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THE PROS AND CONS OF USING TECHNOLOGY IN PRIMARY EDUCATION

A Thesis

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education:

Reading/Language Arts

---

by

Astrid Ryterband

September 2005

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September 2005

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Kimberly Hartnett-Edwards, Second Reader

ABSTRACT

The aim of this thesis is to examine computer technology as an educative tool in primary education and to discover how it's affecting instruction and learning. The writer of this thesis believes that the integration of literacy and computer technology can be met successfully, provided that government, administration, faculty, parents and students work together.

Computer technology affects students in the classroom and at home with positive and negative effects. A study has been conducted comparing students' computer usage habits in three sixth grade classes to their California Standards Test scores.

A review of the related literature concerning how the use of computer technology enhances learning and detracts from learning has been compiled.

Following the review of the literature, the study of three sixth grade classrooms shows that those students who spend more time on computers and have more access to computers score higher, while students using a computer for excessive periods of time spend less time reading, doing homework and have lower scores.

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Special thanks to those individuals at John Glenn Middle School and Raymond Cree Middle School who assisted me in administering the assessments to their students, people such as Lisa Sullivan, David Sitko, Pamela Muncie, Joanie Wilcox and Theresa Weeks.

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CHAPTER ONE

LITERATURE REVIEW

Introduction

The ability to use computer technology on the job as an employee depends upon how well educators prepare their students. The Information Age requires its workers to perform tasks by accessing information, synthesizing information and solving problems digitally. How can our students compete in this micro-electronic environment if they have not been taught to do so beginning in elementary school, continuing in middle school, and then perfecting these skills in high school? While some schools have attempted to teach their required content area implementing the daily use of computers, most schools are still teaching with pencil and paper. By integrating the teaching of computer technology with teaching content, we as educators accomplish two things: we teach students required curricula while they learn computer technology.

The purpose of this three chapter thesis is to shed light on how educators globally have successfully implemented technologies while teaching their students required content matter in humanities, sciences and mathematics. Also, the overuse and abuse of technologies has shown a negative impact on the general population, primarily primary school students.

The purpose of Chapter Two is to determine whether the extensive use of computers on a daily basis affects student-learning outcomes. Lastly, in Chapter Three, a strategic plan to overhaul our schools' linear approach to converting to teaching constructivistly while implementing the practice of technologies will be proposed.

A review of the literature revealed that students who are being successfully taught to use computers while being educated, have experienced a renewed positive attitude toward learning traditionally separated subjects in school by connecting, for example science, language, social studies, while creatively integrating multi-media technology, then sharing the project they have created with their peers. If success is to follow ensuing success, then it stands to reason that these same students' ability to learn successfully in school will transfer to their competing successfully in our technologically-dependent global workforce.

Can using technology benefit sixth graders' quests to become literate? Does the term *computer literate* coincide with language literacy and/or are they mutually inclusive or exclusive? This is the million dollar question from which much debate has ensued. Moreover, if they are mutually inclusive, how can educators merge these two skills so students can become proficient in technology as well as proficiently literate in language and numeracy?

In the past, technology has largely been used in education to learn *from* (Jonassen, Peck, & Wilson, 1999). Technology programs were developed with the belief that they could convey information and hopefully humans could be made to understand information more effectively than they could when the information was conveyed by teachers. But constructivists believe that understanding cannot be conveyed; rather, understanding can only be constructed by learners.

Technology is being widely accepted today to mean that it can be effectively used as a tool to think and learn *with*. But how can technologies be used as meaning-making tools? If educators accept that their goal, as technology using educators is to support meaningful learning, than technologies should be used to engage students in active, constructive, intentional, authentic, and cooperative learning (Jonassen et al., 1999). The strategies of what components are necessary to engage students in meaningful learning while accessing technology will be listed in Chapter Three, as well a sample of a rubric to assess students' multi-media projects.

There is a widespread fear that the over dependency on mechanization or technology depersonalizes our society, creating a lack of human contact and a breakdown in social skills. Erikson (1951), a psychoanalyst and professor, posed the salient prediction that the mechanization of our society can lead to the depersonalization of human relations. This prescient statement posed the possibility that a preponderance of dependency upon technology in Erikson's generation and most likely in the future might lead to deleterious effects on the human psyche. Determining whether technology has caused human interpersonalization to deteriorate is the subject of another research project, and a difficult one at that. This thesis attempts to discover the answer to how much computer technology is good, how much is bad, or more specifically, can education find middle ground in its integration with school curricula.

At the moment, technology advocates are saying that technology's true potential is not being realized because of the lack of suitable infrastructure (Bracey, 1996). Most schools don't have anything close to the wiring required to handle the new and sophisticated information technologies. A recent report found that most schools had woefully inadequate wiring, including a number of situations where circuit breakers tripped if more than four computers were used at once.

In 2000, President Clinton promised to give every school access to the Internet, and ever since then the transition from educating students from a largely text-oriented medium toward one where multi-media tools are trying to be implemented is beginning to impact education. This has been an exciting time. Students who don't want to read can perhaps be snuck into the act of reading by reading blips of print while playing games or talking in chat rooms, perhaps whetting their appetites to read other types of material. And beyond that, instead of merely reading about Apollo 13 or watching the movie, students could experience the virtual reality of space travel. Instead of reading about weather cycles, they can download weather maps from satellites. Instead of studying marine life in the Florida Keys, students can electronically accompany a scientist on a field trip. Moreover, the Internet provides a strong communication link connecting children, teachers, and parents.

The pros of technology sound fabulous, but surely there's a down side, as Erikson intimated in 1951. For instance, adolescence is a volatile time, a time when teens are obsessed with their quest to establish their identity. Danger may lie ahead when there is pressure put upon them to learn technology in order to become productive human capital and to be qualified to compete in the microelectronic revolution. It might be seen as anti-social to not wish to become part of it.

Erikson said that adolescents may seek to find comfort in similarity by seeking to purchase the same products their peers have purchased. Peer pressure demands that adolescents must be fashionably wired by possessing the *au current* cell phone, the latest power notebook, and the latest, most expensive gadgets. And if a family can't afford these expensive gadgets, wouldn't that promote inferiority, isolation and depression in some youths?

Today's adolescents' comfort level appears to be met by being included in chat rooms, e-mailing, and by playing computer games all for hours at a time reducing traditional play time in the outdoors, but producing eye, neck, hand and back strain. Computer usage is up and so is obesity.

And what if a certain child's talent lies in another field, one that has little interest or need to practice with technology, such as athletics, or perfecting art forms in music, dance, theater and vocal arts? He or she may feel excluded from the technological revolution. Yes, technology can translate and record art forms aurally and visually, but can technology teach the mastering of physical and artistic art forms? Some technology users have become proficient in learning the mechanics of technology having called it art. Video jocks, also called VJs, may understand how to create and produce imagistic colored graphics, then project them onto wide screens in night clubs, but does this act qualify as art? Is its technological process comparable to the substantive process of mastering the intrinsic skill of painting by hand? Pro technology students may assert that technology has become the new *bona fide artė nouveau,* the *avant garde movement* of the new millenium. Only the passage of time can validate this assertion.

And if this claim proves to be true, its proof will illustrate that art and technology have become closely connected. In fact, rock concerts without technology are no longer considered to be rock concerts. They have become the collective expressions in a collaborative multi-media performance. But the substance of such concerts still lies in the basic process of mastering an art form, such as playing the guitar, learning how to create and write music, and that warrants practice and multifarious attempts made in close contact with a mentor, teacher, and parents.

Technology is not going to go away. Some love it and embrace it, some accept it, others are afraid of it. The perception of technology in today's population can be divided into a variety of compartments; the pro-technology gang advocates the broad use of computers, digital cameras, camcorders, facsimile machines, multi-tasked cellular phones, and other multi-media tools. This segment understands the benefits of technology can be and are utilized in education, science, medicine, the military, self-defense, space exploration and communication. Their children tend to approach computers and machines as though they were games or interactive toys, thus having no preconceived barriers because their parents believe that it's never too early to dive into the technology sea. These are people who place their babies on their laps while conducting most of their business on the Internet.

Teens and adults in their twenties and thirties (older children) also have no built in prejudice toward the use of technology and use it in all facets of their daily lives. Then there are those adults over forty and above, who, although weren't weaned on computers and technology to the extent that those under forty have, have made a genuine effort to be open-minded, have learned and even mastered the understanding of technology as deeply and broadly as their younger adult counterparts. Many have come to enjoy and appreciate technology and recognize there's no turning back to the days of pencil and paper.

Lastly, there are those older adults who have completely shut off technology, refuse to acknowledge its benefits and have no plans to implement it in their daily lives, claiming they don't understand it, are afraid of it, or simply have no interest in it.

In what manner do these groups' attitudes affect our educational system and their respective school districts? Are teachers, administrators and legislators wiring schools according to the goals the future is inexorably bestowing upon all of us? Do they truly understand where our society is headed and on which course to proceed if it is to produce the capital of knowledge that the United States and all developed countries must amass in order to survive as a nations? And most importantly, can computers and technology teach literacy, or at best, assist as a learning tool, complementing the traditional teacher to student relationship?

Definition of Technology

In today's society, there is a strong rationale for making technological literacy, the ability to understand and use technology, a national priority. Technology may be viewed as the sum of manmade means to satisfy human needs and desires and to solve specific problems in a given situation (Oaks, Gantman, & Pedras, 2000). More importantly, understanding technology involves more than the acquisition of information, it involves the ability to synthesize that information into new insights.

Technology for All Americans defines technology as "human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities" (International Technology Education Association, 1996, p. 96). In other words, technology emphasizes that its end result focuses on solving problems, a worthy endeavor. If all present and future curricula is to be based upon the premise that technology education represents a concerted national effort to provide today's students with the skills and knowledge needed to solve problems and extend human capabilities, then, national standards, curricula and leadership ought to be developed to integrate technology education into all school grade levels. Education needs to be in concert with the needs of society. This philosophy must be translated into curricula that reflect problem solving mastery through applied learning.

In the past the student's role was to learn the knowledge presented by the technology, just as they learned knowledge was to be presented by the teacher. The role of the technology was to deliver lessons that teach learners, just as trucks deliver groceries to supermarkets (Clark, 1983). The logic is, if you deliver groceries, people will eat; if you deliver instruction, students will learn. Before the advent of microcomputers in the 1980s, mainframe computers were used to deliver drill and practice and simple tutorials for teaching students lessons. When microcomputers began populating classrooms, the natural inclination was to use them in the same way. A 1983 national survey of computer uses showed that drill and practice was the most common use of microcomputers (Becker, 1985) along with learning to program in BASIC. Drill and practice represented the tutor role for computers, while programming represented the tutee role where students learned by teaching the computer (Taylor, 1984). Unfortunately, BASIC was a limited medium, and proponents of the constructivist school of teaching believes that in order to learn, students should share the role of representing what they know, rather than memorizing what teachers and textbooks know.

During the early 1980s, educators began to perceive the importance of computers as productivity tools. The growing popularity of word processing, databases, spreadsheets, graphics programs and desktop publishing were enabling business to become more productive. So students in classrooms began using these programs. This tool conception pervaded computer uses, according to a 1993 study by Hadley and Sheingold, which showed that well-informed teachers were extensively using text-processing tools (word processors), analytic and information tools (especially databases and some spreadsheet use), and graphics tools and desktop publishing, along with instructional software (including problem-solving programs along with drill and practice tutorials).

But how do students learn successfully using technologies? How can technologies become intellectual partners with students?

Pros of Using Technology

The Internet

This technology is made up of a worldwide network of networks composed of thousands of smaller regional networks connecting millions of users in more than 90 nations around the globe. These regional networks are composed of still smaller networks that serve institutions, businesses, and individuals who connect their computers to the regional networks via telephone lines and broadband access. To gain access to the Internet, a connection of one's computer to a network that is part of the Internet, such as an access provider allows users to connect to their network for a monthly or hourly fee.

The development of inexpensive multimedia computers and the eruption of the Internet in the mid-1990s has quickly changed the nature of educational computing. Communications and multimedia, little used in 1993, have dominated the role of technologies in the classroom over the past ten years, but their roles in education have been naturally conceived as teachers and sources of knowledge, rather than tools for learning. Many students both in classrooms and homes benefit from the Internet (Liao, 2000). They spend time on the net for both learning activities and entertainment.

Jonassen, Peck, and Wilson (1999) argue that technologies (including the Internet) can help engage learners in active, constructive, intentional, authentic and cooperative learning. If the Internet is to be more than an electronic baby-sitter, learners must articulate an educational purpose for using it.

Al Rogers (1996), a pioneer in the educational uses of networked computers has found starling differences in the way schools use the Internet. He observed that some schools use it simply as a publication medium, missing the major benefits of the conversational potential of the Internet, while others take advantage of this and their students and projects take on new life. The Internet is first and foremost a communications medium, not a publishing medium. The paradigm implicit in the World Wide Web is the ability of the Internet to foster conversations between writers and readers. Given the potential of this kind of interactive dialog, an amalgamation of various strands of educational research can be evidenced. "Constructivist and cooperative learning, process writing, authentic assessment, and more are all logical and students sent milkweed plants on which monarch eggs had been laid to students in different parts of the country, who watered the plant with locally collected rainwater. As the eggs hatched and the caterpillars grew, the students made careful observations of the caterpillars' size and activities. Students in Mr. Smith's class exchanged their observations via email with Ms. Lewis' class at Atholton Elementary School in Columbia, Maryland, which they located through the Teacher to Teacher link of the Journey North home page. The observations continued from August to December, as the caterpillars turned to adult butterflies, and at the end of the project the students sent two butterflies (one male and one female) back to the University of Kansas for the scientists to study. During the entire process, the students created a Website including their written observations, drawings and photographs (www.esc13.tenet.edu/granger).

The Internet offers students the ability to create open-ended, student-directed research projects such as the one conducted in Cathy Ney's classroom in Christiansburg Elementary School called, "TechnoZoo." Ms. Ney assigned her students the task of trying to understand the future survival of many animals by designing and constructing zoo habitats for endangered animals. Teams of four or five students used the Internet and other resources to find information on various habitats such as the Arctic, the South American rainforest, African savannah, American prairie, Australia and aquatia. Each team was also given the challenge of saving five animals from extinction.

To demonstrate what Ms. Ney's students learned, the students built scale models (math skills) of the zoo enclosures they would build to house and preserve the animals and developed five-minute oral reports describing their work. The teams found several Internet databases valuable during the project, including animal information databases at Seaworld, San Diego Zoo and Larry's Hotspots.

Conducting scientific research is among the most complete intellectual activities that learners can pursue (Jonassen et al., 1999). In defining research problems, seeking evidence using the Internet as well as observing their own studies, then communicating their results via the Internet, students engage in active, constructive, and intentional learning. Students using the Internet take on a variety of novel roles. They must observe the world and decide what issues interest them. Agreeing on an issue or topic to investigate requires careful negotiation with other students. Having decided on a research topic, students must clarify which issues can be operationalized and how to locate information about each issue. If an experiment is involved, students must operationalize issues into manipulatable objects and figure out how to measure their manipulations. Students must then convert their discoveries into some form of communication, which must be represented in text and graphics and converted into html code for the Internet. All of these student activities require a complex set of higher-order thinking skills, independent self-regulations skills and, most importantly, hands-on practice.

Constructing Knowledge Via Web Pages

Constructing knowledge involves attending to and gathering new ideas, comparing those ideas to structures, identifying and reconciling apparent discrepancies between what is known and what is becoming known, and modifying the existing knowledge base as required. Papert (1990) argued that the best way to engender knowledge construction is to support the construction of physical artifacts, building knowledge through building things. Building Web pages is among the most constructivist activities that learners can engage in, primarily because of the ownership that students feel about their products and the publishing effect.

Since the Internet is including more and more multimedia resources, building websites is becoming indistinguishable from building multimedia. Students at the Andrew Robinson Elementary School in Jacksonville, Florida have created a Website that demonstrates a comprehensive virtual schoolhouse. It was created and is maintained by students in collaboration with their teachers and principal. The site provides an interesting, easy to use tour through the school with information about what goes on and what students are learning. It features student artwork and many of the drawings of the building are used as clickable maps, so users of the Website can click on pictures to virtually tour the school. Each image has many links to other places. In the principal's office, for example, clicking on the file drawer labeled 'Teachers' brings up a list of links to information and classrooms of the teachers. Follow the link to the computer teacher's lab and there will be artwork of computers, the monitors of which show the names of software the students use such as HyperStudio, Digital Chisel, etc. Then if one of the monitors is clicked, there is information about the software and how the students use it and more. The website's address is: http://www.rockets.org.

This project illustrates the results of giving students control over an exciting project. The Internet made the project attractive and was the source of lots of feedback. Many possible extensions of this project are possible. The students also discovered websites that had developed photographic virtual reality tours using a software product called RealVR. The students at Andrew Robinson Elementary School (1999) decided they should add that capability to their site and explained:

> When we decided to add a virtual reality element to our school's website we spent a lot of time looking at the various browsers and plugins. We wanted to build with technology that would be friendly to the user and create the feeling of being there. We chose RealVR because it fulfilled this requirement. We sent them email explaining who we were and what we wanted to do. Very quickly, the CEO was back in touch with us. RealSpace has provided us with their software and has been very generous with their time in answering questions and providing support. (p. 30)

This is another example of how using the Internet on a computer can inspire and pull students into a world other than their respective classrooms.

Student Home Pages

Personal home pages where students describe themselves can be very instructive. Most home pages are an individual's attempt to help others get to know the author. They are sort of an informal resume, through which browsers can get a multimedia understanding of someone's interests and accomplishments.

Web pages, whether they are on an individual's home page, electronic magazines, photo essays, or another form of Web-based publishing, are written in html, a coding system in which text only documents are expanded to include tags that indicate where to put images, links to other Web sits, changes in text formatting and more. It was developed to allow multimedia documents to be displayed on a variety of different computers with different sized screens. This is accomplished by creating a universal source document that is a set of instructions interpreted by the browser software, like Netscape or Internet Explorer, designed for each type of computer.

Although homepages usually celebrate the self, students in Mr. Sitko's sixth grade classroom in John

Glenn Middle School created a web page studying the Colonies during the Revolutionary War creating home pages for George Washington, Thomas Jefferson, Paul Revere, even Benedict Arnold. Questions were asked of each person who answered from the person's perspective, such as, "Mr. Jefferson, how do you feel about slavery?" or, "Mr. Revere, what drives you to warn the colonists of the advent of the British army?"

This idea could also be developed to help build a context for students to learn about places and concepts, such as Hydrogen's Website or Water's Website. The appeal of the worldwide web, (www) is a good place to create contexts for learning.

Web-based Simulations and Games

Another powerful learning option which gained momentum with the release of Apple Computer's product, "Cocoa" is to create simulations. It was designed to offer kids the opportunity to create interactive media including simulations and games. Elementary students build simple to complex micro-worlds containing objects, and the behavior of these objects is governed by rules. Students create small characters, and then bring them to life that can then be used interactively by Internet users with appropriate plug ins for their Web browsers. On the screen the viewer sees a picture, but it is actually a collage of objects that define how they act and when they act. The rules are established graphically by dragging objects into proximity of each other, then recording what the user wants the result to be by creating before and after representations.

Students in the elective technology classes held at Raymond Cree Middle School find it very motivating and accept and meet the challenge. They have developed a simulation of the food chain and the water cycle, including creating games for others to play. These constructive activities require students to understand the system they are attempting to simulate and the task of developing a simulation helps them figure out what they don't already know. In addition, as students work in this environment, they learn an sometimes even discover the basics of object oriented programming including important programming concepts like variables, counters and loops while having fun and learning content at the same time.

<u>The Internet as a Tool for Collaboration</u>

Although knowledge construction is normally thought of as an individual process, (Jonassen et al., 1999) it can be a social process when students participate in learning communities, yet schools individualize learning and make its outcomes competitive among their students. John Dewey (1932) said that "there's a danger of creating an undesirable split between the experience gained in direct association and what is acquired in school."

But modern technologies hold a key advantage that early visionaries did not enjoy: students and teachers can more easily escape the confines of the closed classroom and open things up to include elements of the outside world -- other classes, students, teachers and experts; other information, projects and media. Riel (1996) noted:

> We send children to school to give them the opportunity to move beyond the constraints of family and friends to open to them a vast range of possible futures, however, the classroom in today's society, is constraining. It isolates both students and teachers from many experiences that will help them to understand the past, develop skills for building a future, and to prepare for their role as citizens. If it once took the whole village to raise a child, then can we expect a succession of isolated teachers to give students all the skills they need? (p. 120)

Riel asserts that students can be exposed to a broader world through multimedia technologies.

Learning Circles

Conducting Learning Circles is one way to escape the confines of the classroom. Margaret Riel and a team of collaborators developed Learning Circles that employed a "task force structure," (Riel, 1991). Like a task force, learning circles have a heavy work or activity orientation. Groups of classrooms sign on to the Internet to communicate and collaborate from a distance, following a timeline to accomplish a defined task. The specific task may be activities such as research, information sharing, compilation of a database, or publishing on a common subject. Riel says that these students or troops "set their own goals and tasks but remain connected to those who work in other locations as part of a community with shared goals and values" (p. 143).

Learning Circles may extend the usefulness of Internet resources by allowing collaboration and comparisons between classes on work related to the website. In this way Learning Circles can augment an online resource into a deeper and more meaningful learning experience.

Another way to escape the classroom is by communicating in an on line forum which is in several important ways better than face to face communication and other technology based forms like telephone conversations and videoconferencing. While it is true that an online discussion doesn't have the richness or the 'bandwidth' of a face to face conversation (more in the cons of technology) but with the Internet there is no race, no gender, no age, no infirmities, only minds: people talking to people.

Most teachers realize that not all students can engage in cogent and coherent discourse. For one thing, most students have rarely been asked to contribute their opinions since they have been too busy memorizing what the teachers tell them will be on Friday's test. So, it has become necessary to support students' attempts to converse and communicating online provides just this opportunity.

Scardamalia and Bereiter (1996) argue that schools inhibit, rather than support knowledge building by focusing on individual student's abilities and learning; requiring only demonstrable knowledge as evidence of learning and teacher hoarding wisdom and expertise. Students' knowledge tends to be devalued or ignored except as evidence of their understanding of the curriculum.

Jonassen et al. (1999) sees classrooms typically to

> not be communities, because students are disconnected or are competing with one another, and within classrooms there are social communities or cliques, but their purpose is not to learn together or from one another, rather, those cliques seek to socially reinforce their own identities by excluding others. (p. 118)

To support intentional learning among students, Scardamalia and Bereiter have developed a Computer-Supported Intentional Learning Environment (CSILEs) where students produce their own knowledge databases in their own knowledge building community. This way, students' knowledge can be "objectified, represent in an overt form so that it can be evaluated, examined for gaps and inadequacies, added to, revised, and reformulated" (p. 201).

An interesting project, developed at Manor Park Primary School in Coventry, UK is called Birds in the Playground. The goal of the project is to observe and record the variety of birds that appear in the school grounds and communicate these results with schools in different areas of the world. Participating schools register for the project by providing introductory description of climate and local environment and create a bird table or natural environment are designed to attract birds. The next step is the collaborative creation of a data collection sheet, a copy of which is then sent electronically to participating schools. For three months, students in all locations collect data about the birds they see in the sighting, the birds sighted, English and Latin names, the numbers of birds sighted, a description of the birds' activities (feeding, flying, courting) and the dates of the sighting. They send the data to a list server for distribution to all sites once a week. Students examine the data they receive each week from each site, looking for similarities, differences, patterns, and other factors of interest. Teachers at participating sites exchange information on how they are using this project as a springboard for activities in language math, science and art classes.

Through this project and others, students at Manor Park Primary School have developed links with schools in the United States, Germany, New Zealand, Australia and South Africa (http://www.ecosaurus.co.uk/coventry/educatn/primary/manorpk1.htm).

Not all of the collaborative projects have science as a focus. A project titled K-12 Folks Tales from World

Communities, for example uses the collaborative power of the Internet to focus students in English, reading and writing. The Fahan School, overlooking the Derwent River in Hobart, Tasmania, is the originator of this project (http://www.tas.gov.au/fahan). Children in year 4 at Fahan School study traditional folktales from their local aboriginal community and compare elements of the dreamtime stories with those of European traditional folk tales, and now with stories from around the world.

Scrawl Walls

A less formal way to collect thoughts from the Internet is through Common Gateway Interface (CGI), a language designed to enable programmers to pass data from one computer application to another. Using this, it is possible to write programs that allow web users to fill out online forms and have the information they provide stored in a database and then use it in a variety of ways. Some sites have used this capability to develop what are known as graffiti walls or scrawl walls (Carvin, 1996). When a user completes a form by adding comments, the CCGI program automatically adds the new contribution message onto the page where it becomes available to other visitors. This is similar to online chat rooms, but the purpose is not to create an exchange between participants in almost real time, but to gather and display information. This is useful to creative educators and students who wish to collect and display opinions in an online survey with the results made instantly available to participants.

Complex Social Problems

The result of most textbooks is that its authors seek to simplify topics for students in order to enhance their ability to understand them. The result is often a superficial understanding of a complex problem. Most social problems require multiple perspectives or viewpoints in order to understand them. Sizer (1996) says we are focused on covering topics rather than developing a deep understanding of them.

In International Relations and Foreign Policy in a Post Cold War World (http://www.nscds.pvt.k12.il.us/nscds/us/seniorseminar/project/main.html), students at North Shore Country Day School discuss foreign policy events and issues as gathered from around the world.

Another Internet project that promotes complex understanding is Nuclear Power in Seaside (http://204.102.137.135/PUSDRBHS/NUKEWEB.HTM) developed by students from Rancho Bernardo High School. It was designed to help students understand the pros, cons and complexity of the issue of nuclear power so they can answer the question of whether a nuclear power plant should be built in Seaside? Students conduct research on the Internet, develop and deliver PowerPoint presentations in a town meeting and then try to reach consensus on a complex issue.

The Internet is an information resource for students with good questions and rather than automatically seeking the wisdom of teachers, students develop information seeking skills and gain the satisfaction of answering their own questions.

Reflection on the Internet

Another interesting Internet project is titled The Pigman - Chapter Sixteen. In this project, developed by Eileen Skarecki of Columbia Middle School in New Jersey, students read the popular adolescent novel, The Pigman which leaves the reader hanging. Skarecki's response is to have students write a final chapter and post the submissions on the Internet for others to read and respond. Collaborating with authors they are reading enhances the reading experience. This simple activity will help students to think deeply about the book and about writing. It will also encourage them to write with a purpose, to think critically about what they write, to read what others have produced and to compare their own work to the work of others. This is one reflective use of the Internet.

Online Communication

Communication takes a variety of forms online including simple browsing of Web pages, electronic mail, use of list servers, electronic bulletin board and NetNews groups, on line chats, low-end videoconferencing, MUDS (multi-user domains) which are forms of Internet based multi-user environments that engage learners in high-level conversations that support personal reflection and MOOs (object oriented MUDs) which are virtual environments that a student enters and participates in. A number of online communication environments have been designed to support students' discourse skills. Computer conferencing has been used effectively with the CoVis (Learning through Collaborative Visualization) Project which seeks to foster collaboration among students, teachers, scientists and educators in the design and use of a scientific collaboratory (Edelson, Pea, & Gomez, 1996) and to become a benchmark project for reforming science education while learning and using the geosciences. It combines project-based science and provides a rich set of information resources, scientific visualization, cognitive tools, networked classrooms to support conversation and collaboration and social/contextual support in the form of teacher workshops and conferencing facilities.

The most powerful part of the CoVis Project is the Collaboratory Notebook (O'Neill & Gomez, 1994). This is a collaborative hypermedia composition system designed to support within and cross-school science projects. The Collaboratory focuses on project investigations rather than curricular content. During a project, the teacher or any student can pose a question or a conjecture which can be addressed by participants around the country.

The Collaboratory provides a scaffolding structure for conversations by requiring specific kinds of responses to messages. For instance, in order to support a conjecture a student may add evidence. When responding to a conjecture, learners can only provide evidence or develop a plan to support that conjecture. This form of scaffolded conversation results in more coherent and cogent conversations. In addition to scaffolding conversation, the Collaboratory also produces a notebook record of the conversation for review and reconsideration by the learners.

Computer-Supported Intentional Learning Environments (CSILEs) incorporate a classroom model for student inquiry and knowledge generation, developed by Marlene Scardamalia and Carl Bereiter of the Ontario Institute for Studies in Education. CSILE includes "intentional learning" in the title because learning is not a byproduct of CSILE activities, it is a direct goal. Its program is used for entering, archiving and retrieving student research. For example, students must select a level for each message they send, based on a simple set of categories (http://csile.oise.on.ca). CSILE can be applied to various subjects, but it is most appropriate for science. Unlike many online projects which resemble electronic field trips or online databases, CSILE is a comprehensive model for inquiry designed to help students conceptualize and research a problem area. Considerable research has been conducted on CSILE, consistently demonstrating positive effects on learning.

Scaffolded conversations are also provided by a program called CaMILE. Developed at the EduTech Institute at Georgia Tech, in 1994 the basis of CaMILE is a collaborative NoteBase where students post notes associated with group discussions (Jonassen et al., p. 130). Each added note is a response to a previous note that someone else has contributed to the ongoing discussion. In addition to the text, the student may include a QuickTime movie that is entered in a multi media margin that shows links to pictures, sounds, spreadsheets or any other kind of file. When a student reads through a discussion and wants to comment on a note, the student must specify the kind of response it. Having to specify the response type scaffolds the development of discussion and argumentation skills.

The Buddy Project

In a project called, "Getting America's Students Ready for the 21st Century," (Riley, Kunin, Smith, & Roberts, 1996, p. 20) more than 7,000 fourth through sixth-graders, at nearly 70 sites, are given computers and modems to take home. Students return the computers when they have 'graduated' and moved to another school. The program called, "Buddy Project" is administered by the Corporation for Educational Technology which receives funds from the state as well as from a variety of business interests. It can be visited at http://www.buddy.k12.in.us.

Evaluations of the Buddy Project (Rockman & Sloan, 1995) have documented a number of positive outcomes such as the students participating have increased the amount of time they spend on educational activities outside of school and families became more involved in educational and learning activities. The students reported watching less television, and there is some evidence that problem-solving and critical-thinking skills, writing and math skills and computer skills all improved. One high school student said:

> Exposure to computers has changed the type of student I am and my methods for attacking problems. I now gain a far better understanding of the topics I pursue and discover links and connections between them. (p. 80)

The Internet and Reading

Allocating time for reading for school aged children is necessary for learning at all subject areas. One of the initial steps of formal teaching is also to teach the reading and comprehension of written materials. These skills, also the requirements of modern life, are prerequisites for understanding all domains from science to art and from humanities to mathematics. Many researchers (Bloom, 1972; Spai & Ellerman, 1990; Bransford & Stein, 1993; Slavin, 1995) argue that academic achievement and problem solving are heavily dependent upon reading comprehension. De Hirsch, Jansky and Langford, (1966), and Leij and Reitsma (1990) also claim that low reading comprehension hinders students' cognitive development. Further, in most societies, school achievement is equated with reading success. Learning how to read is one of the key skills of all developmental tasks in early schooling. School activities provide children with core information about reading and children also develop good reading skills through spare time reading. The ability to read is a minimum requirement to participate productively in a global economy and to fulfill basic civic responsibilities. Many educators are reaching the conclusion that the use of technology can assist, even speed up this necessary skill.

A study of eighth grade students in Turkey examined the use of technology and reading comprehension levels to determine whether reading proficiency was higher in those students that had computers at home and who had access to the Internet, versus those that did not. For many of these students, the eighth grade is the last year they will study in a school. The sample of the following study was randomly selected and consisted of eighth grade students both from 21 public schools and 15 private schools (Akpinar, 2002). A questionnaire with 22 items about information technology use and personal data was prepared by the author and verified by two other experts.

The findings indicated the rate of students using computers at home to assist their learning was very small, even at a negligible level; more that 50% of the eighth graders do have access to a computer and one out of four students have the Internet at home, and that word processing, paint/drawing, or spreadsheet is not common. Further, the hypotheses tests showed that students having access to the Internet scored higher on reading comprehension than students who did not have such access. Similarly, the second comparison based upon having or not having a computer at home indicated that students having a computer scored higher on the test (Akpinar, 2002). The study also showed that only 34% either did not read any books or read one to two books within the year and only 28% of the students' families occasionally read a newspaper.

The study conducted in this thesis project will attempt to reveal whether the randomly selected sixth graders from two different middle schools but with different demographics provides a similar finding to Akpinar's study conducted in Turkey.

The Internet is usually the beginning point at which students are introduced to technology. In a survey response gathered from 483 high school students in Taiwan, the constructivist, Internet-based Learning Environment Survey (CILES) consisted of six scales and was sorted by two aspects. The first aspect, the cognitive-metacognitive aspect, included the scales of student negotiation, inquiry learning, and reflective thinking; whereas the second aspect, the content-technical aspect, involved the scales of relevance, ease of use and challenge. A LISREL structural model was also proposed to examine the relationships between students' responses across these two aspects. The results from the LISREL confirmatory analysis showed that CILES had highly satisfactory validity and reliability to assess students' preferences for constructivist Internet-based learning environments (Chuang, 2004).

This structural model indicated that the Internet learning environments that challenged students' existing concepts could facilitate their preferences for student negotiation, inquiry learning and reflective thinking activities. This demonstrates that the Internet can have rich connections with numerous resources and a variety of perspectives, thus constructing appropriate learning environments to provide different kinds of challenges for learners.

Teaching Reading and Writing with Technology Tools

The computer is available for response-based approaches in the teaching of reading. Readers on a response-based approach are regarded as "active meaning-makers whose personal experiences affect their interpretation of literary works" (Marcus, 1997). Researchers and practitioners agree that integrating various technologies with technological teaching methods and goals has definite advantages. Some include the ability of technology to provide direct instruction and display infinite 'teacher patience"; the motivating power of technology to get students excited about reading and writing; technology's role in preparing students to use the tools of the future and the present, and its ability to organize and store student performance and assessment results and make that information available to students, teachers, parents and administrators.

It is now a well known fact that there is high interest in the use of computer-assisted language instruction. The extensive exercises and drills required in second language instruction, for example, places significant demands on class time, and students must wait for feedback on their exercises until the instructor corrects them. Computer-assisted language instruction, in conjunction with contemporary natural language processing technology, holds out the promise of unlimited, immediate feedback pinpointed to the specific, however, human feedback is what Wiggins (1997) stated is necessary in the classroom, not computer feedback.

However, now that technology is readily available to educators and the public, the process of writing and teaching writing is in the midst of a tectonic change (Yancy, 2004), and educators are finding ways to still become relevant. By guiding and introducing the new technological tools writers use, and in how these tools affect composition and the relationship between writer and audience, their position in education will be assured. Traditionally, as they have for hundreds of years, student writers still compose with pencil and paper. But in addition, writers now compose through e-mail, list servers, and creative software packages. Writers use digital technologies to write many new kinds of texts, such as Web logs, hypertexts, and electronic portfolios. Helping writers develop fluency and competence in a variety of technologies is a key part of teaching writing in this century.

One new element in this expanded writing curriculum is helping students acquire textured literacy -- the ability to comfortably use and combine print, spoken, visual, and digital processes in composing a piece of writing.

Students use digital technology to enhance the writing portfolios. Lizette Piccillo (2003)) asked her high school students to create an electronic portfolio incorporating a technique that taps into Internet technology: hyperlinking, which means linking one computer file to another computer file or web site. Students saved each piece of writing that they have chosen for their portfolios as a separate file in a word-processing program and then created a table of contents for this portfolio. Next, students hyperlinked each title listed in the table of contents to the file containing that piece of writing so the reader could move back and forth between the able of contents and each piece listed. Once students linked all the files to the appropriate titles on the table of contents, their digital portfolios were complete.

From there, "students can add color, images, and audio fries to their portfolios for a product that more fully exploits the resources available through technology," (Beagle, 2003). In some of Beagle's classes, students have created portfolios that link to any number of Web sites, such as *Listmania*, a Web site hosted by *Amazon.com* on which readers list their personal top 25 reading lists (Yancy, 2004).

Students could then apply writing techniques used to create digital portfolios to other academic writing tasks. For example, some teachers asked students to use hyperlinks in their academic essays to connect to additional research, refutations of an argument, or information that is relevant to the essay but not appropriate to include in the body of the text. Hyper linking is an excellent way to include additional material without interrupting a text's coherence.

Another aspect of digital technology that aids writing is the fact that word processors and graphics software programs such as *Fireworks, Flash,* and *Dreamweaver* enable students to integrate words with visual images such as animation, movies, interactive activities and Web pages after receiving basic instruction (Bodley & Bremer, 2004). Once students have had the opportunity to practice the basic skills, they can demonstrate their abilities to use those skills by designing activities that reinforce basic instruction in reading, math, language and science.

The access to imagery that technology makes possible enhances writing by helping students visually diagram and demonstrate their own learning processes in reflections texts. Using both words and visuals makes it easier for students to focus on, analyze and improve their writing methods.

Technology Provides Peer Interaction Plus Higher Student Learning Outcome

High school teacher Alan Perry observed that his students often started their research papers too late in the process to learn well, so he expanded the prewriting process by having students create a slide presentation on their research and ideas before they started writing their paper. He now requires all students to present to their peers, three weeks before the final paper deadline, a 7 to 10 minute slide presentation that explains the purpose and initial findings of the research. The presentation must cite one Internet resource, and one periodical that the student is using for research (Perry, 2003).

Perry's student surveys revealed that 90 percent of the students liked working together on the presentations and believed that they learned more than they would have if they had not presented to their peers. Perry also found that their grades were higher than usual. Some students even turned in their research papers early. Although the creators of slide presentation software did not intend such products to be used as a tool for prewriting and drafting school papers, Perry's students learned to use the software to suit their purpose. The assignment also allowed students to present to a real audience.

Technology Invites Beginning Writers to Write

Susan Haynes, an elementary school teacher at Wilton Elementary School in Austin, Texas observed that several of her students were reluctant writers. They were eager students in many ways, but they simply didn't like to write. To motivate these students, the teacher invited them to compose in a presentation software package. Not surprisingly, given that this software program included color, choice of font style and size, animation and special effects, the kids found that they liked this way of writing, and their writing improved as a result. So, although this software was meant to be used as a digital visual aid for oral presentations, it functioned especially well as a composing tool for young writers.

From 1989 to 1996, a group of teachers and researchers collaborated in the 'Teaching for Understanding Project' at the Harvard Graduate School of Education. Their goal was to formulate a clear and coherent pedagogy of understanding in order for them to learn deeply enough to apply knowledge flexibly and in "real-world" contexts, not just on formal tests (Perkins, 1998).

The Teaching for Understanding Framework posed the core question: how will technology help students develop and demonstrate deep understanding of key curriculum goals? They collected examples of how teachers have used technology to meet the criteria embodied in their framework. One example was demonstrated by Linnie

Regan, a teacher in Watertown, Massachusetts who used the Internet and electronic spreadsheets to help her sixth grade class explore the generative topic, "Feeding the Family: Balanced Diet/Balanced Budget." She taught her class some nutritional information and reviewed mathematics skills related to unit pricing by the use of graphic calculators. She assigned small groups to purchase groceries for a week of balanced meals with a specific budget. The teams examined the database of an online shopping service to gather details about nutrition and prices. An electronic spreadsheet allowed students to organize, compare and analyze information (Wiske, 2004).

Mary Teixera at Tech Boston Academy used computer software called *Geometer's Sketchpad* to inspire her high school students to conduct mathematical inquiry rather than reproduce mathematics proofs discovered by others. Her students constructed geometric figures and then analyzed such data as angles, side lengths, and ratios among different measures. They developed and tested their own conjectures by measuring, dragging, reshaping, and comparing geometric objects. The software, which records and displays the mathematical relationships of objects, allowed students to examine a set of similar cases, observe patterns, and make generalizations. The accuracy and speed of the computer program freed students from the tedium of construction with traditional tools yet enabled them to experience the process of arranging and analyzing shapes.

Professor Cesar Nunes at the University of Sao Paolo in Brazil increased his university students' understanding of physics concepts and programming languages by helping them create computer-based simulations of common events in the physical world. Students in his mechanical physics class made Newton's laws visible by simulating the motion of an elevator. Working in teams, they gathered data about the elevator in their classroom building: the height of each floor, the time it took the elevator to accelerate and decelerate between floors, and the capacities of the elevator motor (including power, energy, and consumption). Nunes showed the students how to analyze and represent their data in relation to forces and velocities and taught them to use a computer programming language like *Macromedia's Flash* to create animations.

Meanwhile, Nunes' computer science students employed Java, another programming language, to write interactive computer programs accessible on the World Wide Web. Finally, students from the two classes collaborated to craft a detailed simulation of the elevator. Their work became part of an archive of simulations that other students can tap to understand the application of physics to everyday objects (Wiske, 2004).

Another success story details that Miranda Whitmore and Janet Jehle of Lexington High School in Massachusetts worked together to enrich an American studies unit on the Harlem Renaissance using several technologies. They identified numerous Web sites about the historical events in the 1920s as wells as the creative works of architecture, poetry, music, drama, art, and literature produced during this period. The teachers organized this hot list of resources with a set of guiding questions using an online tool called *Filamentality* to keep students' investigations focused on their understanding their goals. Whitmore and Jehle created a study guide and an assessment rubric based on student generated questions that students used as they conducted research online with the hot list. An online shared journal became a forum where students reflected on their research findings and questions. Students used the assessment rubric as a basis for commenting on one another's journal entries and exchanging ideas in preparation for writing a critical essay.

Web-based learning systems, if designed appropriately, offer many advantages over the traditional learning environments (Lin, Young, Chan, & Chen, 2005). A study conducted at the Center for General Education and Institute of Information Systems and Applications at National Tsing Hua University in Taiwan addressed the design and development of new approaches and network technologies based on the models to support collaborative teaching, knowledge sharing, lifelong learning opportunities for anyone to offer or participate in courses free of charge. The authors proposed and implemented a Web-based learning Educities environment called, "School for All" in the Web-based.

To satisfy the needs of individual instructors, adaptive Web-based authoring tools and methods of teaching were proposed including: Curriculum Setting, Co-teaching and Privileges Setting, Reward Setting, Assessment Setting and Information Sharing Setting. Thirty representative courses that used this adaptive School for all systems were under close observation and investigation. An additional questionnaire was also used to collect online teachers' perceptions of this Web-based learning environment. Online teachers reported that these adaptive modules could support their online teaching effectively.

Through interactive multimedia, students can approach a topic from more entry points than traditional textbooks permit. This is the main advantage technology has over not using it.

The Cons of Using Technology

In a survey of 17,135 people, the National Endowment for the Arts' study, Reading at Risk (2002) revealed an accelerating decline in the reading of literature, especially among the young. Literary reading declined 5 percent between 1982 and 1992, then 14 percent the next decade. Only 56.9 percent of Americans say they read a book of any sort in the past year, down from 60.9 percent in 1992. Only 46.7 percent of adults read any literature for pleasure. The declining importance of reading is unsurprising and unsettling, yet many educators believe that by using technological tools in computers, such as software programs, literacy will evolve. This is a paradoxical stance because by teaching kids to read while using technology, the inherent danger lies in the fact that technology or *computerese* may become the only way they will feel comfortable in accessing information (the Internet) and playing computer games may become the mainstay of their mode of entertainment, eliminating reading books almost altogether. Instead of brandishing a billy club and carving out the reading forest for themselves, they're using bullets to substantially shorten any reading material.

By 1995, before the flood of video games and computer entertainment, television swallowed 40 percent of Americans' free time, up one-third since 1965. Today, electronic entertainment other than television fills 5.5 hours of the average child's day.

The perils in the transition from a print to an electronic culture lies in the fact that books used to be the primary means of knowing things, but today, most people learn things visually, from the graphic presentation of immediately, effortlessly accessible pictures. People grow accustomed to the benumbing effect of their own passive reception of today's sensory blitzkrieg of surfaces. They recoil from the more demanding nature of active engagement with the nuances encoded in the limitless permutations of 26 signs on pages. Besides, reading requires two things that are increasingly scarce and to which increasing numbers of American kids and adults are allergic to: solitude and silence. Reading involves being alone, a scary concept.

Another paradox is that education today is stressing a cooperative style of learning that involves teamwork, group engagement, cooperation and hands on learning, almost negating the intrinsic concept that reading encapsulates: engagement while reading must occur with the self, not the group. Certainly, there's a time for conversation, for oral skills to grow by listening to others, but that's only one half of the literacy recipe; there's no escape from the stark reality that the second part of the literacy recipe demands, confronting that scary page full of print on one's own, reflecting on one's own, thinking on one's own.

After visiting the educational benefits of incorporating technology into education, it is difficult to oppose the incorporation of technology into educational curricula. To impede or pose a barrier to the micro/nanotechnology wave of the future would serve as an injustice to students placing their trust in the sound judgment and decisions of their elders. However, total dependency on technology, should not be taken for granted, there are other ways to become highly educated, such as independently self educating oneself through study and experience, practicing with a mentor, to mention two.

Today's classroom teachers face a tremendously difficult job. They are expected to achieve a host of challenging and somewhat contradictory goals with large numbers of diverse students: Leave No Child Behind, covers a vast curriculum mandated by standards in every subject—yet must, ideally, differentiate instruction in response to each learner's particular interests and needs. Now these requirements are further complicated by demands that students learn twenty first century skills, including effectively using new technologies, solving problems and applying high order thinking skills, collaborating with peers, and becoming continuing learners (NCREL & Metiri Group, 2003).

Teaching reading and writing, at any grade level, requires expertise and dedication. It is asking a lot to expect teachers to handle their day to day responsibilities, to stay abreast of their field, and to keep a handle on the hot new technology that has made obsolete whatever came out of the box they just finished unpacking.

Preparing students to use digital technologies adds a new layer of challenge to a daunting mission. Learning to read and write text is not enough; students must also be able to communicate and learn with multiple media and with networked, hyperlinked technologies. Considering all these objectives, it has become obvious that teachers and administrators lack a clear consensus about what high-quality teaching, particularly teaching that incorporates new technologies, entails.

N. Susan Emeagwali (2004) states that there is little evidence that high-tech classrooms have done anything to improve student achievement and may be hurting and undermining children's real technological literacy. The Alliance for Childhood, a nonprofit advocacy group, issued the report bemoaning the approximately $55 billion being spent on U.S. schools on computer equipment, training, services and other technologies to advance technological literacy.

"The lack of evidence or an expert consensus that computers will improve student achievement despite years of efforts by high-tech companies and government agencies to demonstrate otherwise—is itself compelling evidence," according to *Tech Tonic: Towards a New Literacy of Technology*. Financial and political connections between education officials and school technology vendors are fueling the push of technology on children, the report said, and it calls for new principles for using technology in the classroom.

Shelly Meade, assistant project manager for the International Technology Education Association's (ITEA) Technology for All Americans Project, applauds concerns raised by the Alliance for Childhood regarding the nation's reliance to develop a 21st century technological literacy for all Americans.

Meade asks, "What is technological literacy? It is critical that a distinction be made between education technology literacy, which focuses primarily on computer usage and the Internet, and technological literacy as a whole, which is more complex and extends to virtually every area of our lives."

Many teachers have found that the current educational software breaks no new ground; it simply attempts to automate the past. Much educational software is created by techies who haven't a clue about how kids learn (Bracey, 1996). MacGillis (2004) visited inner city schools in the Baltimore area and found that administrators, desperate to raise standards, are repeatedly and aggressively solicited to buy software that promises to raise student's literacy scores, yet the software they buy doesn't necessarily do the job. Also, when students are left unattended, as many are, they spend hours playing games and chatting in chat rooms.

No Child Left Behind is making it difficult for states to distinguish the broad world of technological literacy from education technology literacy, by mandating that states have every child technologically literate by the 2005-2006 school years, but not outlining what constitutes technological literacy. So, in order to meet the NCLB requirement, states have focused entirely on computer technology in the classroom, unwittingly reinforcing the notion that technological literacy is attained by using computers, electronic gadgetry and the Internet (Emeagwali, 2004).

Another contrary fact regarding technology is that it is expensive. Andrew Trotter (2004) states that schools in the U.S. estimate they will spend $7.1 billion on technology for the 2004-5 school year. More than 40 percent of school districts in the U.S. will offer their students classes over the Internet during the current school year. Students in poor school districts will be shut out of the opportunity to become technologically literate, unless their families seek outside enrichment, but that, too, is expensive. Speaking of cost, technology equipment breaks down, so a support technology staff must be readily available to repair it.

Another con about technology usage is that online, 3D games simulating virtual experience provides the unlimited escapism of an artificially created world, which, to some consumers, may prove harmful, not to mention addictive. Kids are sucked into spending hours of their time playing these games and communicating in chat rooms with their friends, and strangers, as well; young people hooking up with strangers via the Internet has proven to be highly dangerous. "Cyber bullying" has taken the place of the traditional neighborhood/playground bully. One boy in Vermont who was 'stalked' by his enemies with hateful emails committed suicide. This, of course, is a rare case, however, one death is one death too many.

Other negatives relating to the computer is that the rapidity of accessing information via technology can deceive people into expecting that the same instant gratification they gain in the virtual world translates to the real world, but that is not usually the case.

Another negative aspect to technology is that except for the time when students work in computer labs in a school setting, the computer promotes social and emotional isolation. People lose important communication cues such as body language, tone of voice, accents, dialects, pace, pauses, and other important cues to meaning (Jonassen et al., 1999). There is less and less human interaction occurring in the digital age. When we want to make a simple bus reservation on the Greyhound or on Amtrak for a train reservation we either make one online touching the keyboard and staring at the screen, or we pick up the phone and talk to a prerecorded "menu" of choices which "hyperlink" us to more computerized choices. Amtrak has the simulated voice of a woman named Julie, who sadly enough does not exist in the real world. You want to believe she's human, but alas she isn't. Technology has learned to not only mimic a human voice, but can replicate the degree of false friendliness in the human voice.

Technology has already learned to simulate a human. Robots are used for performing dangerous tasks in space, under water and in volatile criminal situations such as bomb scares and bomb detonations. Looking into the future, perhaps robots will replace human spouses and new laws will have to be enacted permitting a human and a robot to wed and enjoy the same legal rights two humans are entitled to.

"Technology has [even] been partially responsible for the erosion of the family," (Jonassen et al., p. 133). Technology is phrased broadly here to incorporate computers, television and other technologies as having eroded the family by having the ability to destroy the need for the family to entertain itself without technology. Before radio, television, telephones and computers, family members entertained themselves by telling stories, reading books, enacting plays, playing games, playing instruments, singing and dancing, writing letters, stories and books. All these activities have fallen by the wayside because focusing one's attention on the act of touching and responding to a machine negates the need to communicate verbally or physically with a family member; it promotes the separation of activities. Being glued to a machine takes up precious time away from human contact. This leads to isolation.

A recent study (Figure 1) conducted in Russia has determined that computers occupy a significant place in the lives of adolescents away from the school setting. In the past ten years the research study has noted that there has been a substantial decline in the percentage of students who prefer to read books and associate with friends (Sharpe, 2004). At the same time, there has been practically no change in the percentage of students who prefer to watch TV over other kinds of leisure activity. The percentage of students who chose the answer "interacting with the computer" as their favorite leisure activity rose dramatically. These changes (the decline in the importance of "associating with friends" and "reading books," and the parallel rise in the popularity of "interacting with the computer") are statistically significant at the level of .0001. Hence, we can conclude that the leisure time of a student in a major megalopolis has gone through substantial changes in the past ten years. A fundamental aspect is the "computerization" of the student's leisure activity, inasmuch as the reading of books and interacting with peers have been replaced by interacting with the computer. Less book reading and social isolation are negative factors to be found in this age of technology.

Types of activity	1991	2000
	(% of respondents)	
Association with friends	79.3	53.9
Reading books	45.4	26.6
Watching television	42.7	44.7
Interacting with computer	1.8	25.6

Figure 1. The Most Popular Types of Activity in Students' Structure of Leisure

Another negative aspect to learning and working in the digital age is being bound to a machine for hours at a time on a daily, yearly basis that can contribute to all kinds of physical ailments. Staring at the screen monitor induces a hypnotic state. As a worker stares into the monitor, it can produce carpal tunnel syndrome, eyestrain, back, shoulder and neck ache. In other words, depending on computers involves being sedentary, directly contradicting sound health advice which maintains that exercise is what keeps people physically and mentally healthy.

Also, studies have shown that the constant proximity to electro-magnetic radiation at close range causes serious auto-immune disease and has contributed to a higher instance of leukemia. More studies need to be conducted to determine the adverse health effects being exposed to technology and its mandatory electro-magnetic emission is.

New studies have shown that cell phone users are developing tumors in their ears, calling attention to the danger of sonar rays coming into close contact to the human body. Cancer has always existed in humankind, but it has quadrupled with the advent of the Industrial Age and currently with the Information/Electronic Revolution.

Richard Louve (2005) believes that kids today are 'nature-challenged,' that is, they spend most of their time seated in front of a screen, rather than being outside and in touch with nature. If kids do not learn to appreciate nature at a young age, they will have little sympathy or appreciation for it as adults. This lack of environmental awareness could prove to be disastrous to society in the future.

Finally, when all is said and done, there is no substitute for substance, and the special effects technology provides can mask its lacking to the unschooled, unwitting observer. Rock concerts are a good example, exuding a false demeanor of excellence. Often the ritual of producing a multimedia project merely obfuscates the endemic mediocrity that engulfs us, especially in entertainment. Products are made to appear perfect, and in so doing, become less human.

Ernst Fischer (1959) Austrian editor, poet, and critic commented in The Necessity of Art, "as machines become more and more efficient and perfect, so it will become clear that imperfection is the greatness of man," inferring that the bareness of an individual, alone, without the appendage of technology will, one day, become a rarity.

What seemed like a philosophical debate at that time-- the potential loss of humanism in the presence of increasing scientific breakthroughs -- clearly is a more significant issue today.

Our world has been blessed, and some would say cursed with almost fifty years of rapidly changing technology since Fischer made his statement. ENIAC, the world's first computer, began operating in 1946, weighed more than 30 tons and had 1,900 tubes; 1,500 relays; and hundreds of thousands of resistors, capacitors, and inductors.

Today, most middle-class homes have at least one personal computer that sits on a desk (or can be carried in a briefcase) that has greater computing power. In the workplace, most of us have come to rely on our computers, e-mail, faxes, the Internet, and the multitude of other technological advancements that make it possible for us to exchange information rapidly with people nearby or in remote locations, as well as to conduct complex calculations and analyses in the virtual wink of an eye.

The spread of technology into workplace education and training was inevitable, but it's not an application of these modern-day tools that's accepted by every instructor or every learner. Although technology can improve access to and availability of critical information and instructional materials, some educators and trainers believe that technology-based training lacks heart.

There is no substitute for human interaction. Technology may serve to further emotionally and physically isolate all of us. However, like any tool, its use, abuse and excess will cause the user to suffer emotional and physical consequences. But when technologies are utilized constructively, when the use of computers is monitored by parents and educators so that students use computers to further their learning into meaningful activities, the true potential of technologies will and can be realized to everyone's advantage.

Conclusion

This literature review implies that a huge change is occurring in education and we must devote our attention to finding an immediate way to fuse the act of teaching content while implementing technology in order to prepare students for their eventual entry into the work force. "To equip students to access vast stores of information available in cyberspace, schools, colleges, and universities, we will need to become more technologically rich and teachers more technologically sophisticated," (Dixon, 1994).

Differentiating between 'technology literacy' and 'education technology literacy' needs to be made. No Child Left Behind has mandated that every child must become 'technologically literate' by the 2005-2006 school year. The problem is, the act has not outlined the distinction between what constitutes 'technological literacy' and 'education technology literacy,' which means teaching content through technology, while 'technology literacy' means the acquisition of technology independent from a contextual basis.

Teachers and administrators lack a clear consensus about what and how to teach and incorporate new technologies. What is needed is a new post modernist educational constitution that revamps "the linear, sequential, easily quantifiable ordering system dominating education today -- one focusing on clear beginnings and definite endings -- to a more complex, pluralistic, unpredictable system or network," (Doll, 1993).

In the postmodern world, education must move from its premiere position within a closed system to an open system, although the mastering of technology ironically lends itself toward a world of mechanization that the father of our curricular methodology, Descartes, would have appreciated. Today's schools still educate in the modernist tradition where the ends (memorizing facts) are external to the process (the journey) from where questioning can teach problem solving, and there isn't a dynamic between theory and fact and imagination and practicality, that whatever is true, factual, real or discovered, isn't created (Doll, 1993).

Instead of searching and questioning beliefs and paradoxes as Socrates did (although he knew most of the answers) our current trend of curricula begins with what is self-evident and moves in linear links to reinforce, establish or prove that which has already been set and valued. But Dewey said that experience with reflection serves to educate, more so than Descartes's belief that the chain-link method of reasoning, geometric in origin must be used to educate properly.

What is needed is a curriculum that encompasses a series of experiences, programs, courses or units that focus on a common subject or themes so that today's student may become a future worker whose success will lie in h/her flexibility to float between tasks, subject matter and expertise. Technology literacy will become the necessary tool for survival in the work force.

With the thirst to master technology coupled with a post-modernistic state of understanding that knowledge is not finite, that it must be learned in a holistic fashion as opposed to a separation of facts, an ongoing dissatisfaction with linear, finite educational methodology is gaining headway in school curriculum. How do educators reconcile these two seemingly diametrically opposing forces? *Answer: by striking the balance between finite knowledge and inquiry. And technology, when implemented creatively in an aware state of mind can simply serve to foster this quest.*

The creativity of teachers in the aforementioned Pros of Technology has already begun to fulfill the need to bridge technology with inquiry. These teachers are the pioneers of the post-modernist, micro-revolutionary era which has been unleashed and set into motion. Teaching various subject matter under one whole, integrated project instead of educating by separate subjects will become the new curriculum. Teaching literacy with technology, books, films, music, field trips and group collaboration will become the new curriculum. If all curricula are to reflect "problem solving" through applied learning then there should be collaboration between technology teachers and subject matter specialists.

It is clear that new developments in e-learning and other sophisticated learning technologies are impacting education globally. Communication technologies that are free from time or place constraints provide new challenges on how teaching can be organized (Jones & O'Shea, 2004). The new constitutional curriculum must therefore set uniform standards that educators as well as students must meet at a certain time. This can be created on a federal or state by state level. Rubrics incorporating the use of technology in content area projects must be created.* Technology must and eventually will be used concurrently with the teaching of content. In the beginning of this revolution, there must be collaboration between a technology specialist and other general or vocational subject matter specialists by involving any subject matter specialist such as an English teacher, science, math or social studies teacher who wishes to make the curriculum more meaningful and motivating by infusing technological literacy concepts combined with activities in his or her teaching. These activities can create high student interest and motivation, and, moreover, it can greatly enhance, for both teacher and students, the perceived relevance for combining courses, such as math, science, social studies and English (Oaks, Gantman, & Pedras, 2000). Becoming an expert in one subject may no longer work. A jack of all trades, mitigated by the dependency on technology may well become the order of the new day.

A natural solution to this premise is the curricular innovation within tech ed called "thematic curriculum" which encompasses a series of experiences, programs, courses or units that focus on a common subject or theme. Secondary schools are increasingly setting up thematic schools, clusters, academies and programs as subunits within the traditional school using technology to meet its curricular objectives.

This concept of teaching various subject matter under one whole, integrated project instead of educating by separating subjects as schools still do today can be compared to teachers who believe that teaching reading is done by separating syntactic parts, by sounding out letters phonographically, by using word drills, by separating text with a myriad of grammatical rules and demanding that the student learns rules prior to opening a book in order to begin learning how to read.

Its antithesis can be analogized to the above-mentioned setting up of thematic curricula in schools, whereby setting goals and objectives in creating projects by merging subjects with the practice of technology to discover purpose and answers is practiced. Teaching literacy (reading & writing) or 'sociopsycholinguistically' where the fusion of contextualized materials such as books, films, music, field trips and group collaboration based upon individual and group is implemented holistically (Edwards, 2003) can be more effective than teaching by dissection and disconnectedness.

To strike the balance between bridging content and technology, today's pioneer teachers are acclimating young students to new writing technologies in a straightforward way, encouraging them to alternate between using a pencil and simple word processing. They pick up the keyboard just like they used to pick up a piece of paper and pencil. Students work on various stages of the writing process, some using the keyboard, some editing and revising with pencil, some conferencing with the teacher with a piece of hardcopy in their hands, and some 'beaming' their work to the printer for publishing (Yancey & Blake, 2003, p. 266.) This kind of writing environment moves students toward a more sophisticated, multilayered composing process than is possible without using digital technology. When writers start out early moving back and forth between different tools and composing process, this way of working becomes normal and comfortable to them. Facility with word processing sets the stage for using different formats such as boldfacing, italicizing, underlining and using bullets. Knowing how to bring such graphic elements into the writing process may be called the new 'visual literacy.'

Computer tools facilitate cycles of ongoing assessment. They capture work in forms that make revision much easier than it is with traditional composing tools. The Web allows students and teachers to post their work in places where they can get feedback from a wider range of critics, including audiences who really care about learning from the students' work. Archives of student work, assembled as electronic portfolios, help students, parents and teachers recognize and support student progress from year to year. Online projects engage students and their teachers in collaborative inquiry and social action initiatives with peers around the world, which also helps students develop a deeper appreciation for their own and others' cultures (Wiske, 2004).

Software that allows learners to create and present their ideas with multiple media: images, text, sound, video, dynamic models can enrich performances of understanding. New technologies help students produce ideas (post-modern curriculum) rather than simply consume ideas (modern curriculum).

Rebecca Kelly, a teacher at Delmar Junior High School used basic programs such as Microsoft PowerPoint and Netscape Composer in new applications that received state recognition. She used PowerPoint as a cooperative learning tool in which students would organize ideas, sequence events and discuss characters as a group. They used Netscape Composer to create WebQuests focusing on topics such as early explorers of the Americas and a comparison of the sinking of the *Lusitania* and the *Titanic*. The WebQuest is a type of lesson incorporating data from preselected Internet sites for students to use in solving a specified problem. Readability is easily adjusted on the WebQuest because the students are constantly involved in the creation process.

Kelly's eighth grade students created a captioning activity after reading *The Outsiders, Monkey's Paws* and *Dark Crossing*. They used their recall memory to create a short play of two or three minutes. They wrote the script, including newly learned vocabulary words, and then acted it out in front of a video camera. Then, Kelly captioned the video using a character generator, TV and DVD player to put the words of their scripts onto the screen. This process reinforced vocabulary recognition and development. Precaptioned videos were also used as a reinforcement of the reading process and vocabulary acquisition in other content areas. "Students are seeing the value of reading in real-life applications provided by accessing closed captioning and obtaining information from the Internet," (Kelly, 2001).

Reading activities should be organized in a way (collaborative reading, questioning, summarizing, predicting) that students develop inquiry and interpretation skills (Palinscar & Brown, 1984). Reading material supported with pictures, animation and sound should be prepared for students and be made available online so that students can develop skill for both reading from screen and printed sources, and most importantly, the materials to be prepared for electronic platforms are to be interactive, getting students to be active and thinking.

This balance between mastering content, promoting inquiry and acquiring literacy promotes optimum results wherein both students' and teachers' interests serve as a basis for meaning. For meaning to become the primary objective, not a grade, a prevalent project-driven environment should exist, one that gives students technology-based activities that help them practice their literacy skills while mastering the tools of technology (Bodley & Bremer, 2004).

CHAPTER TWO

STUDY OF SIXTH GRADE STUDENTS' COMPUTER USAGE

Purpose of the Study

The purpose of the following study was to determine how computer usage among sixth graders differed and how those differences impacted their California Standardized Test scores.

I created a questionnaire (Appendix B) which asks students their personal preferences and habits in a questionnaire regarding computers, a general knowledge assessment, and two logical reasoning questions for the students to answer.

I chose three separate sixth grade language arts classrooms from two different public schools to conduct my study: Raymond Cree Middle School in Palm Springs, California, and John Glenn School of International Studies in Indio, California. Thirty-five students participated in my study.

Description of Procedure

The questionnaire was multiple choice. The answers were converted to a number between 0 and 1. For example:

0) no	1) yes	
0) never	0.5) sometimes	1) often
0) 0 hours	0.5) 1 hour	1) 2+ hours

The numbers were then entered into an access database for each answer per student.

A general knowledge survey, also given to the students with the computer use questionnaire, was given a score equal to the number of correct answers. This number was then divided by 5 to get a value within the range of other testing results (such as the California Standardized Test which has a range of 1-5).

A logical reasoning test was also given to the students. This was also given a score equal to the number of correct answers.

Of the 35 students who participated in the study, 17 students returned consent forms for their California Standardized Test results.

A database was created using the questionnaire, general knowledge survey, logical reasoning test and the California Standards Test results from the participating students.

This database was then sorted by the relevant independent variables that likely affected students, such as time spent on the computer, time spent reading, computer accessibility and homework preference.

The sorted data was then exported to excel where the graph wizard was used to create graphs of the dependant variables such as the California Standards Test scores, general knowledge scores and logical reasoning scores. I was then able to use these graphs to find correlations that served as the basis for my conclusions.

Hours on Computer versus California Standards Test Scores

To determine how computer use affects students' performance, I sorted the California Standards Test score data by the number of hours spent on the computer at home.

As Figure 2 shows, the students with the best scores were the ones who spent a moderate amount of time on the computer. Those students who spent an excessive amount of time on the computer tended to have lower scores.

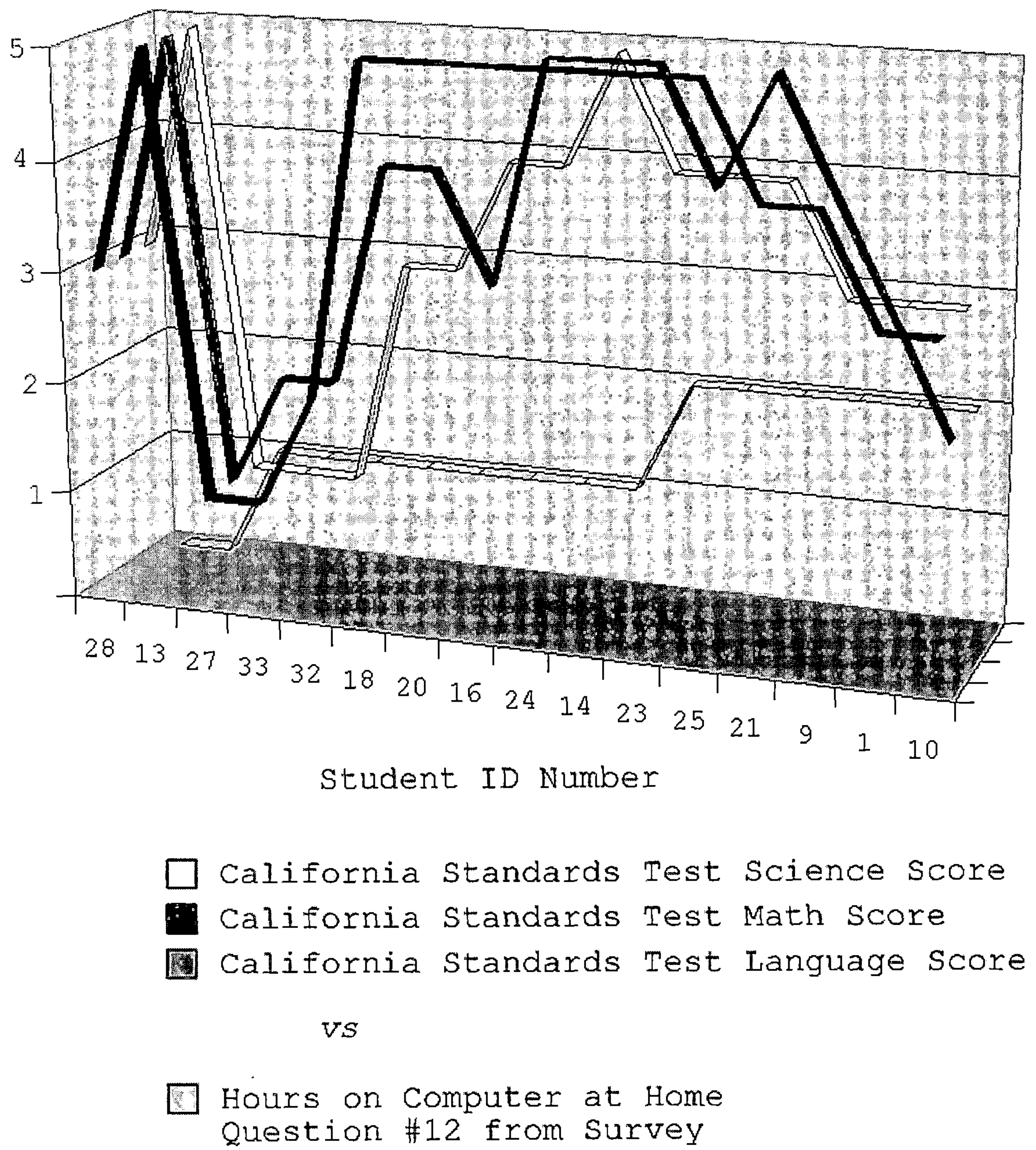

Figure 2. Hours on Computer at Home versus California Standards Test Scores

Question #14

I prefer to spend my time using the computer than doing homework:

Question #12

At home, I use the computer for:

	Yes	No
2+ Hours	91.6 %	8.4 %
1 Hour	50 %	50 %
0 Hours	28.5 %	71.5 %

Figure 3. Homework Preference versus Hours on Computer at Home

Homework Preference versus Hours on Computer

I then compared their answers to question number #14 regarding homework to question number #12 regarding computer use time from the questionnaire.

As Figure 3 shows, of the students who reported spending two or more hours a day at home on the computer, 91.6% preferred using a computer to doing homework. Only 50% Students who spent a moderate amount of time (one hour) using the computer, preferred using a computer to doing homework.

Spending too much time on the computer at home seems to take these sixth graders away from homework time and thereby lowers test scores. Computer use at home seems to help test scores as long as computer use is not excessive.

Hours Reading versus California Standards Test Scores

To determine how reading affects students' performance, I sorted the CST score data by the number of hours spent reading at home.

As Figure 4 shows, the more students read (question #11) the better their CST scores were. Reading at home appears to boost test scores.

Computer Accessibility versus California Standards Test Scores

To determine how access to computers might affect scores I used question #3 and #33 from the questionnaire:

#3 I have a computer at home: a. no b. yes

#33 My school offers me the chance to use a computer: a. yes b. no

A "Yes" answer was given a value of one and a "No" answer was given an answer of zero. I added these two numbers to give me a computer accessibility value for each student. I then sorted the CST scores, the General Knowledge scores and the Logical Reasoning scores by the computer accessibility value. As Figure 4 shows, every score seems to improve with greater computer access.

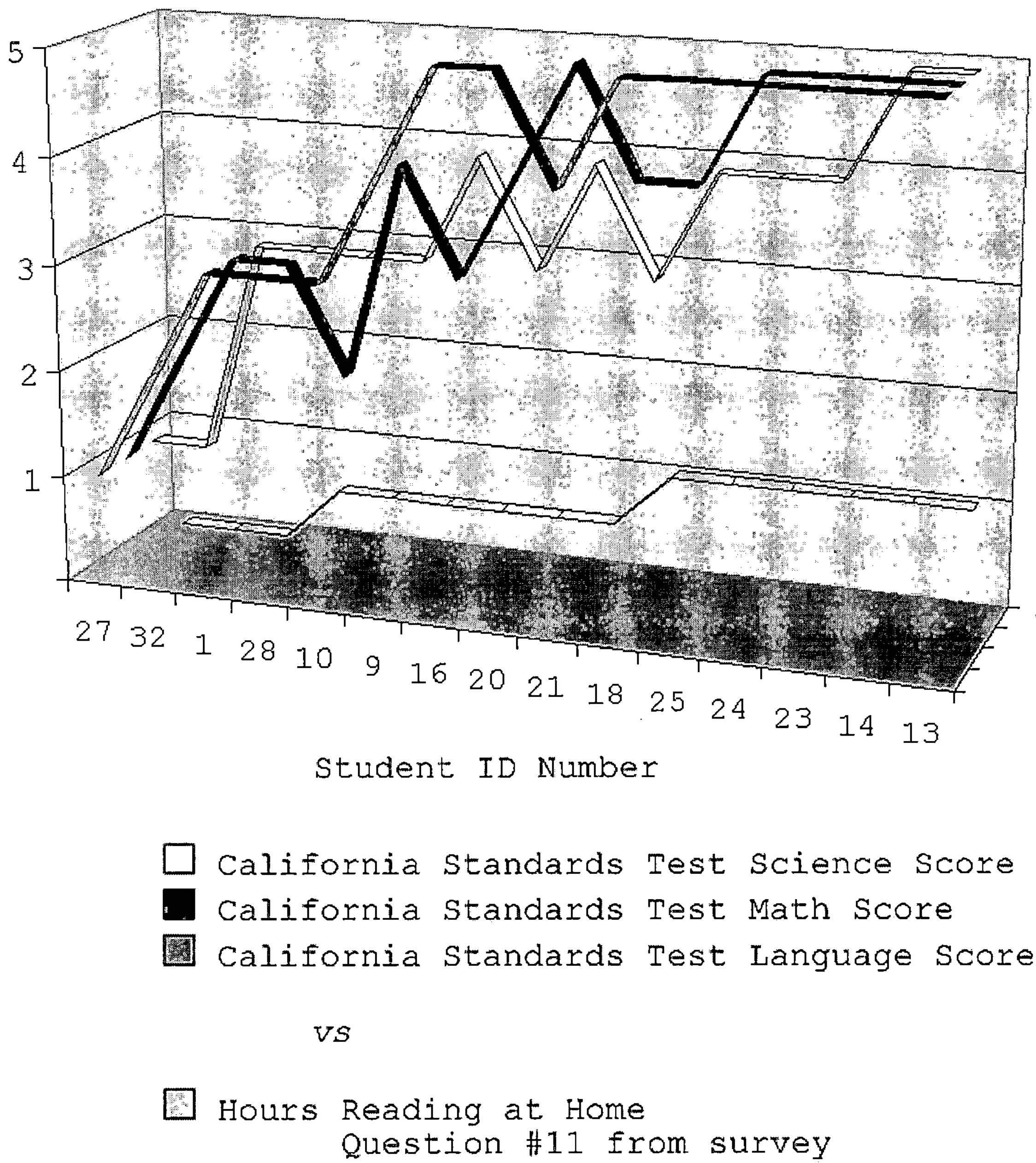

Figure 4. Hours Reading at Home versus California Standards Test Scores

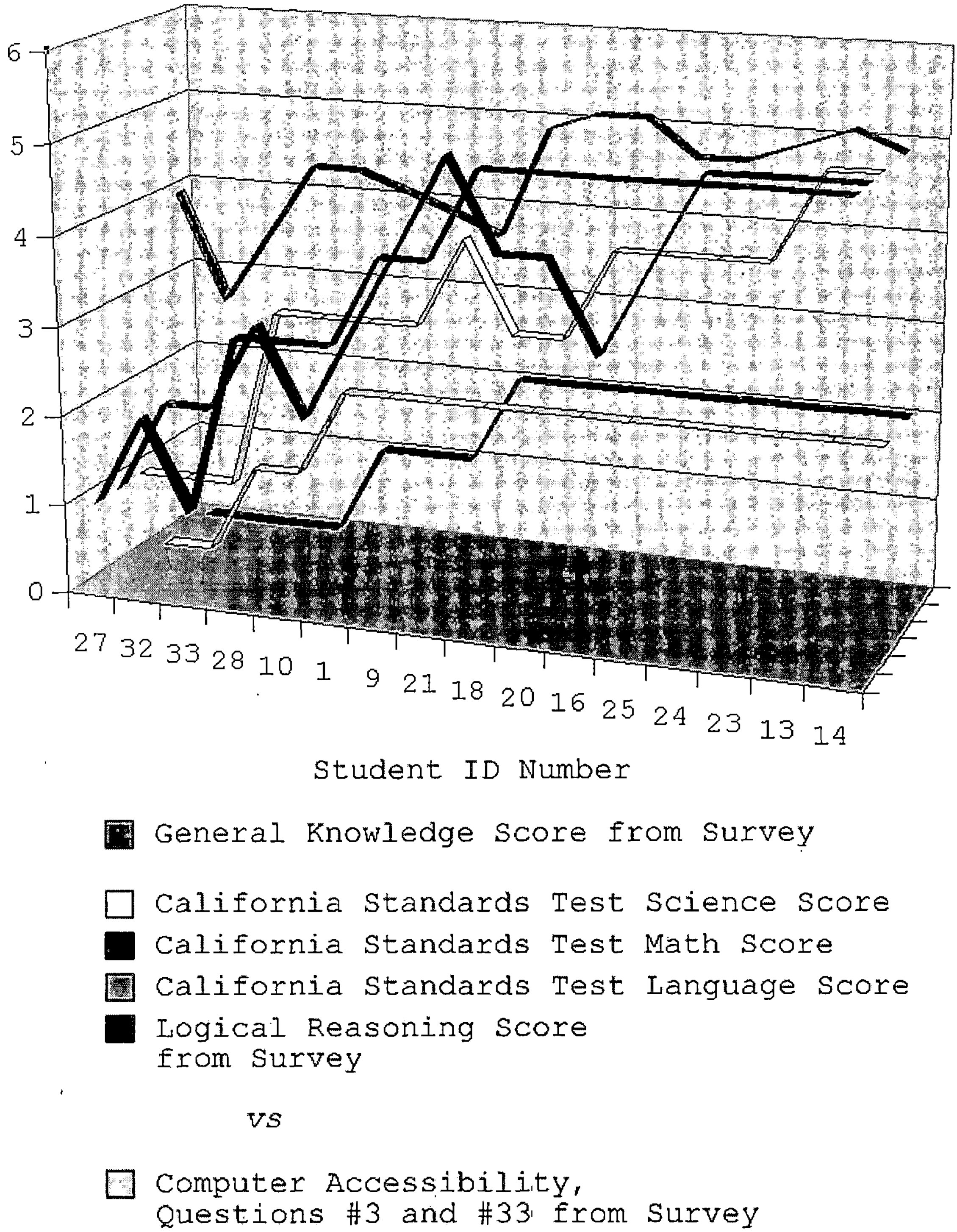

Figure 5. Computer Accessibility versus California Standards Test, General Knowledge and Logical Reasoning Scores

Findings of Study

Moderate computer use (one hour) at home correlates with higher California Standards Test scores compared to students who use computers very little or not at all at home.

Excessive computer use (two or more hours) at home correlates with lower CST scores compared to students who use computers moderately at home.

Excessive computer use also correlates with a smaller preference for doing homework, rather than spending time on the computer, when compared to students who use computers moderately at home.

Longer amounts of time spent reading at home correlates strongly with higher CST scores.

Greater computer access for students at home and at school correlates with higher CST scores, logical reasoning scores and general knowledge scores.

Limitations of Study

The limited number of students who participated was the largest limitation of the study. This study does not attempt to give exact percentages but attempts to find correlations between computer use and student performance to better understand how computers affect students in areas such as math and language arts.

CHAPTER THREE

BLUEPRINT FOR EDUCATORS

Constructivist Education

The implication from Chapter One suggests that when a teacher strikes the balance between content learning and implementing technology, a successful learning situation ensues. Students can memorize ideas that others tell them, but to actively seek to make meaning involves making sense of things. "Meaning often starts with a problem, a question, a discrepant and inexplicable event, a curiosity, wonderment, puzzlement (Duffy & Cunningham 1996), a perturbation (Maturana & Varela 1992), expectation violations (Schank, 1986), and cognitive dissonance, or disequilibrium (Jonassen et al., 1999).

When learners seek to resolve this dissonance, it becomes their problem, not the teacher's, and resolving dissonance ensures some ownership of the ideas and the problem on the part of the learner. That ownership makes what is learned more relevant to the learner.

The role of teachers and technology in learning is indirect. They stimulate and support activities that engage learners in thinking which results in learning, but learners do not learn directly from the technology; they learn from thinking about what they are doing and technologies can support that learning if it is used as a tool and partner that helps learners think. Technology using educators must use technologies to engage students in active, constructive, intentional and cooperative learning.

Constructivism argues that skills will have more meaning if they are acquired initially and consistently in meaningful contexts to which they can be related. Teaching facts and explaining concepts without using them in some context does not result in automatic learning, it leads to forgetfulness.

In order to best serve today's students for their entry in tomorrow's work force, educators must work together with politicians, administrators and parents to reorganize their respective current curricula, emphasizing project-based learning, connecting several subjects at once in concurrence with the implementation of technology to connect skills to meaning. This must occur in every classroom in the United States.

Strategies

Below are strategies to follow which will greatly clarify the task at hand:

1. No Child Left Behind must add to its existing set of educational standards, a grade by grade standard for technology literacy which need not be taught separately but be integrated while learning multiple subjects.
2. All teachers (K-12) must be retrained and certified to teach technology. Teachers must gain fluency with technology.
3. Teachers cannot control all the learning activities in the classroom. If teachers determine not only what is important for students to know and how they should learn it, then students cannot become independent learners. Teachers will be learning with the students.
4. All or most content subjects must be taught implementing technology every step of the way.
5. Projects should cover multiple subjects, such as English, Social Studies and Geography while incorporating technology.
6. Provisions should be made for exceptional children. They may be assigned projects which they can work on independently, away from the group.

Maxine Greene (1995) states that "It is suggested that young people are to be molded in the service of technology and the market, no matter who they are," but for those students who excel in other ways or prefer to not focus on technology, alternatives must be allowed.

7. All standards and rubrics must be created in such an open ended way that development and experience are to be taken into account for test scores which are not the end all of each subject area and project.

The seventh point stresses openendedness as a criterion for assessing a child's progress, rather than pinning a test score as a total measuring tool for a child's progress. Tanner (1997) states that teachers and parents must be careful in not pushing a child beyond her intellectual development. Educators and parents can not expect children to perform in the same way an adult would. This puts needless emotional pressure on the child and her parents. "One is impelled to wonder whether K-2 youngsters in mathematics can be expected to effectively use a variety of strategies in the problem solving process and make organized lists or tables of information necessary for solving a problem" (p. 231).

Insofar as assessment goes, if instructional theory says that learning is an active, constructive, authentic process, so should the ways in which educators assess learners and the criteria used to evaluate them.

Constructivist Assessment

Traditionally students are assessed for the amount of knowledge they have acquired from the teacher and the textbook. Constructivism suggests that schools need to assess the meaning that learners have constructed from their interactions with the world, so the meaning and interpretations that students and groups construct will vary from each other, so there cannot be one correct answer. The only way to assess learning is while it is in progress since it is process oriented. Teachers must assess learning as it is occurring rather than separating assessment from learning, focusing not only on what students have learned, but on the ways that students learn. Because meaning making is a complex phenomenon, assessment of learners' knowledge must be multifaceted and multimodal (Jonassen, 1990). Educators need to develop more diverse ways of assessing learning. They should assess student constructed knowledge based produced while implementing technology. Assessment need not be a separate process that occurs after learning has occurred. Technology can beget student representations of what they know.

With traditional rubrics, students get a letter grade with little substantive feedback about their performance, since the child has been programmed to only cares about his grade. Instead, a meaningful learning environment in which the students and teachers work together to develop a rubric that will promote intentional learning by identifying important aspects of the performance should be created to gather information about the learner's performance. Later, the student can use the information as input for reflection on her performance which provides evidence.

There are several elements that combine to form an effective rubric which is a set of scales, one for each element that is considered important. The scale for each element consists of several ratings that describe the different levels of performance that are expected.

In an effective rubric, all important elements are included, ratings are distinct, comprehensive and descriptive. The rubric should communicate clearly to both students and parents, and finally, an effective rubric provides rich information about the multiple aspects of the performance and avoids the temptation to create a contrived score. Many teachers are compelled to turn the ratings given on individual elements into scores for each element, then to combine these scores to form a total scored and then a grade. When individual elements are combined, information that could improve performance is lost. When ratings are treated as numeric scores and combined, elements of more and less importance are generally treated as if they were of equal value and an inaccurate picture of the performance is created.

Developing rubrics is a difficult task. There's no single right answer. A rubric is effective to the extent that it helps learners focus on the important elements of a performance and provides information on which they can reflect and base strategies for growth (Jonassen et al., 1999).

Educators should:

- Develop rubrics collaboratively with learners.
- Encourage learners to use the rubrics to guide them during the learning process. When rubrics are given to students before the learning activity begins, students can

use the content of rubrics to focus their activities.

- Encourage students to explain the rubrics to parents and other interested individuals, perhaps in the context of student-led conferences during which they describe the progress they're making and the lessons they have learned.
- View rubrics as providing important information educators and learners can use to select learning activities, rather than as evaluative devices with which to label, sort, or grade students.

Appendix E demonstrates what a sample rubric may look like in order to evaluate a high school multimedia project. A rubric is created for each assigned project. Students are expected to demonstrate the learned skills and create projects that are age appropriate and educational in, for example, the retelling of a story from a text, which is, in effect, a multimedia book report presentation. For the students, the best evaluation is the enthusiasm shown by their target audience, which is usually their peers.

Conclusion

Writing this thesis project has brought attention to how inadequately prepared our current educational system is in confronting the need to assimilate technology in today's curricula. If we don't move forward to connect the use of technology with project based learning merging multifarious subjects, we will commit a grave disservice toward the health of our students' future. This problem is being addressed in certain private schools but there is no broad brushstroke integrating technology with daily curricula in the public schools.

The use of technology on a daily basis in our current national educational curricula will accelerate our children's natural intellectual evolution. It has been said that today's average fourteen year old possesses the equivalent educational level to that of an adult in the middle ages with his doctorate in philosophy. Several decades ago, advanced algebra was typically the highest level of math to be mastered in high school. Today, in the beginning of the twenty-first century, middle schools expect students to become proficient not only in algebra, but also in pre-calculus, while students in high school are expected to become proficient in calculus and basic physics.

In this last century, with the advent of television, children have been flooded with many concepts and images, some positive, some negative. This continual stream of information has greatly increased children's level of intellectual sophistication worldwide from that of the pre television era. Computers today are poised to create yet another leap toward raising the educational potential of our children. With the presence of entertaining educational software, the Internet, and a newly invigorated attitude from educators, our students are poised to shatter our conceptions of the limits we have made for the possibilities of their minds. Quantum physics and a thesis for grade school? It may surely become possible for those who feel they are ready.

By choosing a respective curriculum, parents, educators, administrators, and politicians set the bar for how high a level of mastery in a given subject children can reach and in which way they have become transformed while reaching it. Children only believe in the limits we have chosen for them. If we cannot envision the potential our children are capable of tapping into, we will severely curtail their ability to utilize the availability of state of the art technology the working world will expect them to operate. We as educators must accept the fact that children have the ability to surpass the level of knowledge adults possess today. On this cusp of the post-modern movement in education, we must strike a balance between contextual learning and the over-zealous implementation of technology. We stand on the cliff of the post-modern, micro-electronic revolution, looking forward, and by moving along the surge of this electric current, for there is no turning back, we will not experience intellectual vertigo: we will not fall or fail, we will soar and as we float among the stars. Those education pioneers, philosophers, scientists and visionaries who have bequeathed their impassioned legacies to us will smile.

More research needs to be conducted in order to measure whether kids using computer technology regularly and are automatically saturated with information, are at the same time raising their intellectual and cultural awareness in a similar way to how watching television regularly began to affect kids and other viewers in the 1950s. By controlling the use of computers in a child's daily life, the study conducted in this thesis shows that intellectual growth can be accelerated.

APPENDIX A

INFORMED CONSENT FORMS

INFORMED CONSENT FORM FOR
Master's Thesis Project: The Pros and Cons of Using Technology in Primary Education

By Astrid Ryterband
Master's Candidate at California State University San Bernardino
College of Education/Reading and Language Arts Graduate Program

Dear Parents/Guardians:

I am conducting research for my graduate school thesis project in order to examine technology as an educative tool in primary education and to discover how it's affecting literacy instruction.

By having your children fill out a voluntary, confidential, anonymous questionnaire, facts survey and participate in a short reading comprehension test in their classroom during the week of **March 14, 2005**, I will then be able to compare their answers and scores with three other sixth grade classrooms in the Coachella Valley which will lead me to a clearer understanding of how computer access benefits, harms, or has no effect on the surveyed students' reading comprehension level and general knowledge or whether little to no computer access does the same.

Your child will not need to study or do homework for this project, nor will your child's grade in the classroom be affected one way or another. All answers are confidential and anonymous and will solely be integrated in my thesis. There are no foreseeable risks or benefits in your child's participation. You may contact me privately if you have any questions, if this activity has caused you any concern. If you seek help regarding this for any reason, counseling is available. A copy of the questionnaire, facts survey and reading comprehension test is in the principal's office, should you wish to review them.

Please print your child's name and sign your name on the line below and have your child return this form to his/her teacher.

Thank you very much for your participation, Astrid Ryterband
Email: aryterband@collegeofthedesert.edu

I hereby give my consent for ________________________ (student's name) to participate voluntarily in the above-mentioned study.

Parent:____________________________________ **Date:** __________________

Teacher____________________________________ **Date:** __________________

TO: PARTICIPATING STUDENTS of JOHN GLENN MIDDLE SCHOOL AND RAYMOND CREE MIDDLE SCHOOL

FROM: Astrid Ryterband **DATE: 3-23-05**

RE: Master's Thesis Project: The Pros and Cons of Using Technology in Primary Education, California State University San Bernardino, College of Education/Reading and Language Arts Graduate Program

Dear Parents/Guardians:

Thank you very much for your children's participation in the surveys and reading comprehension assessment they took last week. I am currently in the process of analyzing the data from all the students who participated from several different schools into valid statistics.

To fully process my findings in the above-mentioned study, I need to compare your child's most current California Standardized Test scores to the other students' scores who participated in this study. Your child's name and scores will be used solely for the purpose of this thesis project and nothing else. No names will be published at any time and your child's right to privacy is completely ensured.

If you agree, I would ask you to give permission to release your child's test scores to me for the purpose of this project.

Thank you,

Astrid Ryterband
Master's Candidate, California State University, San Bernardino, College of Education, Reading and Language Arts
aryterband@collegeofthedesert.edu

I hereby agree to release to Astrid Ryterband, the scores of my child's recent California Standardized Test with the understanding that his/her privacy is to be guaranteed.

Student Name ______________________________ (Please print)

Parent/Guardian ____________________________ (Please sign)

APPENDIX B

QUESTIONNAIRE

Date: ______________________ Grade: ______________________

Name: ______________________ School: ______________________

QUESTIONNAIRE - ABOUT YOU

1. I like to read books, magazines, newspapers:	a. not much	b. sometimes	c. a lot
2. I use a computer in school:	a. almost never	b. once/twice per week	c. every day
3. I have a computer at home:	a. no	b. yes	
4. I use the computer to:	a. do work	b. play games	c. email/chat
5. I know how to use the Internet:	a. no	b. a little	c. very well
6. I look at/read the news headlines on the home page of our Internet browser:	a. never	b. sometimes	c. each time
7. I click on news headlines on the Internet that interest me:	a. never	b. sometimes	c. often
8. I like to send emails and chat online:	a. never	b. sometimes	c. often
9. I play games on the computer:	a. never	b. sometimes	c. very often/always
10. I have used educational software on the computer at home:	a. never	b. a few times	c. often
11. At home, I read books, textbooks, etc. for :	a. 0 hours	b. 1/2 hour	c. 1+ hours
12 At home, I use the computer:	a. 0 hours	b. 1 hour	c. 2 + hours
12b At home, I watch TV:	a. 1 hours	b. 2 hour	c. 3 + hours
13. I shop online and use e-Bay:	a. never	b. sometimes	c. often
14. I prefer to spend my time using the computer than doing homework:	a. yes	b. no	
15. I prefer to see friends than use a computer:	a. yes	b. no	

16. I am interested in going to the theater

17. I have downloaded songs on the Internet: a. never b. sometimes c. often

18. I am interested in art: a. yes b. a little c. no

19. I am interested in politics: a. yes b. a little c. no

20. I have gone to a ballet: a. never b. a few times c. many times

21. I use a computer more than I watch TV: a. yes b. no

22. I like to go to the public library and go to book stores to read: a. yes b. no

23. I prefer to use a computer than go to a library or book store: a. yes b. no

24. I like traveling and seeing new things: a. yes b. no

25. I like using a computer more than traveling and seeing new things: a. yes b. no

26. I play outside a lot: a. yes b. no

27. I prefer to use a computer than play outside: a. yes b. no

28. I would rather play a musical instrument than play on the computer: a. yes b. no c. always

29. I would like to work with computers when I grow up: a. yes b. no

30. Computers are used for just about everything like medicine, the military, aviation, movies: a. yes b. no c. don't know

31. I love computers: a. yes b. no

32. I want to become good at using computers: a. sometimes b. often

33. My school offers me the chance to use a computer: a. yes b. no

34. I can become just as educated by reading books as by using a computer: a. yes b. no

35. I think physical exercise is important: a. yes b. no

36. When I use a computer a lot, I exercise less: a. yes b. no

37. Sitting for a long time is healthy: a. yes b. no

38. I see friends less when I use a computer: a. yes b. no

39. Friends are more important to me than using a computer: a. yes b. no

APPENDIX C

GENERAL KNOWLEDGE SURVEY

Name: ________________________ Grade: ______________________

School: ______________________ Date: _______________________

General Knowledge Survey About What You Know

1. A novel is usually considered to be: a. fiction b. non-fiction
2. An author is the person who: a. writes the book b. edits the book
3. A book written about someone famous is: a. biography b. auto-biography
4. A best-seller is a book that is: a. very popular b. will be published

5. A tsunami is: a. a big wave b. a big earthquake
6. Tornadoes usually occur in the American: a. Northwest b. Midwest
7. Hurricanes in Asia are called: a. cyclones b. typhoons
8. The tsunami in the Indian Ocean was caused by: a. a big wave b. a big earthquake
9. The biggest fault in California is the: a. San Andreas b. San Jacinto

10. American law is based on the: a. U.S. Constitution b. Magna Carta
11. The president and cabinet are part of the: a. legislative branch b. executive branch
12. The American Revolutionary War was fought between: a. Colonists vs. Indians b. Colonists vs. England
13. A governor presides over a: a. state b. country

14. The most needed resource in the world is: a. oil b. water
15. Iraq's geographical neighbor is: a. Iran b. Lebanon
16. Saudi Arabia's largest export is: a. oil b. headscarves
17. The American Civil War was fought between: a. Union vs. Confederacy b. U.S. Government vs. African Americans
18. The American military is involved in a. Iraq/Iran b. Iraq\Afghanistan
19. Mary Bono is a California: a. Senator b. Representative
20. The House of Representatives is in: a. legislative branch b. judicial branch
20. The earth is located in which galaxy? a. Andromeda b. The Milky Way
21. The largest planet in our solar system is: a. Saturn b. Jupiter
22. Satellites orbit: a. Earth b. the moon
23. The moon orbits the: a. Earth b. the sun.
24. The study of dinosaurs is called: a. archaeology b. paleontology
25. Whales are: a. mammals b. fish
26. Animals that are amphibious can live in: a. water b. land and water
27. Penguins live in: a. the Arctic Circle b. Antarctica
28. A monitor on a computer is the: a. screen b. keyboard
29. A computer processes information in: a. modem b. CPU
30. The Internet can locate: a. a lot of information b. all information
31. An educational CD installed in a computer is called: a. software b. hardware
32. A computer has: a. hard drive b. A drive c. both
33. Computers are used in: a. medicine b. aviation c. both
34. Games in computers can be: a. educational b. fun c. both

APPENDIX D

LOGICAL REASONING QUESTIONS

Logical Reasoning

1. Amy, Bob, Carrie, and Dan are standing in line to buy ice cream.

See if you can figure out their order from the following clues:

Carrie is between Amy and Bob.
Dan is next to Amy.
Bob is not first.
Write who is first, second, third and last

Carrie ______ Amy ______ Bob ______ Dan ______

2. The kids in the Washington family—Allison, Beth, Carl, and Danny — do their own laundry every week. They found that sorting the socks always took too much time, because it was hard to tell which socks belonged to which kid. They decided that, to save laundry-sorting time, each one of them would always wear the same color socks — green, blue, red, or yellow.
Use the clues to find out which kid got which color socks.
Allison refused to wear yellow or green socks.
Beth refused to wear green or blue socks.
Carl chose blue.
Danny picked the color that both Beth and Allison refused to wear.
Allison ______ Beth ______ Carl ______ Danny ______

Retrieved online from:
http://school.discovery.com/brainboosters/logic/washingtheWashingtonSocks.html
http://school.discovery.com/brainboosters/logic/lineup.html

APPENDIX E

RUBRIC FOR MULTIMEDIA PROJECT

RUBRIC FOR MULTIMEDIA PROJECT

Points	A (4 Points)	B (3 Points)	C (2 Points)	D/F (0-1 Points)
PICTURES	Same as B with more detail. User created many pictures with the drawing tools or used Fireworks or Photoshop.	Appropriate, interesting pictures throughout that tell the story.	Too few pictures or pictures don't relate well to the story.	No images or images are unrelated to the story.
SKILLS	Appropriate use of all learned technical skills to enhance the story and newly discovered techniques.	At least one instance of each of the above skills.	Most of the skills included.	Many missing skills.
AGE APPROPRIATE	Appropriate for target audience. There are no typos or grammatical errors. Type size and language are age appropriate.	May have one typo or grammatical error.	Not age appropriate.	Not age appropriate.
NAVIGATION	Title page with other pages branching off. Use of various scenes. Navigation path is clear and logical. All links work.	Use of at least 3 scenes. There is a clear order to the sequence of the book. All links work.	Most links work.	No links.
OVERALL PROJECT	Appropriate use of elements that make it look great. Made the project fit the intended audience.	Looks good	Poor taste in color choices and the project isn't all that interesting. It looks like it was put together with little thought.	Doesn't look good. Little thought went into the production of the story.

Rubric created by Barb Bodley and Janet Bremer, technology instructors at Cincinnati Hills Christian Academy High School and Otto Armleder Elementary School in Cincinnati, Ohio.

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