect. Their scores are different enough to be significant. For middle school, the question of the amount of time spent playing video games at home on school days had an influence on their differences in mean scores at the pretest stage.

Table 39 ANOVA for Middle School and Pre Content Analysis of Variance results: Responses stored in SCORE1. Factors stored in SURVEY Q9.
Factor means

SURVEY Q9	n	Mean	Std. Error
1	2	26	2
2	18	46.66	3.2338083
3	18	36.44	3.4661975
4	4	34	2.5819888

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	3	1563.1746	521.0582	2.8430426	0.0505
Error	38	6964.4443	183.27486		
Total	41	8527.619			

alpha [α] confidence level of 95% and a probability P-value of 0.05

At the post-treatment, the P-value is greater than 0.05 and cannot reject the null hypothesis of no effect. Amount of time spent playing video games no longer had an influence on the middle school group post-treatment scores. At the pretest control stage, amount of time spent online had a significant influence on their knowledge at the start of the program and by the end of the treatment there was no longer an influence.

Survey Question 10

For survey question 10, (Table 4.40), how many hours on average in a day while in school do you play computer video games? Respondents reported 50% do not play video games at school, 43% stated less than one hour, and 7% stated one hour or more.

Table 4.40 Results for SURVEY Q10:

Q10. How many hours on average in a day while in school do you play computer video games?	Frequency	Relative Frequency
1. I do not play computer video games while at school	62	0.47
2. Less than 1 hour	57	0.43
3. 1-2 hours	7	0.05
4. 2-3 hours	3	0.02
5. 3-4 hours	2	0.01

The ANOVA test for the sub-samples responses for Survey Question 10 provided a non-applicable number (NaN) meaning their frequencies were not significant enough to provide a quantifiable P-value.

Survey Question 11

For survey question eleven, (Table 4.41) do you have a digital camera where you live? Respondents reported that 35% had not digital camera, and 65% had access to a digital camera.

Table 4.41 Results for SURVEY Q11:

SURVEY Q11 Do you have a digital picture camera where you live?	Frequency	Relative Frequency
1. There is no digital picture camera where I live.	46	0.35
2. There is a digital picture camera where I live but I cannot use it.	13	0.09
3. There is a digital picture camera where I live and I get to use it.	47	0.36
4. I have my own personal digital picture camera to use.	25	0.19

In Table 4.42 for the all members of the control pretest group sample, where pretest treatment was the factor, the P-value is 0.05 (0.0201) rejecting the null hypothesis of no effect. Their scores are different enough to be significant. For all members, the question of having access to a digital camera at home had an influence on their differences in mean scores at the pretest stage.

Table 4.42 ANOVA For All Pre Content Analysis of Variance results: Responses stored in SCORE1. Factors stored in SURVEY Q11.

Factor means

SURVEY Q11	n	Mean	Std. Error
1	46	31.043478	1.906753
2	13	36.615383	4.3875384
3	47	38.553192	2.1435118
4	25	41.6	3.4563951

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	3	2213.1792	737.72644	3.3908505	0.0201
Error	127	27630.607	217.56383		
Total	130	29843.787			

alpha [α] confidence level of 95% and a probability P-value of 0.05

At the post-treatment, the P-value is greater than 0.05 and cannot reject the null hypothesis of no effect. Access to a digital camera no longer had an influence on the high school group post-treatment scores. At the pretest control stage, access to a camera had a significant influence on their knowledge at the start of the program and by the end of the treatment there was no longer an influence.

Survey Question 12

For survey question twelve, (Table 4.43) do you have a color printer for your digital picture camera or a computer color printer where you live? Respondents reported that 31% had no color printer, 8% had one but no access, and 65% had access to a color printer.

Table 4.43 Results for SURVEY Q12:

Q12. Do you have a color printer for your digital picture camera or a computer color printer where you live?	Frequency	Relative Frequency
1. There is no color printer where I live.	41	0.31
2.There is a color printer where I live but I cannot use it	8	0.06
3. There is a color printer where I live and I get to use it	46	0.35
4. I have my own personal color printer to use.	37	0.28

In Table 4.44 for the all members of the control pretest group sample, where pretest treatment was the factor, the P-value is 0.05 (0.0353) rejecting the null hypothesis of no effect. Their scores are different enough to be significant. For all members, the question of having access to a color printer at home had an influence on their differences in mean scores at the pretest stage.

Table 4.44 ANOVA For All Pre Content Analysis of Variance results: Responses stored in SCORE1. Factors stored in SURVEY Q12.

Factor means

SURVEY Q12	n	Mean	Std. Error
1	41	34.048782	2.2915409
2	8	24	2.3904572
3	46	38.260868	2.1665964
4	37	39.351353	2.6554427

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	3	1938.3107	646.1036	2.9492762	0.0353
Error	128	28041.205	219.07191		
Total	131	29979.516			

alpha [α] confidence level of 95% and a probability P-value of 0.0

At the post-treatment, the P-value is greater than 0.05 and cannot reject the null hypothesis of no effect. Access to a color printer no longer had an influence on the high school group post-treatment scores. At the pretest control stage, access to a printer had a significant influence on their knowledge at the start of the program and by the end of the treatment there was no longer an influence.

Survey Question 13

For survey question thirteen, (Table 4.45) do you have a digital video camera where you live? Respondents reported that 43% had not video camera, 11% stated there was one, but had not access, 27% had access to a video camera, and 18% had access to a personal video camera.

Table 4.45 Results for SURVEY Q13:

Q13. Do you have a digital video camera where you live?	Frequency	Relative Frequency
1. There is no digital video camera where I live	58	0.44
2. There is a digital video camera where I live but I cannot use it	15	0.11
3. There is a digital video camera where I live and I get to use it	35	0.26
4. I have my own personal digital video camera to use	24	0.18

In Table 4.46 for the high school members of the control pretest group sample, where pretest treatment was the factor, the P-value is 0.05 (0.0019) rejecting the null hypothesis of no effect. Their scores are different enough to be significant. For all members, the question of having access to a video camera at home had an influence on their differences in mean scores at the pretest stage.

Table 4.46 ANOVA For High School and Pre Content Analysis of Variance results: Responses stored in SCORE1. Factors stored in SURVEY Q13.

Factor means

SURVEY Q13	n	Mean	Std. Error
1	42	32.190475	2.3132296
2	9	29.777779	3.2049344
3	25	32.8	2.2030282
4	14	48.57143	4.9588575

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	3	3266.5398	1088.8466	5.399822	0.0019
Error	86	17341.46	201.64488		
Total	89	20608			

alpha [α] confidence level of 95% and a probability P-value of 0.05

At the post-treatment, the P-value is greater than 0.05 and cannot reject the null hypothesis of no effect. Access to a video camera no longer had an influence on the high school group post-treatment scores. At the pretest control stage, access to a video camera had a significant influence on their knowledge at the start of the program and by the end of the treatment there was no longer an influence.

Survey Question 14

For survey question fourteen, (Table 4.47) do you have access to a computer program for editing digital video where you live? Respondents reported that 70% had no access to a computer program, and 30% had access to the software program.

Table 4.47 Results for SURVEY Q14:

Q14. Do you have a computer program for editing digital video where you live?	Frequency	Relative Frequency
1. There is no computer where I live	33	0.25
2. There is a computer where I live but there is no digital video software for editing video	59	0.44
3. There is a computer where I live and there is digital video software for editing video I can use	16	0.12
4. I have my own personal program for editing digital video.	23	0.17

In an analysis for the relationship between the mean of the pretest control sample's quantitative response variables and qualitative explanatory variables within the survey, access to video editing software is a factor, the P-value for total sub-sample, is greater 0.05 and cannot reject the null hypothesis of no effect.

In Table 4.48 for the Desktop Publishing Unit members of the control pretest group sample, where pretest treatment was the factor, the P-value is 0.05 (0.0003) rejecting the null hypothesis of no effect. Their scores are different enough to be significant. For DTP members, the question of having access to a video editing software at home had an influence on their differences in mean scores at the pretest stage.

Table 4.48 ANOVA For DTP Unit and Pre Content Analysis of Variance results: Responses stored in SCORE1. Factors stored in SURVEY Q14.

Factor means

SURVEY Q14	n	Mean	Std. Error
1	10	23.2	3.2550814
2	18	35.11111	4.084795
3	5	39.2	7.735632
4	6	59.333332	6.0589695

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	3	4966.7964	1655.5989	6.933399	0.0009
Error	35	8357.511	238.78603		
Total	38	13324.308			

alpha [α] confidence level of 95% and a probability P-value of 0.05

At the post-treatment, the P-value is greater than 0.05 and cannot reject the null hypothesis of no effect. Access to video editing software no longer had an influence on the high school group post-treatment scores. At the pretest control stage, access to a video editing software had a significant influence on their knowledge at the start of the program and by the end of the treatment there was no longer an influence.

Survey Question 15

For survey question fifteen, (Table 4.49) do you think if students had access to communication technologies at home like the technologies students have in the classroom, they would do better in school? Respondents reported that 30% strongly agreed, 40% agreed, 20 % were unsure, 6% disagreed, and 5% strongly disagreed. The greater majority (70%) of students felt that access to communication technologies in the home would benefit their education.

Table 4.49 Results for SURVEY Q15:

Q15. Do you think that if students had access to technologies at home like the technologies students have in the classroom, that they would do better in school?	Frequency	Relative Frequency
1. Strongly agree	39	0.3
2. Agree	51	0.39
3. Not sure	25	0.19
4. Disagree	8	0.06
5. Strongly disagree	7	0.05

In an analysis for the relationship between the mean of the pretest control sample's quantitative response variables and qualitative explanatory variables within the survey, access to communication technologies at home as a factor, the P-value for total sub-sample, is greater 0.05 and cannot reject the null hypothesis of no effect. This question's content had no influence on their pre-treatment knowledge.

In a study conducted in 1993, the researcher, Jerry Komia Domatob, from Ohio University examined the perceptions of African academic, and government and business officials on new communication technologies for development of Sub-Saharan Africa.

- Groups observed were optimistic of the positive impact of new communication technologies on training, education, and rural development
- 85% of government and business had positive views and,
- 78% of academics felt if will be helpful in education and training (Domatob, 1997, p64).

TABLE 4.50: Overall SURVEY RESULTS

	SURVEY QUESTIONS	Responses	Pretest	Where
1	Use of a computer where you live?	Nearly 85% had access to a computer.	Yes	Male Group
2	Go online and surf the Internet where you live?	Nearly 75% had access to the Internet	No	Above USA %
3	Know how the computer is connected to the Internet?	Nearly a third reported high-speed access.	No	USA % avg
4	Hours in a day do you go online at school?	16% do not, 63% less than hour, 12% 1-2 hours, and 6% 2-4 hours	No	None
5	Hours online in a day at home Sun-Thursday?	19% did not, 15% less than hour, 28% 1-2 hours, 17% 2-4 hours, and 20% 4-6 hours	Yes	HS Group
6	Do you like playing computer video games?	53% like to play, 28% sometimes play, and 18% either do not like or never play	No	NaN
7	Do you play video games where you live?	60% play video games, while 40% no	No	None
8	On what do you play your computer video games?	25% online, 40% on a game player station.	No	NaN
9	Hours on average in a day while Sun-Thursday?	19% do not play, 41% less than hour, 23% played 1-2 hours, 15% more than 2 hours	Yes	HS/MS Groups
10	Hours you play computer video games at school?	50% do not play, 43% less than one hour, and 7% stated one hour or more.	No	NaN
11	Do you have access to a digital camera where live?	35% no access, and 65% had access	Yes	All
12	Do you have access to a color printer where you live?	35% no access, and 65% had access	Yes	All
13	Do you have access to a video camera where live?	54% no access, 27% had access to a video camera, and 18% owned one	Yes	HS Group
14	Do you have access to video editing where you live?	70% had no access, and 30% had access	Yes	DTP Group
15	Do you think if students had access to communication technologies at home like the technologies students have in the classroom, they would do better in school?	30% Strongly agreed, 40% agreed, 20% unsure, 6% disagreed, and 5% strongly disagreed.	No	None Other Studies

CHAPTER 5

Summary, Conclusions, and Recommendations

It was the problem of this research to investigate the affects of standards-based communication technology education units on the achievement of selected standards for technological literacy by middle and high school students in technology education. An additional problem was to investigate whether access to communication technologies such as the Internet, video-computer games, and other digital equipment outside the classroom has any influence on a student's achievement in school.

A proficiency in reading, science, mathematics, and technology is considered one of America's fundamental concerns of accountability in our public schools (Wood, 2004). The Law, No Child Left Behind (2002) requires school programs, teachers and students to adhere to higher standards reading, science and mathematics by the year 2014 (Wood, 2004). Developing sound curriculum that promotes literacy in those areas is critical. Science and mathematics education are characterized as theoretical whereas technology education (TED) emphasizes constructive philosophies. The TECH-know Project developed co-curricular instructional materials that are closely aligned with foundational science, mathematics and technology concepts. Their effectiveness will depend on marketing and dissemination nationally (Peterson, 2000). This objective is consistent with the goals of No Child Left Behind (2002) and developing instructional materials that address America's fundamental concerns of accountability in our public schools.

<u>Procedure</u>

The population of interest for this research included teachers and students in middle school and high school Technology Education programs interested in Communication Technology Curriculum. The samples were limited to Technology Education middle and high school classrooms participating in the TECH-know Project's Communication Technology Education Units:

1) Cyberspace Pursuit, a Middle School unit that explores technologies related to the Internet and webpage development.
2) Desktop Publishing, a High School unit that explores the technologies related to conventional and digital printing.
3) Digital Photography, a Middle School unit that explores the technologies and concepts behind electronic imaging.
4) Film Technology, a High School unit that explores the technology behind digital video and concepts for video production.

These instructional units required classrooms and labs with access communication technologies that include desktop computers, access to the Internet, digital imaging and displaying equipment, printers, scanners, and associated materials.

Criterion-referenced tests (CRT) were developed within the course of the TECH-know Project's expert content development and pilot testing. The treatment was an application of the completed commercially available standards based curriculum TECH-know Units that had been developed over the past four years through a series of pilot testing and editing. The TECH-know materials were identified with the Standards for Technological Literacy, National Science Education Standards, Principles and Standards for School Mathematics

(Taylor, 2004). A matching post-CRT followed to treatment to assess course content and related identified standards. This data was collected, retrieved and analyzed with a statistical significance set at an alpha [∂] of 95% confidence level and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in this significant test.

In addition to the CRT data gathered from pretest and posttest scores, additional information was ascertained on student access to communication technologies outside of the classroom such as the Internet, video-computer games, and other digital equipment outside the classroom had any influence on a student's achievement in school. An ANOVA analyzed the relationship between the mean of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [α] of 95% confidence level and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests.

Findings and Conclusions

Are students learning mathematics, science and technology content based on the pretest and posttest scores? According to the results from statistical significance testing, all four TECH-know Communication Units of instruction produced a significant P-value according to student's gains from the analysis of their pretest and posttest scores in technology, mathematics and science content. In can be determined that the treatments in the TECH-know Communication Units had a positive affect on student scores. These units of instruction provided an appropriate vehicle for the inclusion of mathematics, science, and technology applications that would benefit advocates of modern standard-based education programs. These TECH-know Unit adhere to the 2002 Law, No Child Left Behind (2002) that requires school programs, teachers and students to adhere to higher standards reading, science and mathematics by the year 2014 (Wood, 2004).

This study investigated in variables of influence on student scores relative to these units of instruction. The study asked does gender as a variable have an affect on students based on pretest and posttest scores? In the case of gender, when compared separately, males to males, and female to females, gender had a significant affect on both group's pretest and posttest scores for the units of instruction. Overall when gender was tested separately it had a positive influence on student scores based on the analysis of these units of instruction. It would appear that both groups learned the materials at a significant level (Table 5.51). In can be concluded with a high probability, that the nature of these instructional units utilized within the limitations of the study, performed well without gender bias.

Table 5.51 One Sample T-statistic where units are grouped by gender and mean gains

Gender/Unit	Sample Mean	Std. Err.	DF	T-Stat	P-value
FT					
Females	37.33	9.690149	11	3.85	0.0027
Males	36.41	4.437102	38	8.2	<0.0001
DTP					
Females	28	10.01976	13	2.79	0.0152
Males	23.68	5.570972	24	4.25	0.0003
CP					
Females	45.77	4.527011	8	10.11	<0.0001
Males	41.66	3.131786	11	13.3	<0.0001
DP					
Females	30.66	3.399346	8	9.02	<0.0001
Males	33.33	4.070093	11	8.18	<0.0001

$H_0 : \mu = 0, H_A : \mu \neq 0$
CP= Cyberspace Pursuit, DTP= Desktop Publishing, DP= Digital Photography, and FT= Film Technology

The study asked does grade level as a variable have an affect on students based on pretest and posttest scores? An improvement in the overall posttest mean scores from the pretest mean scores is shown to have significant increase in both the TECH-know Middle School Units analyzed separately and TECH-know High School Units analyzed separately. Overall all the student's grade levels when comparing high school to high school scores; and middle school to middle school scores, each had an influence on student's scores. It would appear that both groups learned the materials at a significant level (Table 5.52). In can be concluded that with a high probability, that the nature of these instructional units utilized within the limitations of the study, performed well within the level of learning for middle school and high school students.

Table 5.52 Paired T statistics of the paired difference between SCORE1 and SCORE2 each Unit

Units	Sample Diff.	Std. Err.	DF	T-Stat	P-value
HS - DTP	21.78	4.36	46	4.99	<0.0001
HS - FT	28.59	3.6	66	7.92	<0.0001
MS - CP	43.4	1.82	39	23.76	<0.0001
MS - DP	29.29	1.73	64	16.9	<0.0001

alpha [α] confidence level of 95% and a probability P-value of 0.05
CP= Cyberspace Pursuit, DTP= Desktop Publishing, DP= Digital Photography, and FT= Film Technology

The study asked do teachers as a variable have an affect on students' achievement based on pretest and posttest scores? Based on the analysis of students' scores when grouped by teacher, overall the treatments performed by a majority of the teachers had a significant effect on student scores. Theses teachers came from a diverse background of gender, education, and classroom experience. Teachers [A], [C], [E], and [F]'s treatments of the units of instruction of the paired t-test statistics for their students' overall knowledge demonstrated a smaller than 0.05 P-values (A < 0.0001, C < 0.0001, E < 0.0001, F < 0.0001) thus rejecting the null hypothesis of no effect (that teachers do not have and affect on student scores). Overall these teachers' treatments had an affect on their student scores. In can be concluded that within a high probability, that the nature of these instructional units when utilized within the limitations of the study, performed well without bias to the characteristics of teacher. Teachers that apply the units of instruction with fidelity have a positive influence on student's scores.

For teacher [D] the P-value the units of instruction was greater than 0.05 (DTP: 0.8438, FT: 0.2544) and cannot reject the null hypothesis of no effect. The scores by this teacher's units of instruction are not significant. It should be noted that Instructor [D] reported that the pilot-test assessments were used instead of the field-test assessments at pre and post treatment. The pilot assessment key was used to perform assessments of the sample's treatment. The differences between these two assessments were minimal. It should be noted this error in assessment could account for the greater P-value. It cannot be accepted that there was no affect by the treatments by this teacher [D], but rather the value of the probability can only make a supposition of error in the scoring. If the assessments were performed incorrectly then the error was in the process of the evaluation of the treatments, rather than a statement on the performance of the teacher or the treatments. It is just as probable that Teacher [D] had significant influence on students' score, but the error was attributed to the assessment.

This study also analyzed student scores when both male and females scores are grouped separately by the their teacher. This analysis demonstrated that for both groups, the teacher had an affect on their differences in mean scores (Tables 4.20 and 4.21).

In addressing the first research question, do the four TECH-know Communication Technology Units of instruction have any influence on students' pretest and posttest scores? According to the analysis of variance in Table 4.22 and 4.23, these units of instruction had greater influence on males' scores than on females' scores. For males in these treatments there was an affect on their scores. For the females, their scores are not significant. For females the treatment had no affect on their differences in mean scores. According to this analysis, the units of instruction had greater influence on males' scores than on females' scores. It is possible that males are more interested and influenced by the technology units, while females are more influenced by the teacher. Something other than the units of instruction had an influence on female's scores. To account for this difference additional research is recommended.

In addressing the fifth question, is there evidence that access to communication technologies outside the classroom make a difference in students' pretest and posttest scores? A series of 15 questions were provided to ascertain students' responses about access to technology at home. These responses were identified to their pretest and posttest content scores. For the purpose of this study, the pretest scores served as the control group and the posttest scores served as the treatment group. In the analysis of variance [ANOVA] analyzes the relationship between the means of the quantitative response variables and a qualitative explanatory variable, the categories of which groups are compared at an alpha [α] confidence level of 95% and a probability P-value of 0.05 (Agresti & Finlay, 1997). The P-value probability was the primary reported result in these significant tests.

In survey question one, do you have the use of a computer where you live? Nearly 85% of the respondents stated they either had access to or use of a personal computer. Based on an ANOVA analysis, for males, the question on access to computers was found to have had an influence on their differences in mean scores at the pretest stage. This significance on the question of access to computers at home for males suggested that there was some knowledge at the pretreatment level to account for this significance of variance to their pretest scores.

For survey question two, can you go online and surf the Internet where you live? For the ANOVA analysis, there was no significance found in the data at the pretreatment level. However the descriptive statistics stated that nearly 75% of the respondents reported having access to the Internet where they live. These percentages are higher than the national average as 68.7% percent of Internet users in the United States according to Nielsen//NetRatings reporting as of October 2005 (Miniwatts, 2005). This can be noted as a positive attribute as to the sample's access to the Internet is above the national average.

For survey question three, do you know how the computer where you live was connected to the Internet? Nearly a third of the respondents reported to have high-speed access to the Internet. This percentage is consistent with the percentage of broadband subscribers in the United States, December 2004, according to Nielsen//NetRatings and noted in Chapter Two (Miniwatts, 2005). This can be noted as a positive attribute as to the sample's access to the Internet is consistent with the national average.

For survey question four, how many hours on average in a day do you go online at school? Respondents reported slightly more than half went online less than one hour a day on average during school hours. No ANOVA significance was associated with this data.

For survey question five, (Table 4.33), how many hours on average in a day while NOT in school do you go online connecting to the Internet where you live from Sunday through Thursday? Respondents reported that 19% did not go online, 15% spent less than one hour, 28% spent 1-2 hours, 17% spent 2-4 hours, and 20% spent 4-6 hours online. For high school group, the question of the amount of time spent online at home on school days had an influence on their differences in mean scores at the pretest stage. This significance on the question of amount of time online at home for the high school group suggested that there was some knowledge at the pretreatment level to account for this significance of variance to their pretest scores.

For survey question six, do you like playing computer video games? Respondents reported that more than 3/4 of the group liked to play video games. This large majority of the respondents demonstrated the attraction of video gaming on middle and high school students, yet no ANOVA significance was associated with this data.

For survey question seven, do you play video games where you live? Respondents reported that well over half of the group played video games where they live. This large majority of the respondents demonstrated the attraction of video gaming on middle and high school students, yet no ANOVA significance was associated with this data.

For survey question eight, on what do you play most of your computer video games where you live? Respondents reported that 25% play games online with other players and 40% play games on a TV/DVD game player station. This large majority of the respondents demonstrated the attraction of video gaming on middle and high school students, yet no ANOVA significance was associated with this data.

For survey question nine, how many hours on average in a day while NOT in school do you play computer video games where you live from Sunday through Thursday? Respondents reported that 19% do not play video games, 41% stated less than one hour, 23% played 1-2 hours, 15% played more than 2 hours a day. For the high school and middle school groups, separately the question of the amount of time spent playing video games at home on school days had an influence on their differences in mean scores at the pretest stage. This significance on the question of amount of time playing video games at home for the high school and middle school group suggested that there was some knowledge at the pretreatment level to account for this significance of variance to their pretest scores. This data agrees with Dr. James Paul Gee, author of What Video Games Have to Teach Us About Learning and Literacy (2003), who stated that a young gamer learns resources for future problem solving within this semiotic domain of game playing. According to Gee, video games encourage good principles of learning and makes individual learning powerful (Gee, 2003).

These findings on high school and middle school students playing video games deserves a more detailed study and offers an opportunities for more research into the areas of video games as an influence on student scores.

For survey question ten, how many hours on average in a day while in school do you play computer video games? Respondents reported 50% do not play video games at school, 43% stated less than one hour, and 7% stated one hour or more. No ANOVA significance was associated with this data. It may or may not demonstrate the probability of this ANOVA analysis, yet the differences in the significance in Question 10 and Question 9 should be noted for their responses and the group's ANOVA significance.

For survey question eleven, do you have a digital camera where you live? Respondents reported that 35% had not digital camera, and 65% had access to a digital camera. This significance on the question of access to digital equipment at home for the all members of the group suggested that there was some knowledge at the pretreatment level to account for this significance of variance to their pretest scores.

For survey question twelve, do you have a color printer for your digital picture camera or a computer color printer where you live? Respondents reported that 31% had no color printer, 8% had one but no access, and 65% had access to a color printer. This significance on the question of access to digital equipment at home for the all members of the group suggested that there was some knowledge at the pretreatment level to account for this significance of variance to their pretest scores.

For survey question thirteen, do you have a digital video camera where you live? Respondents reported that 43% had not video camera, 11% stated there was one, but had not access, 27% had access to a video camera, and 18% had access to a personal video camera. This significance on the question of access to digital equipment at home for the members of the high school group suggested that there was some knowledge at the pretreatment level to account for this significance of variance to their pretest scores.

For survey question fourteen, do you have access to a computer program for editing digital video where you live? Respondents reported that 70% had no access to a computer program, and 30% had access to the software program. This significance on the question of access to editing software at home for the all members of the Desktop Publishing group suggested that there was some knowledge at the pretreatment level to account for this significance of variance to their pretest scores.

For survey question fifteen, do you think if students had access to communication technologies at home like the technologies students have in the classroom, they would do better in school? The greater majority (70%) of students felt that access to communication technologies in the home would benefit their education.

Recommendations

In regards to the findings in this study, the TECH-know Communication Technology materials demonstrated significant success in student achievement on core science, mathematics, and technology curriculum. Students' scores demonstrated significant gains in each of the four units of instruction. In addressing the academic concerns of a proficiency in reading, science, mathematics, and technology accountability in our public schools as required by No Child Left Behind (2002), these TECH-know Units would be prove beneficial to school programs, teachers and students interested in studying Communication Technologies as well as desire to adhere to the higher standards required by No Child Left Behind (2002). Science, mathematics, and technological literacy is vital to the national interests its citizenry. The TECH-know Units of instruction result in significant learning for all students in the middle and high school technology classroom that have an interest in Communication Technologies.

Implications for further research

Extensive development preceded this study on the assessment of the affects of standards-based communication technology education units. The significant achievement of selected standards for technological literacy by middle and high school students in technology education depended on the development of those quality materials. Future research of instructional materials should incorporate a statistical analysis of their core science, mathematic, and technology concepts and principles. As was discovered in this study, is it possible that males are more interested and influenced by the technology units, while females are more influenced by the teacher. Something other than the units of instruction had an influence on female's scores. To account for this difference additional research is recommended.

In developing curriculum materials, they must consider how they influence all students. In this study it was noted in the research of the ANOVA analysis of females the treatment had no affect on their differences in mean scores. According to this analysis, the units of instruction had greater influence on males' scores than on females' scores. The scores for the female participants was significant in regards to their pretest and posttest scores, but the ANOVA analysis found that something other than the units of instruction had an influence on their scores. To account for this difference additional research is recommended.

In developing curriculum materials, they must consider how teachers are an influence on students' scores. In the case of the teacher significant test that returned and non-significant P-value, it was discovered the wrong assessments were administered. For the benefit of future research, providing instructors with clear and understandable procedures might alleviate this problem in the future. It should be a goal to promote fidelity in future research projects. Research is the process to an unknown. Proper planning is a possibility of obtaining the closest answer available.

Additional inquiries into access to digital technologies should be the pursuit of future research. Communication technologies are in a constant state of evolution. Throughout the history of developing civilizations, communication is the key to its transformation and advancement. Communication technologies evolve to serve the needs of new generations. Negative and positive implications materialize and must be addressed and understood. Research and development of curriculum materials in communication technologies benefits the future of the student learner and guides the direction of curriculum developer. Our ability to use, manage and understand communication technologies depends a capacity to share information. To better understand that future begins in the development of sound, quality instructional materials that include communication technology curriculum. Would a greater knowledge of how access to graphics and communication technologies in the home lead to greater learning, or is there evidence that an over access to graphics and communication technologies have adverse influences on student learning? More research into access to technologies outside the classroom could lead to a greater understanding of their benefit as well as detriment to learning. Researching access to communication technologies outside the classroom would possibly benefit curriculum developers in understanding trends in student learning and how to accommodate those learning styles.

Communication technologies are evolving and becoming more and more the nervous system of our contemporary society, transmitting and distributing sensory and control information and interconnecting numerous interdependent units. Because these technologies are so vital to commerce, systems of control, and even our personal relationships, any modification in communication technologies has the potential for profound influence on practically every area of society. It should be an important aspect of research to understand and promote the benefits as well as the potential downside impacts communication technologies would have as a result or their implementation as well as their loss within portions of society.

One of the most important communication technology issues is the trend toward media convergence. Research toward curriculum development should generate an understanding of the larger role that media convergence is playing in the adoption and evolution of new communication technologies. Technological convergence offers both interesting and complex goals of the communication curriculum developer. It offers a rich history of where and when divergent technologies were conceived and developed overtime for human use to provide single source access to information and tools of communication. The challenge of curriculum developers in communications technologies will be the goal of providing this history, as well as being current and progressive in curriculum development. What is communication technology? Scholars have referred it to the tools, techniques, knowledge, choices, and decisions associated with sending and receiving information. Communication technologies are also influential to our cultural, societal, and personal means of communicating. As modern communication technologies bring members of the world closer. The message in the sending and receiving information has not change as much as how its being sent and received. Future communication technologies will provide even greater user preferences, but as they become more complex and these technologies converge, what will be the implications of how curriculum is developed and delivered to tomorrow's students, and how learning is influenced.

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Appendix 1

Pre-Evaluation Cyberspace Pursuit 2005

MS

Directions For Numbers 1-25 : Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. Remember: Make no marks on this test.

1 When creating a website, why is it important to separate your projects and images into separate folders, rather than putting them all in the same folder?

A So your website will load faster.

B So your site is organized and easier to maintain over time.

C So images will work properly.

D So links will work properly.

2 Why should you use a color scheme (or theme) when designing a web site?

A Pictures download more quickly.

B Themes use less computer memory.

C Viewers get a unified, professional look.

D The site is easier to find.

3 What was the Internet originally named?

A ARPANET

B INTRANET

C Local Area Network

D The World Wide Web

4 The Internet began as a project worked on by civilian university researchers and who?

A NASA

B The White House

C The United Nations

D The US Military

5 Why is it important to make your site accessible by all people?

A The American Disability Act states that all people should have access to the Internet.

B It isn't important.

C Every person in the world will visit your site.

D Everyone has difference web design preferences.

6 Why should you optimize images on a website?

A Optimized web pages take more space.

B Pixels become magnified.

C Web pages will load faster

D Words are easier to read.

7 What is a hyperlink?

A An object on a web page that links to another page

B An image file with a .gif extension

C A special link that, when pressed, loads the page faster

D The physical connection from a CPU to a network hub

8 When designing and developing the Internet, what was the original goal?

A Personal communication

B On-line shopping

C Education research

D Scientific and military communication

Pre-Evaluation Cyberspace Pursuit 2005

9 What is HTML?

A It is a code or language for website building.

B It is the way you connect to a website.

C It is the code that makes a computer work.

D It is a code for network communication between computers.

10 Hyperlinks that lead to other points within a web page are often called internal links. They are also more specifically named:

A Anchor links.

B Delta links.

C Incremental links.

D Relative links.

11 What resolution should an image be that will be used on the web?

A 75 pixels per inch.

B 100 pixels per inch.

C 72 pixels per inch.

D 300 pixels per inch.

12 Why is it often bad to use an image or pattern as a website background?

A They take too long to load.

B They are ugly.

C They are not compatible with screen readers.

D They often make it difficult to read text.

13 What is the Internet?

A A network of technologies used to for sending and retrieving information.

B A big web site.

C One large computer server.

D A group of websites.

14 Why should you be careful of certain information you put on your website?

A You should not use copyrighted information because it belongs to someone else.

B Because some people won't like the information on your website.

C You should not use copyrighted information because it is not correct.

D Some information may keep your website from loading.

15 If an image on a website is 10 kilobytes in size, how long would it take to download it on an 80kbps (kilobits per second) connection?

A .125 second

B 125 seconds

C 10 minutes

D 1 second

16 An e-mail message being sent contains 640 bits of information. How many bytes is this?

A 64

B 80

C 128

D 256

17 Sending and retrieving information on the Internet includes the following steps.
1. Information is transmitted
2. The receiver responds.
3. The source computer converts the information into binary code.
4. The receiver's computer decodes the binary information
5. An electronic message is composed.
The correct order in which these steps occur is:

A 1, 5, 2, 3, 4

B 5, 3, 1, 4, 2

C 2, 3, 1, 5, 4

D 4, 2, 1, 3, 5

18 A computer virus is:

A An entity or particle that infects a multi-celled organisms.

B A piece of Code that can make a computer do unwanted things.

C A disease that developed that affects microchips.

D Code that can blow up your computer

19 What is the Open Source Initiative (OSI)?

A An organization that promotes web standards for disabled people.

B An organization that makes programming easier.

C A non-profit organization that promotes distributing software along with source code so it can be modified by anyone.

D A for-profit organization that discourages distributing software with source code.

20 Which of the following statements describes a negative impact of the World-wide use of the internet?

A Developing societies without Internet access are less competitive in the global marketplace.

B The Internet has improved our ability to communicate across distances.

C Companies allow employees to work from home decreasing the required office space.

D Scientist having immediate access to large amounts of research material.

21 Any utility software that protects your hardware from unwanted damage is?

A Spy-ware

B Internet cookies

C Anti-virus software

D Internet worms

22 What is a negative issue concerning computers and the natural environment?

A Pirating music and video.

B Spy-ware

C Proper disposal of computer hardware.

D The source computer converts the information into binary code.

23 What is a "web browser"?

A A program used for creating a website

B A person who is viewing a web site

C A program that allows users to access documents on the Internet.

D A program used for editing images

Pre-Evaluation Cyberspace Pursuit 2005

24 Who first used the term “Cyperspace” to describe the Internet?

A H.G. Wells

B Steven Speilberg

C Al Gore

D William Gibson

25 What is a modem?

A A device for translating the digital data of computers into analog signals?

B A device for transferring AC to DC electrical currents for your computer.

C A device for hyper-linking two web pages.

D A device for storing digital data.

Pre-Evaluation Cyberspace Pursuit 2005

?	⊙	Answer/ Scale	Objective	?	⊙	Answer/ Scale	Objective
1	1	B	CP02.03.Technology	14	14	A	CP02.03.Technology
2	2	C	CP02.03.Technology	15	15	D	CP02.03.Technology
3	3	A	CP02.03.Technology	16	16	B	CP02.01 Math
4	4	D	CP02.03.Technology	17	17	B	CP02.01 Math
5	5	A	CP02.03.Technology	18	18	B	CP02.01 Math
6	6	C	CP02.03.Technology	19	19	C	CP02.01 Math
7	7	A	CP02.03.Technology	20	20	A	CP02.01 Math
8	8	D	CP02.03.Technology	21	21	A	CP02.02 Science
9	9	A	CP02.03.Technology	22	22	C	CP02.02 Science
10	10	D	CP02.03.Technology	23	23	C	CP02.02 Science
11	11	C	CP02.03.Technology	24	24	D	CP02.02 Science
12	12	D	CP02.03.Technology	25	25	A	CP02.02 Science
13	13	A	CP02.03.Technology				

Total questions on test: 25

Minimum points required to achieve mastery category

Objectives measured: 3	Items	Points	●	◒	Questions measuring this objective
CP02.03.Technology	15	15	11	10	1 2 3 4 5 6 7 8 9 10 11
CP02.03.Technology					12 13 14 15
CP02.01 Math	5	5	4	3	16 17 18 19 20
CP02.02 Science	5	5	4	3	21 22 23 24 25
Totals		25	19	16	

CP02

? = Test Question Number ⊙ = line on GP Form

Pre-Evaluation Cyberspace Pursuit 2005

Items used in test

?	Item name	?	Item name	?	Item name
1	CP02.03.00.12	10	CP02.03.00.03	18	CP02.01.00.03
2	CP02.03.00.09	11	CP02.03.00.10	19	CP02.01.00.04
3	CP02.03.00.05	12	CP02.03.00.14	20	CP02.01.00.05
4	CP02.03.00.04	13	CP02.03.00.13	21	CP02.02.00.01
5	CP02.03.00.07	14	CP02.03.00.08	22	CP02.02.00.02
6	CP02.03.00.02	15	CP02.03.00.15	23	CP02.02.00.05
7	CP02.03.00.06	16	CP02.01.00.01	24	CP02.02.00.03
8	CP02.03.00.11	17	CP02.01.00.02	25	CP02.02.00.04
9	CP02.03.00.01				

Appendix 2

Pre Evaluation Digital Photography 2005

MS

Directions For Numbers 1-25 : Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. Remember: Make no marks on this test.

1 What three colors are processed by digital camera in order to produce an image?

A Black, White and Red

B Blue, Green, Yellow

C Red, Green and Blue

D Cyan, Magenta and Yellow

2 In order to minimize file size and loss of quality of an image for printing, how should it be saved?

A .gif

B .tiff

C .png

D .html

3 Which high-speed connection is the **BEST** link between the digital camera and the computer?

A Parallel

B 8-serial

C USB

D 32 pin serial

4 How has digital photography affected social aspects of our culture?

A People now take less pictures because digital photography is so complicated.

B The ease of taking digital photos has increased and sped up people's ability to share pictures with each other.

C The cost of taking digital photos is significantly more than film-based photos

D Digital photography has not made a large impact on people socially.

5 How has digital photography affected the environment?

A Digital photography is overall less threatening to the environment because no chemicals are used to develop photos.

B Digital photography is overall more threatening to the environment because more chemicals are used to develop photos.

C Digital photography is less threatening to the environment because digital cameras are made of recycled materials.

D Digital photography is more threatening to the environment because the digital files created cause more landfill waste.

6 Digital cameras produce images that are digital data files, they are easy to store and manipulate using:

A Dark rooms.

B Silver halide.

C Safelights and enlargers.

D Image processing software.

7 The world's first photo was taken by:

A Thomas Knoll

B Robert Noyce

C Sony Mavica

D Joseph Niepce

8 Some things to consider regarding photo composition are:

A File size and speed

B Camera angle and framing

C Pixels and storage space

D File format and battery life

9 Which of the following statements about creating digital pictures is **not** true?

A A digital camera is the only way to convert photographic film images into a digital data file.

B Inkjet printers are affordable and produce quality images on photo quality paper.

C Very expensive equipment is necessary to download images to any computer.

D Digital inkjet images are seldom as good as negative photographic images.

10 One of the advantages of digital photography over traditional film-based photography is:

A You can view photos immediately and delete unwanted photos.

B Digital photography always takes better photos than film-based photography.

C Digital cameras are always easier to use.

D Batteries last longer in digital cameras.

11 Digital photography is creating a picture using:

A Film.

B Drawing skills.

C CCD technology.

D Chemical processes.

12 A flatbed scanner is a device used to convert large prints directly to:

A Digital files.

B Slides.

C Smaller prints.

D Negatives.

13 When using a digital camera, the best way to preview the composition of your picture before taking it is by:

A Making sure the auto focus is turned on.

B Using another non-digital camera.

C Using the viewfinder or LCD screen.

D Forming a square with your thumbs and forefingers.

14 The built in electronic flash on a camera generally has a range of how many feet?

A 1-4

B 5-10

C 11-20

D 21-25

15 Which type of file format works best when displaying photos on the Internet?

A .tif

B .gif

C .jpg

D .bmp

Pre Evaluation Digital Photography 2005

16 To find the resolution of an image, divide the width in pixels by the width in inches. Given an image 900 pixels and 3 inches wide, what is the resolution?

A 300 ppi

B 600 ppi

C 900 ppi

D 2,700 ppi

17 In a layout for a brochure, the space available for inserting a photo is a 1.5" x 2.5". The photograph that is to be scanned for placement into the document is 3"x 5". Which scale percentage (height and width respectively) should be utilized in order to fit the photo into the brochure?

A 50%, 50%

B 40%, 40%

C 50%, 40%

D 45%, 45%

18 Resolution indicates the amount of detail in a digital photo. It is indicated in PPI, which stands for:

A Pixels per inch.

B Pixels per indicator.

C Pins per inch.

D Print per inch.

19 When scanning an image to print on paper, a scan image of how many dots per inch will produce the best quality?

A 48 ppi

B 150 ppi

C 200 ppi

D 300 ppi

20 How many pixels are in a megapixel?

A 100

B 1,000

C 1,000,000

D 2,000,000

21 Which is an essential requirement for both film photos and digital photos?

A Overcast conditions

B Light

C Expensive camera and tripod

D A beautiful landscape

22 What are two or the preferred input devices used by a digital photographer for acquiring images?

A Negatives and Prints

B Digital cameras and scanners

C Keyboards and disk drives

D mp3 players and DSL lines

23 Chemicals and light are processes used in:

A Drawing.

B Printing.

C Film Photography.

D Lithography.

24 Film based pictures are made up of tiny grains of silver halide, whereas, digital images consist of dots of color and brightness. In digital, these picture elements are called:

A Pin heads.

B Pixels.

C Output.

D Frames.

Pre Evaluation Digital Photography 2005

25 What is a problem on an image that is often caused by a camera's electronic flash reflecting color from a person's eyes?

A Contrast

B Red eye

C Black eye

D Distortion

Pre Evaluation Digital Photography 2005

?	⊙	Answer/ Scale	Objective	?	⊙	Answer/ Scale	Objective
1	1	C	DP03.03 Technology	14	14	B	DP03.03 Technology
2	2	B	DP03.03 Technology	15	15	C	DP03.03 Technology
3	3	C	DP03.03 Technology	16	16	A	DP03.01 Math
4	4	B	DP03.03 Technology	17	17	A	DP03.01 Math
5	5	A	DP03.03 Technology	18	18	A	DP03.01 Math
6	6	D	DP03.03 Technology	19	19	D	DP03.01 Math
7	7	D	DP03.03 Technology	20	20	C	DP03.01 Math
8	8	B	DP03.03 Technology	21	21	B	DP03.02 Science
9	9	B	DP03.03 Technology	22	22	B	DP03.02 Science
10	10	A	DP03.03 Technology	23	23	C	DP03.02 Science
11	11	C	DP03.03 Technology	24	24	B	DP03.02 Science
12	12	A	DP03.03 Technology	25	25	B	DP03.02 Science
13	13	C	DP03.03 Technology				

Total questions on test: 25

Minimum points required to achieve mastery category

Objectives measured: 3	Items	Points	●	◒	Questions measuring this objective
DP03.03 Technology	15	15	11	10	1 2 3 4 5 6 7 8 9 10 11
DP03.03 Technology					12 13 14 15
DP03.01 Math	5	5	4	3	16 17 18 19 20
DP03.02 Science	5	5	4	3	21 22 23 24 25
Totals		25	19	16	

DP03

? = Test Question Number ⊙ = line on GP Form

Pre Evaluation Digital Photography 2005

Items used in test

?	Item name	?	Item name	?	Item name
1	DP03.03.00.12	10	DP03.03.00.13	18	DP03.01.00.01
2	DP03.03.00.10	11	DP03.03.00.01	19	DP03.01.00.05
3	DP03.03.00.03	12	DP03.03.00.14	20	DP03.01.00.03
4	DP03.03.00.07	13	DP03.03.00.11	21	DP03.02.00.01
5	DP03.03.00.02	14	DP03.03.00.15	22	DP03.02.00.02
6	DP03.03.00.04	15	DP03.03.00.09	23	DP03.02.00.03
7	DP03.03.00.05	16	DP03.01.00.04	24	DP03.02.00.04
8	DP03.03.00.08	17	DP03.01.00.02	25	DP03.02.00.05
9	DP03.03.00.06				

Appendix 3

Pre Evalutiation Desktop Publishing 2005

HS

Directions For Numbers 1- 25 : Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. Remember: Make no marks on this test.

1 A point is the measurement from the top of the ascender to the bottom of the:

A Bowl.

B Baseline.

C Serif.

D Descender.

2 Red, yellow, and blue are what type of colors?

A Primary

B Secondary

C Tertiary

D Complementary

3 What is the visual perception of motion that is repetitive?

A Contrast

B Movement

C Emphasis

D Rhythm

4 Empty space in a design is often referred to as:

A White space.

B Area.

C Foreground.

D Background.

5 The digital image to be used in a poster needs to be cropped. What is actually being done to the image?

A Making it smaller by changing the width and height ratios

B Deleting unwanted parts of an image so that the result is more useful

C Making it larger by changing the width and height ratios

D Changing the color scheme from CMYK to Pantone

6 Which system that is based on ink colors common to printing is **MOST** widely used in graphic communications?

A HVC

B Crayola

C Pantone

D Primary

7 Graphic communication is using what to convey a message?

A Morse code

B Words, drawings and photographs

C Radio commercials

D Public speaking

8 What type of printing uses a plastic or rubber carrier?

A Gravure

B Screen

C Offset

D Flexography

9 Mixing a primary and a secondary color produces a:

A Split complementary.

B Tertiary.

C Color triad.

D Shade.

10 What type of printing is done when using CMYK?

A Spot color

B Process color

C Pantone

D Black and white

11 Which is **NOT** a form of printing processes?

A Gravure

B Gutenberg

C Offset

D Flexography

12 In desktop publishing, the correct order for the five stages of development is:

A Rough-layout, comprehensive layout, thumbnails, and final product.

B Thumbnails, comprehensive layout, rough-layout, and final product.

C Thumbnails, comprehensive layout, rough-layout, and final product.

D Thumbnails, rough-layout, comprehensive layout, and final product.

13 The image quality of a printer is measured in what units?

A DPI

B LPI

C PPI

D CCD

14 What is Desktop Publishing?

A An application software like PageMaker

B The use of audio editing equipment

C The use of a computer system and graphic software

D A software that allows you to layout a document

15 Given a 3" x 5" space for a photograph in a brochure and a 6" x 10" photograph, what technique should be used in order to fit the entire photograph into the brochure?

A Scaling

B Cropping

C Deleting

D Altering

16 What does a document show when a design consistently uses the same typeface for headings, subheadings, captions, and text?

A Rhythm

B Emphasis

C Unity

D Shape

17 In 1440, Gutenburg revolutionized the written word with his invention of what?

A Movable type
B Paper
C Ink
D Halftones

18 What are examples of cool colors?

A Orange, yellow and red
B Pink, periwinkle and mauve
C Black, white and gray
D Blue, green and purple

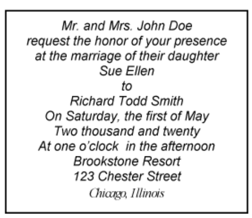
Mr. and Mrs. John Doe
request the honor of your presence
at the marriage of their daughter
Sue Ellen
to
Richard Todd Smith
On Saturday, the first of May
Two thousand and twenty
At one o'clock in the afternoon
Brookstone Resort
123 Chester Street
Chicago, Illinois

Fig.DP12.02

19 What type of balance does the distribution of text in Fig.DP12.02 show?

A Formal
B Asymmetrical
C Informal
D Unilateral

20 Which emotions does the color blue generally evoke?

A Envy and luck
B Bright and cheerful
C Excitement and power
D Calm and serious

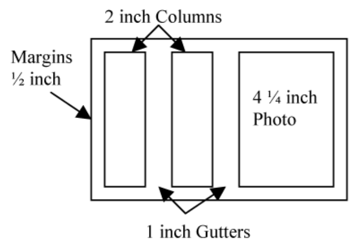

Fig.DP12.01

21 A graphic designer has begun preparing a rough layout electronically, but first must designate the total page width that will be needed. According to Fig.DP12.01, what is the width of the paper in inches?

A 11 ¼
B 11 ½
C 11 ¾
D 12

22 Given a 4-column format for a newsletter with 2¼" columns, ½" gutters, and ½" margins, what is the total width of the page in inches?

A 11 $^{1}/_{8}$
B 11 ½
C 12 $^{1}/_{8}$
D 12 ¼

23 Given a standard tri-fold brochure with ¾" margins (top, bottom, left and right), what size gutters in inches are needed in following layout rules?

A ½
B ¾
C 1
D 1 ½

Pre Evalutiation Desktop Publishing 2005

24 Given a 2" x 4" photograph and a 4" x 8" layout space, what scale percentage is needed to fit the photograph?

A 50

B 100

C 150

D 200

25 What are the three basic shapes?

A Square, circle, rectangle

B Rectangle, octagon, sphere

C Square, circle, triangle

D Octagon, triangle, sphere

Pre Evalutiation Desktop Publishing 2005

?	⊙	Answer/ Scale	Objective	?	⊙	Answer/ Scale	Objective
1	1	D	DP12.03 Technology	14	14	C	DP12.03 Technology
2	2	A	DP12.03 Technology	15	15	A	DP12.03 Technology
3	3	D	DP12.03 Technology	16	16	C	DP12.02 Science
4	4	A	DP12.03 Technology	17	17	A	DP12.02 Science
5	5	B	DP12.03 Technology	18	18	D	DP12.02 Science
6	6	C	DP12.03 Technology	19	19	A	DP12.02 Science
7	7	B	DP12.03 Technology	20	20	D	DP12.02 Science
8	8	D	DP12.03 Technology	21	21	A	DP12.01 Math
9	9	B	DP12.03 Technology	22	22	B	DP12.01 Math
10	10	B	DP12.03 Technology	23	23	D	DP12.01 Math
11	11	B	DP12.03 Technology	24	24	D	DP12.01 Math
12	12	D	DP12.03 Technology	25	25	C	DP12.01 Math
13	13	A	DP12.03 Technology				

Total questions on test: 25

Minimum points required to achieve mastery category

Objectives measured: 3	Items	Points	●	◒	Questions measuring this objective
DP12.03 Technology	15	15	11	10	1 2 3 4 5 6 7 8 9 10 11
DP12.03 Technology					12 13 14 15
DP12.02 Science	5	5	4	3	16 17 18 19 20
DP12.01 Math	5	5	4	3	21 22 23 24 25
Totals		25	19	16	

Pre Evalutiation Desktop Publishing 2005

Items used in test

?	Item name	?	Item name	?	Item name
1	DP12.03.00.04	10	DP12.03.00.06	18	DP12.02.00.04
2	DP12.03.00.12	11	DP12.03.00.10	19	DP12.02.00.05
3	DP12.03.00.02	12	DP12.03.00.11	20	DP12.02.00.03
4	DP12.03.00.05	13	DP12.03.00.13	21	DP12.01.00.01
5	DP12.03.00.01	14	DP12.03.00.15	22	DP12.01.00.02
6	DP12.03.00.09	15	DP12.03.00.08	23	DP12.01.00.03
7	DP12.03.00.03	16	DP12.02.00.02	24	DP12.01.00.04
8	DP12.03.00.07	17	DP12.02.00.01	25	DP12.01.00.05
9	DP12.03.00.14				

Appendix 4

Pre Evaluation Film Technology 2005

HS

Directions For Numbers 1-25 : Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. Remember: Make no marks on this test.

1 Leadroom is necessary when the object moves:

A Up and down.
B Toward the camera.
C Away from the camera.
D Sideways.

2 What are the four basic elements of a camera chain?

A Camera, switcher, preview monitors, CCU
B Camera head, CCU, camera pedestal, lens
C Camera head, sync generator, power supply, CCU
D Power supply, pickup device, viewfinder, camera head

3 Which type of editing refers to creating a logically sequenced story despite the fact that great chunks of the story are actually missing?

A Complexity editing
B Juxtaposition
C Special effects editing
D Continuity editing

4 In video, to "pan" is what type of camera movement?

A Pivoting the camera up and down
B Pivoting the camera left to right
C Moving the camera left to right
D Moving the camera toward or away from the object

5 Which method of brainstorming allows you to write a single word in the middle of a page and then branch off from that word to similar words?

A Clustering
B Word association
C Spidering
D Web mapping

6 A medium shot shows:

A Waist to head.
B A tight view of a face or object.
C Head to shoulders.
D Feet to head.

7 What part of the camera support is used to create movements such as tilts or pans?

A Stedicam
B Truck
C Head
D Dolly

8 The ability of a student or teacher to include a very short segment of a copyrighted song on an educational video for in-house screening is based on:

A Copyright infringement.
B Public domain laws.
C Fair use doctrine.
D Royalty-free CDs.

Pre Evaluation Film Technology 2005

9 For interviewing techniques, which statement is less true than the other statements?

A Never give the microphone to the person being interviewed.

B The person being interviewed should be looking 20 degrees off camera towards the reporter.

C Ask questions that require a complete sentence answer.

D Checking your sound occasionally to make sure it's working.

10 What is the correct order of these steps during production scheduling?

#1 Backtrack with number of editing days

#2 Add 2-3 days for absences

#3 Figure out due date for project

#4 Backtrack with number of taping days

A 1, 2, 3, 4

B 2, 4, 1, 3

C 1, 4, 2, 3

D 3, 1, 4, 2

11 During problem analysis, which question is **MOST** likely to be asked?

A Who will be watching the video?

B How will the video's success be measured?

C Why is there a need for this video?

D Are both sides of the issue included in this video?

12 A light placed 45 degrees to the side of the subject, which washes the shadow, softens the image and raises the overall illumination of the subject is called the:

A Spot light.

B Key light.

C Back light.

D Fill light.

13 Which microphone uses amplification by sound waves alone on a moving coil transducer surrounded by a magnetic field?

A Dynamic

B Ribbon

C Condenser

D Super-cardioid

14 What type of microphone do **MOST** news anchors use?

A Shotgun

B Studio

C Lavalier

D Ribbon

15 To effectively target a particular group with a video message, it is important to know that group's characteristics such as age, gender, and income level. Finding out this information is known as:

A Marketing research.

B Brainstorming.

C Script development.

D Broadcasting.

16 Complete the following time code calculation:

00:03:01,12 – 00:02:13,13 =

A 00:00:47,29

B 00:00:48,29

C 00:01:12,25

D 00:05:14,25

17 Which principle or rule of composition divides the camera frame into three equal sections?

A Fire hosing

B Rule of thirds

C Crossing the axis

D Medium shot

18 A lighting director measured 300 footcandles on the subject from the key light and 75 footcandles from the fill light. What is the lighting contrast ratio?

A 3:1

B 4:1

C 75:300

D 300:75

19 Complete the following time code calculation:

00:01:42,28 + 00:02:17,17 =

A 00:02:95,45

B 00:03:01,15

C 00:04:00,15

D 00:04:30,45

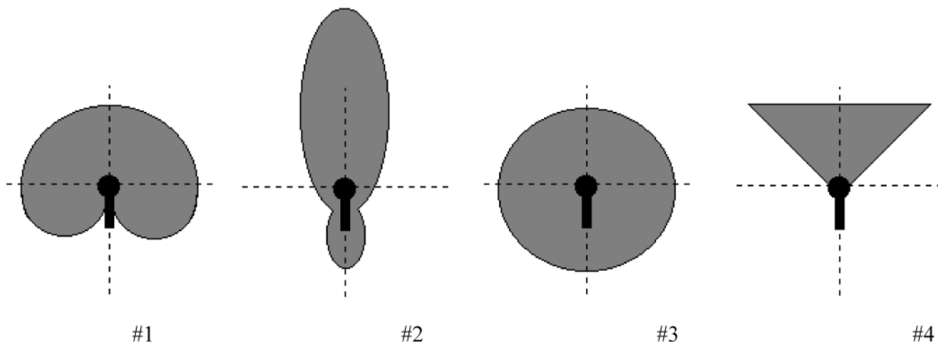

Fig.FT13.01

20 Using Fig.FT13.01, which microphone pickup patterns corresponds to a shotgun microphone?

A #1

B #2

C #3

D #4

21 A person sees a video as continuous motion when in fact the video is made up of many still photos. What principle does this address?

A Electronic symmetry

B Persistence of vision

C Rapidity of sequencing

D Chromatography

22 Which type of system uses a waveform to record a source?

A Digital

B Analog

C Streaming

D Hxadecimal

23 What is the average color temperature of daylight?

A 1200 K

B 3200 K

C 5600 K

D 8100 K

24 Video editing that uses random access video storage is:

A Linear editing.

B Non-linear editing.

C Tape to tape.

D Analog.

25 Which process eliminates redundant data in order to save disk space when transmitting video and audio data files?

A Compression

B Digital artifacts

C MPEG III

D Pixels

Pre Evaluation Film Technology 2005

?	⊙	Answer/ Scale	Objective	?	⊙	Answer/ Scale	Objective
1	1	D	FT13.03 Technology	14	14	C	FT13.03 Technology
2	2	C	FT13.03 Technology	15	15	A	FT13.03 Technology
3	3	D	FT13.03 Technology	16	16	A	FT13.01 Math
4	4	B	FT13.03 Technology	17	17	B	FT13.01 Math
5	5	A	FT13.03 Technology	18	18	B	FT13.01 Math
6	6	A	FT13.03 Technology	19	19	C	FT13.01 Math
7	7	C	FT13.03 Technology	20	20	B	FT13.01 Math
8	8	C	FT13.03 Technology	21	21	B	FT13.02 Science
9	9	D	FT13.03 Technology	22	22	B	FT13.02 Science
10	10	D	FT13.03 Technology	23	23	C	FT13.02 Science
11	11	C	FT13.03 Technology	24	24	B	FT13.02 Science
12	12	D	FT13.03 Technology	25	25	A	FT13.02 Science
13	13	A	FT13.03 Technology				

Total questions on test: 25

Minimum points required to achieve mastery category

Objectives measured: 3	Items	Points	●	◒	Questions measuring this objective										
FT13.03 Technology	15	15	11	10	1	2	3	4	5	6	7	8	9	10	11
FT13.03 Technology					12	13	14	15							
FT13.01 Math	5	5	4	3	16	17	18	19	20						
FT13.02 Science	5	5	4	3	21	22	23	24	25						
Totals		25	19	16											

? = Test Question Number ⊙ = line on GP Form

Pre Evaluation Film Technology 2005

Items used in test

?	Item name	?	Item name	?	Item name
1	FT13.03.00.08	10	FT13.03.00.03	18	FT13.01.00.03
2	FT13.03.00.05	11	FT13.03.00.15	19	FT13.01.00.05
3	FT13.03.00.14	12	FT13.03.00.11	20	FT13.01.00.04
4	FT13.03.00.06	13	FT13.03.00.13	21	FT13.02.00.01
5	FT13.03.00.01	14	FT13.03.00.12	22	FT13.02.00.02
6	FT13.03.00.09	15	FT13.03.00.02	23	FT13.02.00.03
7	FT13.03.00.07	16	FT13.01.00.01	24	FT13.02.00.04
8	FT13.03.00.04	17	FT13.01.00.02	25	FT13.02.00.05
9	FT13.03.00.10				

Appendix 5

Technology Assessment Student Survey 2005

Numbers 51- 65 are a Student Survey. Please give each question careful consideration. There are no "right" or "wrong" answers.

51 **Do you have the use of a computer where you live?:**

A There is no computer where I live

B There is a computer where I live but I don't get to use it.

C I use a computer that is shared by other family members

D I have my own personal computer.

52 **Can you go online and surf the Internet where you live?**

A There is no computer and I cannot go online where I live.

B There is a computer but it is not online to the Internet where I live

C There is a computer that is online to the Internet where I live

D I have my own personal computer and can go online where I live

53 **Do you know how the computer where you live is hooked up to the Internet?**

A I do not have a computer where I live.

B The computer is online but I do not know how the computer is connected to the Internet where I live.

C The computer is connected to the Internet by a dial up connection.

D The computer is connected to the Internet by high-speed access (cable or digital phone line).

E The computer is connected up to the Internet by wireless connection.

54 **How many hours on average in <u>a day</u> do you go online connecting to the Internet at your school?**

A I do not go online at school.

B Less than 1 hour

C 1-2 hours

D 2-3 hours

E 3-4 hours

55 **How many hours on average in <u>a day</u> while <u>NOT</u> in school do you go online connecting to the Internet where you live from Sunday through Thursday?**

A I do not go online where I live.

B Less than 1 hour

C 1-2 hours

D 2-4 hours

E 4-6 hours

56 **Do you like playing computer video games?**

A I do like playing video games

B I sometimes like playing video games

C I don't like playing video games

D I never play video games

Go on to next page

Technology Assessment Student Survey 2005

57 **Do you play computer video games where you live?**

A I don't play computer video games where I live.

B I don't play computer video games where I live but I do play them away from home.

C I play computer and video games where I live and away from home.

D I only play computer and video games where I live.

58 **On what do you play MOST of computer video games where you live?**

A I don't have any way to play computer video games**.**

B Portable electronic game player.

C Online Internet games with other players

D Interactive games on a computer.

E TV-DVD Game Player station.

59 **How many hours on average in <u>a day</u> while <u>NOT</u> in school do you play computer video games where you live from Sunday through Thursday? (Choose the closest number to the amount of time you play)**

A I do not play computer video games where I live.

B Less than 1 hour

C 1-2 hours

D 2-4 hours

E 4-6 hours

60 **How many hours on average in <u>a day</u> while in school do you play computer video games? (Choose the closest number to the amount of time you play)**

A I do not play computer video games while at school.

B Less than 1 hour

C 1-2 hours

D 2-3 hours

E 3-4 hours

61 **Do you have a digital picture camera where you live?**

A There is no digital picture camera where I live.

B There is a digital picture camera where I live but I cannot use it.

C There is a digital picture camera where I live and I get to use it.

D I have my own personal digital picture camera to use.

62 **Do you have a color printer for your digital picture camera or a computer color printer where you live?**

A There is no color printer where I live.

B There is a color printer where I live but I cannot use it.

C There is a color printer where I live and I get to use it.

D I have my own personal color printer to use.

Go on to next page

Technology Assessment Student Survey 2005

63 **Do you have a digital video camera where you live?**

A There is no digital video camera where I live.

B There is a digital video camera where I live but I cannot use it.

C There is a digital video camera where I live and I get to use it**.**

D I have my own personal digital video camera to use.

64 **Do you have a computer program for editing digital video where you live?**

A There is no computer where I live

B There is a computer where I live but there is no digital video software for editing video.

C There is a computer where I live and there is digital video software for editing video I can use.

D I have my own personal program for editing digital video.

65 **Do you think that if students had access to technologies at home like the technologies students have in the classroom, that they would do better in school?**

A Strongly agree

B Agree

C Not sure

D Disagree

E Strongly disagree

Stop here

Appendix 6

TECHKNOW TS2005 **Teacher Survey** 2005-07-22

Teacher Name ____

Gender: Male Female Your Age _________ Ethnicity_____________

Years of overall teaching experience ________________

Years of teaching Technology Education ________________

Highest degree achieved HS BS BA MS MA EdD PhD other_____________

What is your degree in?____

Are you lateral entry into TECH ED Yes No

Approximate additional hours of training outside the classroom (credits, hours toward terminal degree) ____

____

Professional background (outside of teaching) example: Electrical Engineer, Artist. etc.

____

____

____

School Demographics

School Name____

- Overall Student population ___________________
- Overall Grade levels ________________________
- Teacher to student ratio__________________
- Socio-economic levels of school's population base __________________
- Greater Region (ex) Southwest ________________________
- Local Region – urban, suburbs, rural ___________________________

Your Classroom Demographics

- Number of students participating in project ________________
- Number of students you teach overall _____________________
- Number of working computers in classroom or designated lab
  MACS _____________________PCs ___________________________
- Number of computers in classroom with Internet access or designated lab
  MACS __________________ PCs____________________________
- Digital equipment in classroom or designated lab
  - Digital Picture Cameras _______________________________
  - Digital Video Cameras ________________________________
  - Scanners ____
  - Color / Printers _____________________________________
  - VCR/DVD Players ____________________________________
  - Video Game Player station ____________________________
  - OTHER Communication
    Technologies____

  ____

  ____

Use reverse if extra space is needed.