2002

The effectiveness of integrating technology into science eduaction (sic) compared to the traditional science classroom

Kimberly Ann Sigears

THE EFFECTIVENESS OF INTEGRATING TECHNOLOGY INTO

SCIENCE EDUACTION COMPARED TO THE TRADITIONAL

SCIENCE CLASSROOM

A Project

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education:

Instructional Technology

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ABSTRACT

This project addresses the integration of technology into science education by using a teacher-created web-based learning environment focused on the California State Framework for seventh grade.

The project design has 3 main sections, development, implementation, and evaluation. The first section included PowerPoint tutorials that addressed each body system and provided students with an informative understanding of each. Online activities were also linked to the tutorials where students were given specific URLs to reinforce concepts. Throughout implementation of the project, thirty students were exposed to the web-based learning environment, thirty more students were exposed to traditional-based instruction for a 9-week period.

The evaluation of this project indicated that the project did not foster higher order thinking skills. As a result, a revision in the technique of questioning, as well as the author's teaching styles was conducted to foster a learning environment that promotes the development of higher order thinking skills, while exposing students to technology.

ACKNOWLEDGMENTS

First, I want to thank God for blessing me with the strength and knowledge to complete this milestone in my educational career.

Second, I want to thank Dr. Leh and Dr. Robertson for their support and dedication that went into developing this project. Without their support and guidance this project would not have been possible. A special thanks to the both of them for working with me long distance. Many Thanks!! I would also like to thank all the wonderful professors in the Instructional Technology program at California State University, San Bernardino that I have had the opportunity to work with in class and one on one when completing other projects over the course of my educational experience.

DEDICATION

I want to first dedicate this project to Dr. Fawn Ukpolo, words cannot begin to describe all you have done for me in the time that I have known you. You have made me want and aspire for more than I ever imagined possible. Because of you I have accomplished this and strive to accomplish so much more. With your love, support, and guidance over the past five years I have reached another milestone in my educational career. I hope that you can look back and realize all you have accomplished with me. Thank you for not giving up and taking me under you wing. Thank you for coaxing me out to California, it has been an enlightening experience that I will remember for the rest of my life. For you and all you have done I am eternally grateful!

Second, I want to dedicate this project to my mom and step dad. Thank you for your ongoing support regardless of my decisions. I know choices I have made throughout the past year have not been easy, but I did it, and survived. I accomplished what I set out to accomplish and I did it with your love and support. Thank you!

To my mother, thank you for all you have done to help mold me into the strong-willed, independent person I have become. Thank you for all your support and guidance throughout my educational career. Most importantly, thanks for being there!

My last dedication is to my dad. This project is dedicated in loving memory of my father, Gene Sigears. I know you are looking down from heaven and smiling. I have and will continue to do all I can do to make you proud!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

FRONT MATTER

Introduction

In recent years, education has undergone drastic changes in the area of science. With these changes, students are now more active participants, thus actively engaged in activities that not only prepare them for the next grade, but also prepare them for the world. In preparing students for the world, they are actively engaged in the learning process, thus they become active readers, and more attentive listeners. Students must be exposed to all aspects of knowledge necessary to achieve success in the work industry.

When technology first emerged, it was predicted that technology was going to revolutionize education. With overwhelming fears that technology would replace teachers in the classroom, many shunned the idea of using technology. As time evolved, educators began recognizing that computers will never replace the traditional classroom, but can be used to enhance opportunities for learning.

Over the past decades, success has resulted from combining knowledge with new technological advances. Since

World War II, technology has restructured the lives of most people. Technology today is no longer a reconstructive effort, but a necessity to ensure success. Technology surrounds everyone on a daily basis and is used for entertainment purposes, communication, calculations, and increases the potential for higher learning outcomes almost daily.

As we enter another century, the demands for technology are dominating education. As educators, it is important that students are not only exposed to the various curriculums, but it is adamant that they are able to meet the demands in the rapidly developing technology-based world.

> Science and technology are transforming our world, providing an age of possibility and a time of change as profound as we have seen in a century. We are well prepared to shape this change and seize the opportunities so as to enable every American to make the most of their God-given promise. One of the most important ways to realize this vision is through thoughtful investments in science and technology (p. 9).
>
> President, William J. Clinton

The field of education is a logical place to start exposing students to the technologies available. Education is directed toward promoting progress and change, however incorporating technology into education should not be a supplemental expenditure, but rather a means to enhance subject matter across the curriculum.

To identify advantages and disadvantages of promoting technology incorporation into curriculum one must observe both ends of the learning spectrum. At one time the ability to read and write were both innovations in the field of education. In the Twenty-first Century, educational innovations center on restructuring the curriculum to incorporate technology.

We have reached an age where the integration of technology into the curriculum is no longer a suggestive connotation, but a necessary renovation in order to create a more productive learning environment. The direct purpose of integrating technology into education is to provide a more meaningful learning experience for students. However, it should not be assumed that instructional technology would transform all students into successful individuals. An assumption might be that technology can raise student achievement and activate higher order thinking skills, while increasing motivation, which in return produces successful individuals (Archer & Milheim, 1995).

Recently, a new age of science education has emerged. The new focus of science education has circled around the integration of technology into science education. In order for educators to meet the compliance of the new technology standards, education must endeavor a reconstruction beginning with the curriculum.

The integration of technology into science education can be expensive with regards to equipment, and time consuming, but not impossible. Technology cannot be dropped into the curriculum and expected to run smoothly. According to Roblyer et al, (1997) in order for technology to generate motivation, educators must observe applications in working progress and develop a personal perspective for integrating technology into the curriculum that is both beneficial to them, as well as the students. Miller and Seller (1990) suggested, that technology is vital in penetrating the barriers to change, as well as becoming a force in charge.

In the future, it is hoped that the enhancement of higher order thinking skills will be confirmed and that new assessment methods and curriculum will emerge transitioning to reflect each other in the new technology age. The goal is not for the computer to replace the actual science laboratory, but to assist in providing students with a simulation for complex, expensive, and dangerous experiments, that otherwise would not be possible, saving both time and money. The technology infiltration is not going to stop! Educators are expected to provide a curriculum that reflects leadership in this area.

An innovative approach to teaching science education is one that provides students with opportunities to rely on their own natural curiosities. It also guides them through a process of discovering answers to questions they have generated, not questions provided by the teacher (Vincent, 1993). The integration of technology into science education provides a multitude of opportunities for students to arouse their curiosity and further research it.

In summary, technology has been put in the hands of teachers and they have to begin revolutionizing the curriculum in order to encompass a learning environment that promotes success and prepares students for the future. Teachers therefore, have become even more responsible for promoting an environment that is learner friendly and interactive so students are eager to learn and higher order thinking skills are addressed.

There are various types of technology that can be integrated into the classroom. The students should not be limited to simulations and drill-and-practice software.

Teachers should encompass all technologies available and enhance the curriculum with the appropriate technological device to get the most out of learning experiences. By integrating technology into the curriculum, technology can add variety to teaching methods and enhance the learning process, while preparing students for the world around them.

Statement of Problem

The study of the Structure and Functions in Living Systems is a significant portion of the California science curriculum in the seventh grade (California State Board of Education, 1990). Teaching this topic requires detailed coverage of the human body systems and functions that take place in them. There are various software programs available that deal with the issues presented in the curriculum, but there does not seem to be software that is specifically oriented toward this topic and the relationships within it for seventh grade. In the past, teachers have used a curriculum set forth by the school district, in which teachers were given the topics to address and instructed how to deliver the information, along with some transparencies in order to stimulate the students' interest on the topic.

The rationale for developing this project was to integrate technology into science education, using a problem-solving approach, as well as information literacy. In order to address problem-solving skills, activities that emphasize process skills were created for each concept. The second rationale for developing this project was to address student motivation and raise student accountability, thus making students more active participants in their learning process.

Overview

During the 2000-2001 school year, the author delivered the course discussed in this project, to student's enrolled in the class. The author/instructor taught two science classes on a daily basis in 55-minute time blocks. The purpose of this project was to integrate a web-based learning environment into science education, using a problem-solving approach, as well as addressing information literacy. In developing this project, there were two distinct phases. The first phase included the development of a teacher-created web-based learning environment with various interactive activities. Activities that emphasized process skills were developed for each concept presented. The second phase included implementation of instruction over the course of a 9-week period. During this time, two groups of students were exposed to material contained within this project using two different methods of instruction. One group was exposed to concepts through a web-based learning environment, where the other group was exposed to concepts using the traditional method of instruction, including lecture/response and cooperative group work.

During the development and implementation of this project, all related literature reviewed was taken into consideration. The biggest goal was to develop a learning environment that was both informative and user friendly, while addressing higher order thinking skills.

Before the development process began, the author evaluated software on human body systems. Most software related was too complex for the seventh grade level. The author collected multiple materials to be included in instruction for a 9-week period for both the traditional-based and web-based instructional groups. Both groups were exposed to the same instructional content; the variance was the way in which it was delivered.

In designing the tutorials, PowerPoint was used and a 10-15-slide presentation was created for each body system.

The purpose of the tutorials was to make them as interactive as possible. Each tutorial contained a group of five questions at the end, which were multiple-choice and related to information presented throughout the tutorial. The users were also provided with links to specific URLs that contained follow-up activities to reinforce concepts. Some of the follow-up activities simulated lab activities similar to those conducted in a traditional science classroom. Upon completion of a tutorial for each section and follow-up activities, the students were assessed.

Students in the traditional-based instruction group; received information contained within tutorials in a lecture-response mode where the teacher directed instruction and transparency supplements were used. The students in this group also completed follow-up activities, as well as assessments on each system.

Prior to implementation, each group was given a pre-test to assess their knowledge of the material prior to receiving instruction. At the end of the 9-week implementation period, the students in both groups were given a post-test. The results of both tests were calculated and compared. The purpose of the assessments was not to evaluate the students progress, but to evaluate the content of the course and the delivery of instruction to determine if both lower and higher order thinking skills were being addressed by the instructor. The results obtained in this project, were used to reconstruct instruction in order to improve the delivery, as well as the learning environment for the upcoming school year. The evaluation of results indicated that the content contained within the project addressed lower order thinking skills in both groups, however, higher order thinking skills were not addressed in either group. The implementation of the project was a success! However, there are various aspects that will be addressed in upcoming revisions.

Project Goals

The goal of this project was to assist the teacher in integrating technology into a seventh grade science classroom, with an emphasis on the human body systems. Through the integration of technology into science education, this project aided in enhancing the learning environment, while motivating students to become more active participants in their learning experience.

The goals ascertained in this project were used to address instructional needs and roadblocks in the classroom setting discussed in this project. The results were used to make applicable changes to the delivery of the curriculum in the upcoming school year to provide students with a stimulating learning experience.

Significance of the Project

This project is significant because as we approach a new paradigm in education, the use of technology in the classroom continues to take on a different role. In this project, one can witness ongoing examples of technology being incorporated into the classroom on a daily basis. The use of this web-based learning environment was a first in science education for Alder Middle School. The structure of class's up to this point had been centered on the traditional lecture-response mode with transparency supplements to reinforce ideas presented. In some instances, there were lab activities to reinforce concepts.

With the implementation of this project, both the teacher and students took on very different, more complex roles. The students became more active participants in their learning process, where as the teacher went from the complete giver of knowledge to a person who supplied the students with the means to acquire knowledge. Through the implementation of this web-based learning environment, students consistently received instruction enhanced through the incorporation of technology, where the teacher utilized technological advancements and placed them in the learner's hands.

Limitations

The following limitations apply to the project:

1. The author does not provide users with a tutorial to familiarize them with the web-based learning environment because students using it were instructed on how to navigate throughout it in class. Therefore, outside users may have difficulty using the web-based learning environment.
2. The web-based learning environment was only accessible to students in the computer lab therefore, students were unable to review material contained within or access the learning environment outside of school.
3. The project is a culmination of an ongoing web-based learning environment; therefore, the use of the web-based learning environment to users is limited. Ultimately, the learning environment will be expanded to include all content standards centered on this subject matter.

Definitions of Terms

- Technology- a variety of technologies used to support instruction such as: computers (desktop), telecommunications (Internet, local networks, etc.), and software.
- ELL (English Language Learners)- Spanish is their primary language and they have been placed into English rich environments in order to enhance their English speaking and writing skills.
- Traditional Classroom- a classroom led by the teacher using a lecture/ response mode.
- Web-Based Classroom- a classroom where the teacher is a facilitator of learning and the students learn science with the enhancement of multimedia materials, such as a web-based learning environment or technology-oriented supplements.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

Chapter Two consists of a discussion of the relevant literature, specifically, the literature pertaining to science education and technology. As a result of a review of current education literature, this chapter will attempt to demonstrate the link between the objectives stated earlier and the design of the web-based learning environment. The topics reviewed include the natural world of science education, the rationale for integrating technology into science education, how technology in science education affects the students, the teachers' role in a technology-based science classroom, and the evaluation of technology in science education.

The Natural World of Science

Science is an area of study that is being reinnovated on a regular basis due to new discoveries that are taking place, medical advancements, and the role of technology within this field. Science is a field of study where critical thinking and the thought process are challenged. Not only is science in the real world being reinnovated, but science in the classroom is also taking on a new, more complex role. In the world today, it is expected that students master critical thinking skills and challenge the thought process. It is important that students understand how the scientific world works in order to be prepared for adulthood and the world that surrounds them. In the future students will be required to make decisions that reflect a solid knowledge and background of both science and technology.

In science education, students make formal observations that are driven by a curiosity of the subject being observed. Not only are students required to make informal observations, but also students are to report their findings. Unfortunately, in the scientific field, knowledge of studies and observations are not made public knowledge until scientists have researched the topic to the full extent and have tested the findings thoroughly. Therefore, society is not exposed to steps worked through in order to obtain the findings and conclusions.

In science education in making observations and collecting data to study, students tend to work in collaborative groups while following the guidelines of the scientific process. In a science classroom, students should be grouped with students they can develop a good working relationship with and students who they feel comfortable sharing ideas with. Before, the integration of cooperative groups in education may have been seen as cheating, but now it is seen as a collaborative effort to solve problems. There are times in science education where students are still required to work independently, but it is important to also prepare students to be able to work well with others.

To excel academically in science education, students must be able to conduct research, collaborate with others, and most importantly science has to be fun. In order for students to get the most out of their learning experience, the students have to be made more responsible for their learning outcome. The students must be given the opportunity to explore and discover. Allowing students to experiment provides them with the opportunity to address all the science content areas. In an environment that promotes more student responsibility, the teacher is required to be less of a facilitator. As a teacher integrating guidelines presented in the California Science Framework can develop these skills. According to the California Science Framework (1990, p. 175),

> Students should be asked questions that address background knowledge they may be bringing to the learning experience; teachers are required to take on a non-judgmental role when it comes to a students understanding of science; teachers are required to provide students with various learning strategies and techniques that will enable each student to get the most out of their learning experience; and lastly, the students should engage in discussions that promotes cooperative learning.

The California State Framework (1990) also addresses the value of instructional technology in developing a new science curriculum. "As new technological devices, such as scientific calculators, computers, videotapes, and videodisks, become less expensive and more significant as mechanisms for teaching and learning, their role should be constantly evaluated for their contribution to an effective science program" (p. 178).

In a middle school science environment, the curriculum is full of opportunities for students to engage in learning that is both fun and arouses their curiosity. By integrating technology into science education, new ways for presenting information can be developed, and students can experience an environment that promotes meaningful learning, while providing a fun and curiosity-evoking environment. Technology can provide students with a connection to the outside world and events all in a safe environment. Not only does the integration of technology promote curiosity, but also the role of the teacher is redefined. The traditional role of the teacher is lifted from being the giver of knowledge to the facilitator of learning. Teachers are required to expose students to scientific facts and concepts they are expected to achieve. Through allowing the students to explore and experiment, they are able to achieve this.

As you can clearly, see we are approaching a reformation in science education, as we know it. Educators will be required to change their approach to teaching science in order to reflect an environment that meets the needs of all students. The teachers will also be required to provide opportunities for the students to integrate the use of technology into their learning experience in order to meet the demands of the future. The goals of scientific literacy and technology literacy have been enhanced to reflect each other. Both have the same objectives in common and when incorporated into the curriculum will produce individuals that are prepared to meet the demands of the 21st Century. The biggest goal of reaching scientific literacy is to provide students with the essential knowledge, which enables them to incorporate technology into their daily lives.

In the Twenty-First Century, educators have been challenged to meet the following Technology Literacy Challenge presented by former President Clinton and Vice President Gore. The goals are as follows:

- All teachers in the nation will have the training and support they need to help students learn using computers and the information superhighways.
- All teachers and students will have modern multimedia computers in their classrooms.
- Every classroom will be connected to the information superhighway.
- Effective software and on-line learning resources will be an integral part of every school's curriculum.

The technology-goals are not to replace the traditional curriculum, but have been implemented to enhance student learning and motivation, while demonstrating productive outcomes. One of the goals of technology education is to promote technological literacy of a broad and encompassing nature (Technology for All Americans Project, 1996, p. 10).

Rationale for Integrating Technology into Science Education

An understanding of science education has become a critical objective in modern schools today. There are numerous approaches that have been developed which support effective science learning through integrating technology. There are several relationships that have been developed which support a connection between technology and science education. These relationships include observation and reporting, analysis and mathematical capabilities, as well as collaboration and networks. According to Woosley and Bellamy (1997), these relationships can result in a number of significant opportunities in science education. Science can give students in distant locations the ability to work with actual scientists on inquiries. Students can witness live feeds from under the ocean, space exploration, etc. Also, students can use technology to publish their results of a science fair project so that students all over the world can view them.

Concern for the integration between science and technology has been a major theme identified in recent educational reform documents (Reynolds, 1996). Desired outcomes of current reform efforts range from achieving science and technology literacy to functioning in an information-based workforce. We live in an age of technology where children in our schools often know more about technology than their teachers, due to teachers not being exposed to technology, which has become part of students' everyday lives outside the classroom. Science and technology are closely intertwined, and each supports the other. For example, science helps people understand the world, where as technology helps people shape the world. There are two major approaches to using technology in science education. First, the students can learn "from" technology, and second, they can learn "with" technology. According to Reeves (1998), technology should be introduced into science education because it is believed to have positive effects on teaching and learning.

On a daily basis, scientists use technology to conduct research yet, in a survey released by the National Assessment of Education Progress Survey (1996) showed that except for social studies at 8%, science teachers were the lowest users of technology among the major content areas. Therefore, it can be concurred that in science education, students are not receiving enough exposure to technology. According to Craig (1998), schools on average have one computer for every six students nationwide and 78% of those computers are wired to the Internet. Yet, many middle school science teachers reported not using technology in the classroom learning activities except for word processing, grade book, and games (Hammer & Reis 1998).

The approach of integrating technology into science education is based on the idea that students cannot learn through the lecture/ response mode or textbooks alone. To understand the material being presented, they must experiment, work with their hands to discover their nature and properties, and apply the scientific concepts they learn by creating products of their own and enhancing them with the use of technology. Using this method, students get a chance to use and build their technology skills, as well as their mind skills. According to Waetijen (1993), learners may create their own multimedia knowledge representations that reflect their own perspectives on or understanding of ideas. Technology can be integrated rather inexpensively in science education to aid students in conducting experiments, sharing data, and to assist the teacher in making use of instructional time.

There are several reasons for using technology in science education. These reasons range from the universality of technology in today's society to technology's potential for aiding students in their inquires. Krockover, Lehman, Buchanan, Rush, and Bloede (1997, p. 166) suggest the following reasons why technology should be integrated into science education:

- One reason for employing computer and multimedia into science education is because they are used everywhere.
- Many children are accustomed to using it at home in the forms of videos, preprogrammed television shows, camcorders, video games, computer games, and online information services such as AOL.
- In science education, technology can be used to gain access to information previously unavailable to students.
- Technology can be used to provide speed, accuracy, and convenience in inquiry investigations.
- Technology can be used to provide learning experiences suitable for individual needs of students.
- Technology permits teachers to bring the world into the classroom.
- Perhaps the most compelling reason for using technology in science education is that scientists use it.

Science and technology are integrated into our daily routine, and knowledge of both is a necessity in the workplace, which makes it essential for all students to learn. Adding technology to the science curriculum is a way to replace much of the dreary, tedious atmosphere of traditional science classrooms by adding a stimulating environment conducive to learning. According to Aracher and Milheim (1995), purposeful use of computers in classroom instruction can enhance student outcomes. Well-planned and executed lessons can accomplish a broader understanding of concepts and help students retain and transfer knowledge across the curriculum.

The interconnection between science and technology can be used as a new kind of learning that radiates beyond the laboratory or classroom. As this new reform has developed, teachers and students have begun to use technology in ways similar to scientists. In your typical reformed science class you may see teachers and students using probes to gather data, computers to process and manipulate information, and the Internet to communicate. According to Madison (1997), students reap the rewards of discovery and gain insight into methods and the process of science. Listed below are six ways in which technology is transforming science education in classrooms across America (Devitt, 1997, p. 41).

- By immersing students in inquiry-based learning, as outlined in the National Science Education Standards developed by the National Academy of Sciences, and helping them understand the role of technology in that process, educators can establish a classroom setting for students with application far beyond the classroom.
- Using the World Wide Web to promote access to inaccessible worlds.
- Challenging students to think like scientists is an effective way to guide students in framing questions, attempting to answer questions through experimentation, communicating results of experiments, and testing answers to see if they are valid.
- One of the most important applications of computers in science education is their ability to turn pictures into data. Computers—in their best uses—allow learners to explore 'what ifs' in domains not normally accessible.

- Allowing students to explore and manipulate through simulation provides interactive software, which opens the door, which leads to discovery.

Science and technology are closely intertwined, both providing for the other in almost circular patterns. From the earliest technological developments, such as the magic lantern, to the Worldwide Web, technology has been a force in development of civilizations (see Table 1).

Table 1. Technology Timeline for Science Education

Decade	Educational Trends in Science Education	Kinds of Technology
1890s	• Laboratory movement in science • Kindergarten movement	• Magic Lanterns
1900s		• Instructional films
1910s	• Progressive schools movement	• Educational radio broadcast • Tape recorders
1930s		• Slide projector
1940s	• Nature study movement • NSTA formed • NSF established by Congress	• Training films • Overhead projectors
1950s	• Curriculum reform movement • Sputnik crisis	• Educational movies • Programmed instruction
1960s	• Science curriculum (ESS, SAPA, SCIS) • ERIC- Educational Research Information Clearinghouse • Metric Education	• Controlled readers • Projecting microscopes • Film loop projectors • Listening stations
1970s	• Environmental education • Outdoor education • Middle school movement • Energy education	• Educational TV
1980s	• Back to Basics • Cooperative learning • Teacher Preparation Standards	• Computers • Camcorders • VCR's

1990s	• Scope and Sequence • Science for All Americans • Project 2061 • Benchmarks • Systematic Reform	• Telecommunications (Internet) • Computer-based multimedia

Shim, J. (1998). International Journal of Science Education

According to Whittaker (1994), integrating technology into science education results in an increase in student motivation, engaging the learner through creating their own technology-based materials, and increasing the perceptions of control and responsibility for their learning.

Applying technology in science education has struck a very responsive chord in schools. The interaction between the two also provides a badly needed humanizing effect. According to Barba and Reynolds (1996), if technology is properly used, i.e. placed squarely in the hands of learners, it cannot help but facilitate discovery learning. Technology offers the use of exciting media to deliver the outside world to the classroom and access students' minds. In the past in order for students to see another part of the world, the expense was an issue. Currently, students can take virtual field trips, inside volcanoes and travel to outer space all in the classroom at no cost to the students.

The integrative approach of technology into science education seeks to help students learn and appreciate the relevancy of how these two are tied together and how each builds on the other (LaPorte, Sanders, & Scarborough, 1993, p. 26-28). There is a place for technology in traditional instruction where it will enhance student outcomes and promote higher order thinking. It is believed that technology and its cultural implications serve as an important curriculum where by science can be co-investigated (Ebert & Strudler, 1996). Traditionally, school curriculum has been largely based on the concept that instruction should be separated into distinct categories for ease of understanding and then reassembled at a later time. Recent professional literature in technology education has supported the idea of integrating traditional instruction with technology (see Table 2).

A great example of how teaching has increasingly influenced the way teachers teach and how learners learn science is the Internet. The Internet puts teachers and students in a collaborative research mode. Students often teach themselves because they have a wealth of knowledge at their fingertips. The Internet may sometimes hold a threatening role for the "traditional teacher," because students are responsible for their own learning. On the other hand, Internet resources allow science teachers to be very creative and go above and beyond the traditional science classroom. The integration of the Internet into the science curriculum brings science education to life! Caine and Caine (1991) suggest teachers who made more effort and were more creative in their curriculum approaches were rewarded with higher levels of student learning and appreciation.

Table 2. How Technology Fits into Traditional Instruction

Needs addressed by traditional instruction:	How technology fits into the system:
1. Individual pacing, remediation, or lower level skill development, especially when teacher time is limited.	1. Sets sequencing and allow access to resources- e.g. via task managers. 2. Via software substitutes, computer testing, and drill-and-practice software.
2. Making learning paths more efficient (i.e. faster), especially for instruction skills that are prerequisite to higher-level skills.	3. As an information source, e.g. learning "packages" or integrated learning systems (ILS).
3. Performing time-consuming and labor-intensive tasks (i.e. skill practice) for students and teachers, freeing time for other, more complex needs.	4. As a tool- e.g. desktop publishing, word processing, real time graphing, skills practice software.
4. Supplying self-instructional sequences, especially when teachers or other resources are not available or teacher time for structured review is limited, and or highly motivated to learn skills.	5. Via sequenced tutorial packages and substitutes. 6. Using networked systems

Shim, J.(1998). International Journal of Science Education

Integrating technology into the curriculum can be a very universal approach, because it can be adapted to address various learning styles and student abilities. The students are given the opportunity to progress at a self-paced level. This is an important aspect when accommodating students with special needs, as well as non-English proficient students (Glass, 1993).

How Technology in Science Education Affects the Students

In a science classroom that integrates technology, students are required to take on more responsibility for their learning process, where as in the traditional science classroom, the teacher gives students the necessary information. Students can use technology in science education like paper and pencils in traditional classes to learn the subject matter being taught. Instead of the traditional lecture/response class, the students experiment and manipulate information to achieve a learning outcome with the enhancement of technology.

With a technology enhanced science curriculum, the students work in cooperative groups to identify the problem, conduct research, manipulate their findings, and create a technology-oriented presentation. This, not only ensures that students are actively engaged in their learning process, but it makes their learning experience more meaningful. The students are then held more accountable for what they have learned. Students are given the freedom to arrive at solutions to the problem or question presented in their own unique way. The students begin to acquire self-discipline through their persistence for a workable solution to their problem, and people skills are acquired by working cooperatively with others in the group (McCade, 1995). When technology is used effectively, it allows students to become more active participants in the teaching and learning process. According to Martin (1997, p. 109),

> In today's schools, science instruction during the elementary school year is infrequent and inconsistent. During middle school years, a student's window to the natural world is typically a textbook accompanied by dreary worksheets. As a result, students enter high school thoroughly bored by science and give no thought to the subject beyond the required courses, which more often than not affirms their expectations of an unrewarding experience.

Honebein (1996) suggests that to make learners more ambitious about science and the integration of technology that educators adhere to seven goals:

1. Provide students with experience and the knowledge of the construction process.
2. Provide experience in and for multiple perspectives.

3. Embed learning in realistic and relevant contexts.
4. Encourage ownership and voice in the learning process.
5. Embed learning in social experience.
6. Encourage the use of multiple modes of representation.
7. Encourage self-awareness of the knowledge construction process. (p. 23-25)

Methods of instruction appear and reappear as the single most important factor cited in research as the cause of student boredom. Courses generally do not provide hands-on opportunities for the students to experience variation in science education. Rather, "the high school curriculum is characterized by strict disciplinary approaches that are limited to the body of knowledge with little attention to how that body of knowledge develops or how it makes an impact on culture and society" (NCSE, 1991, p.1). " . . . students who were once turned off by education, when exposed to technology in a school setting their curiosity is aroused and they become motivated which enhances a greater success opportunity" (Greenfield, 1984).

The Teachers Role in a Technology-Based Science Classroom

The implementation of technology in the classroom not only affects students, but teachers also take on a different, more complex role. The teacher becomes the facilitator of thinking, instead of the facilitator of learning, because instead of supplying students with knowledge, the teacher supplies the students with the means to find knowledge. The teacher shares control of learning by making the students more active participants in the learning process. Teachers make significant changes in classroom management styles and give more control to their students. The teacher encourages students to work in cooperative groups to reach their outcomes while integrating technology in order to promote discovery learning. Instead of telling the students what will happen, the students explore and research to find the outcome. This helps to fashion the content, in that, integrating technology into science content allows for a multitude of learning experience.

In addressing the development of life long learning in science education and the integration of technology, educators are advised to allow skill developments that will enable students to inquire, construct new ideas, wrestle with complexity, cope with uncertainty and ambiguity, adapt unconventional problems, and develop a high degree of interpersonal and intrapersonal competence (McCormick, 1995).

Unlike before in the traditional lecture/response classroom, the students are actively engaged and class participation increases. Implementing technology in the classroom also requires rethinking on the part of teachers. Teachers must change their objectives, redesign methods of teaching, and transform from a giver of knowledge to a transactive facilitator, providing students with the means to discover. " . . . adding technology to the curriculum turned out to be the easiest part of the lesson plan" (McCormick, 1995).

It is imperative that teachers become more efficient in using current technology so that they can use it comfortably with their students. Despite the technologies available in schools, a large number of teachers report little or no use of computers for instruction. Nelson and Hays (1992) have reemphasized the need for reform in science education with regards to technology. McManus (1996, p. 319) states, "We are a science and technology illiterate society. Americans do not understand enough science and technology to make potential decisions required of them."

Education has utilized technology for many years through the use of filmstrips and videos. Unfortunately, those types of technologies have become staple supplements in the curriculum. However, it is the emergence of personal computers that paved the road for applications such as word processing, spreadsheets, databases, graphing, distance learning, etc. Computers can provide practice through drill-and-practice software programs, create realistic simulations, gather experimental data otherwise impossible to obtain, process data so valid conclusions can be reached, and enable teachers and students to communicate with peers throughout the world.

The teacher's biggest goal should be to motivate and engage the students to enable them to form appropriate conceptualizations. Enhancing technology extends students senses so that explanatory conceptions may be formed and higher order thinking levels are explored. Technology can be used to create dynamic and interactive representations of phenomena. These phenomena extend far beyond what are possible in the typical science laboratory environment.

Teachers must come to understand that in order to compete with today's world, science education has to be reinnovated from traditional lecture/response mode to a new technology-based mode (Shim, 1998). Through the integration of technology, science can develop a hands-on/minds-on endeavor. There is an important rationale that technology is not only everywhere, but rather that it is in fact here and thus, we should embrace it especially in our schools, because this is where our youth are acquiring their skills of tomorrow. Science and technology are infallibly linked together! It is inevitable that technology will begin to play a part in science activities in the classroom. The integration of technology into the science curriculum has already begun and continues to grow at a rapid speed. Educators will be expected to design objectives and match them with district and state content/ skill standards. The next responsibility for the teacher then becomes assessing how technology could assist students in their learning process.

The United States Congress Office of Technology Assessment (OTA) report indicates that teachers have not been trained to use technology effectively in teaching. In fact, teachers are not always offered the proper training and therefore, are intimidated by the technology available for them. If teachers are not properly trained on integrating technology into the curriculum, how can they be expected to do so? One of the biggest needs cited is the integration of technology into the curriculum. "Curriculum integration is central if technology is to become an effective educational resource, yet integration is a difficult, time-consuming, resource-intensive endeavor (Wicklein & Schell, 1993).

Effective integration of technology into science education seems effortless! Students know what they are expected to do and technology applications are seamlessly woven into lessons, where the teacher functions as a learning consultant who supports students' efforts. Students easily transition from independent to collaborative work, and they are comfortable evaluating their own efforts and learning from their successes and failures.

In conclusion, the teacher's role in a technology-based science classroom is to choose technological applications that promote active mental processing. The student's discoveries are vital and must ensure a state of mindfulness while they interact with the technology. Educators should also consider varied capabilities of technology that are relevant to science learning and use them in combinations as appropriate. This ensures that through exploration activities, higher order thinking skills are being addressed.

Evaluation of Technology in Science Education

In science education, students should be encouraged and geared toward obtaining scientific literacy in order to understand the world they live in. Through the integration of technology, students obtain scientific literacy while being prepared for the world around them. With integrating technology into science education, the term "assessment" takes on a whole different meaning. The students are no longer assessed through paper-and-pencil assessments, but the students are given the opportunity to create multimedia products, such as PowerPoint presentations and web pages. In developing assessment tools for technology-oriented science education, more thought goes into creating a way for evaluating the students and their creations. The assessment tools require more detail and consideration.

Evaluating students in a traditional classroom setting can sometimes present obstacles for teachers. In order to assess and evaluate students you have to create a type of evaluation that is authentic and addresses the needs of all students in the learning environment. With regards to evaluation, schools have to embrace the task of certifying that key skills are learned and how the typical teacher can efficiently evaluate the quantitative qualities in order to give a more "authentic assessment." With regards to authentic assessment and technology, teachers are no longer grading students on the content of a paper, but they are assessing students on their creation of a technology-oriented project. An example of this would be instead of a traditional research paper, turning in a PowerPoint presentation. Another example, would be throwing out the encyclopedias and accessing the Internet to a research a topic. Teachers, who allow students to use technology as part of their learning process, and those who model problem-solving using technology, are providing for their students a basis for life-long learning (McCormick, 1995).

Assessing and evaluating student outcomes in science education that revolves around a technology-oriented classroom can be a difficult task. In the traditional science class, evaluation techniques were easier to address because teachers developed both subjective and objective assessments that allowed them to assess what the students had learned. Through the integration of technology assessment takes on a different role. Students can be assessed on their creation of multimedia projects, self-evaluations, and observations. The students can also be asked to keep a journal where they would document what they have experienced or encountered while using technology in their learning process. The creation of technology-oriented assessments has been successful in all grades across the nation. Through the process of creating technology-oriented assessments, the students are not only required to identify a problem related to the content area, but they are required to pose a solution to the problem, research and design a solution, then present their findings in a format that integrates technology.

With the integration of technology into science education and evaluation techniques both students and teachers are provided with the opportunity to interact with each other. A technology-oriented assessment is a perfect example of "authentic assessment". The students are using prior knowledge, but they are also gaining new knowledge from the project they are being asked to define. The design of technology oriented projects measure the true learning achieved by the student and gives them the opportunity to explain, clarify, and rethink their learning experiences. Students are given the opportunity to learn from not only the completion of their project, but from each other.

Web-based Learning Environments in Education

Web-based learning environments are defined as " . . . a hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported (Khan, 1997, p. 4)." There numerous definitions of what web-based learning is comprised of, but one thing that all the definitions have in common is that web-based learning takes advantage of the Internet and the World Wide Web, in order to deliver information to students in an educational environment.

Web-based learning environments are emerging in the field of education, as the Internet becomes a popular teaching tool in the classroom. The use of web-based learning environments in the classroom offers a multitude of advantages, with an occasional disadvantage as with any learning environment. Using web-based learning environments in the classroom has been proven to offer an alternative to the treacherous learning environment in the traditional classroom. Web-based learning environments enable learners to take on more responsibility for their learning experience and motivation.

The literature reviewed for this project indicates that a critical factor to the success of web-based learning environment is the incorporation of usability design into the development process (Henke, 1997). It is imperative when incorporating the use of web-based learning environment that it replicates the best possible classroom environment and distance education, while at the same time taking advantage of the Internet.

Incorporating web-based learning environments enable learners who prefer or are required to learn outside traditional classrooms the opportunity and motivation that makes learning more exciting (McManus, 1996). In 1996, Clark defined web-based learning as "individualized instruction delivered over public or private computer networks and displayed by a Web browser." A web-based learning environment provides the equivalent of a traditional classroom with additional advantages.

Most web pages are designed so that students can be directly informed or have direct contact with the creator. A web-based learning environment offers not only communication between the teacher and students, but it offers supplemental tutorials and interactive activities to enhance student learning and motivate the students during their learning process (McElhome, 1999).

There are various attitudes regarding the use of web-based learning environments due to the new revolution that has taken place in the field of educational technology. As with any emerging enhancement in the field of education, this too has received both positive and negative reviews on the effects it will have on student learning and achievement. Most research reviewed supports the use of web-based learning environments. However, there is research that is not in support of the use of this technological advancement.

Web-based learning environments have been proven to encourage student creativity and allow students to construct their own knowledge base. The use of web-based learning environments encourages learners to shift from being passive learners to team members who rotate independently between prearranged laboratory research and computer stations (Ebert & Strudler, 1996).

CHAPTER THREE

DESIGN AND DEVELOPMENT

Introduction

In a country where education is undergoing dramatic transformations, enhancements continue to change the curricular structure of content matter. Extraordinary achievements discovered in the field of technology, are beginning to trickle over into the field of education as students are being prepared for the "real world." Due to technological changes being presented in the outside world, these issues have begun to challenge the field of education. As with any change, teachers are being asked to rethink the structure of curriculum in their field of study. Not only is technology being integrated into the field of mathematics, but science teachers are also being affected by the challenges set forth.

In previous chapters, a brief description of the project has been discussed in order to familiarize readers with the project. In the following chapter, the author presents readers with the various components of the web-based learning environment, elaborating and providing a detailed illustration of each.

Description of Project

This project consists of the development and integration of a web-based learning environment into science education. The information contained within this project encompasses the science concepts regarding Structure and Function in Living Systems. The project incorporates one main approach to learning. The main approach regards students being more active participants in their learning experience in an effort to increase motivation and raise student accountability through the incorporation of technology into science education.

A web-based learning environment was developed specifically for this project. The following science concepts were addressed: the ten body systems, and complex processes that take place in each system, the structure and function of the system, how the bones and muscles work together to provide a structural framework for movement, and finally how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy. This project includes various websites to supplement the material being taught. The students were introduced to specific topics about the Structure and Function of Living Systems at a seventh grade level. The author introduced the students to the web-based learning environment that served as an instructional tool for the purpose of this project.

With regards to evaluation, the students were given a pre-test prior to implementation of the project and a post-test upon completion of the 9-week period, the purpose of this was to aid the author in determining the effectiveness of the web-based learning environment with regards to the instructional use.

Learner Characteristics

This project was developed for a group of sixty, seventh grade ELL students at Alder Middle School in Fontana, California. The students ranged in age from eleven to thirteen years of age. The students came from low-income socioeconomic environments. The student's nationality was predominantly Latino. The students had attended school in the Fontana Unified School District since the fifth grade and transferred from feeder schools in the surrounding area to Alder Middle at the beginning of there sixth grade year. The student's interests included hanging out with friends, skate boarding, playing video games, and occasionally reading. The students' primary language was Spanish. They lived in a home where their parents were predominantly Spanish speaking with very little English skills. Because the students were classified as Spanish being their primary language, they were labeled as ELL (English Language Learners) students. The students ranked in the 50th percentile on California's SAT-9 tests for math and language arts. The students STAR-Reading levels range were fifth grade.

The student's prerequisite skills included having an understanding of basic computer operations. This would include being able to start the computer up, the ability to access the web-based learning environment, and the ability to move through the learning environment effortlessly.

Learning Environment

For the purpose of this project, there were two distinct learning environments, the first was a traditional classroom and the second was in a computer lab. Implementation of this project into both the classroom and the computer lab took on two very dissimilar roles.

First, in the traditional classroom, instruction took place in a large group format where the teacher was the giver of knowledge. The teacher was responsible for presenting the students with information and situations and in return, the students were able to freely ask questions and take part in discussions on a given topic. In the traditional-based group, the lab activities involved the use of manipulatives in completing tasks to reinforce concepts presented in class.

Second, in the web-based learning environment, the students were active participants in their learning experience and worked through assigned tasks at a self-paced level. The students interacted with the learning environment and resources in order to retrieve information. The teacher reviewed concepts from the previous day at the beginning of class, as well as introduced concepts for that day. The students then worked using the web-based learning environment. Throughout the period, the teacher moved about the room questioning students, as well as assisting those who needed help. The students interacted with various web-based activities similar to those in the traditional based learning environment. For instance, in the traditional-based learning environment a lab might consist of dissecting a cow heart in order to explore the function of each structure, where as in the web-based learning environment, the students would conduct the dissection via the Internet, identifying the same structures and functions.

Teacher's Role

In both learning environments, the teacher's role took on a different portrayal. In the traditional-based learning environment, the teacher was the information giver, delivering instruction using a lecture-response mode, along with visuals to reinforce concepts. In the web-based learning environment, the teacher was a facilitator, delivering instruction with the enhancement of technology, through the incorporation of the web-based learning environment.

Design

This project contains four sections, which was broken into subsections. They are: levels of organization for structure and function in animals, organ system functions, structural framework for movement, and the reproductive processes. Preceding each lesson, the students were given background knowledge in order to stimulate their interest on the topic.

The web-based learning environment contains various pages and links within the environment. In the pages that follow, illustrations of the index page, as well as linked pages throughout the learning environment are displayed. A brief explanation is also provided for each linked page within the learning environment.

The index page is the homepage of the web-based learning environment. All other pages within the learning environment are accessible from this page. Figure 1 refers to the index page of the web-based learning environment. On the index page, students gained access to other parts of the web-based learning environment by selecting the topic they wished to study.

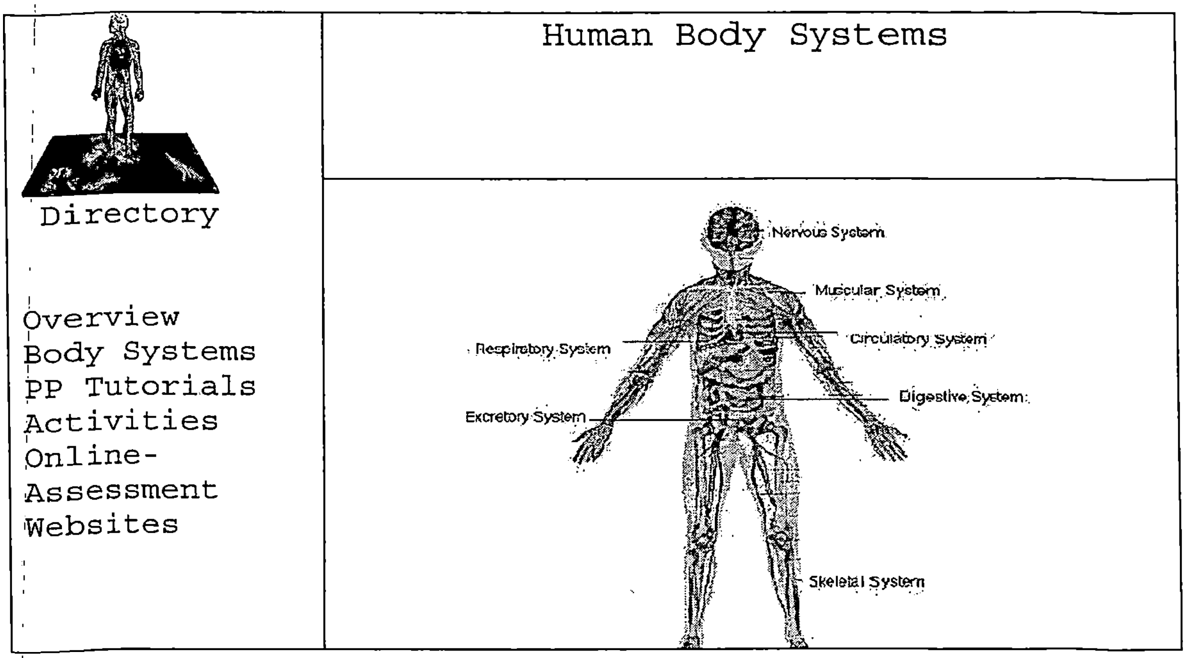
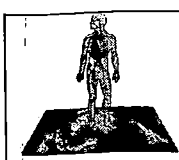


Figure 1. Index Page Web-based Learning Environment

In the window containing the body with system labels, the students simply clicked on the name of the system they wanted to learn about, and they were shown a brief discussion of that system in order to familiarize them with a particular body system prior to completing lesson, as well as a five-question quiz to wrap up the topic being discussed.

Figure 2 provides an example of an environment that offered students a more in-depth overview of each of the ten body systems. In this section of the web-based learning environment, the students were introduced to the body systems and how they are interconnected to one another in order to perform the necessary functions for survival.



Overview

Each of our body systems are interconnected and dependent on each other. Our heart, which is part of our circulatory system, does not beat unless our brain, which is part of our nervous system, tells it to. Our skeletal system is dependent on our digestive system for increase in size and strength. Our muscular system needs our respiratory and circulatory systems to supply energy in the form of oxygen nutrients. It takes all the systems for human growth and development.

The human body is organized into systems. A system is a group of tissues, organs, and parts that work together to do an important job for the body. Many jobs of the body involve cooperation between systems. All systems of the human body depend on each other.

Figure 2. Overview of Body Systems

The students were also able to access links to other pages that elaborated on the ten body systems. In some instances, interactive activities were provided where students identified jobs performed by various systems. It was suggested that the students read the overview prior to beginning instruction. The overview set the tone for the material that students were exposed to in this web-based learning environment, as well as activated prior knowledge.

The tutorial page contains links to all PowerPoint tutorials. The students access the tutorials at a self-paced level and were given an outline as to which order to complete the tutorials. Figure 3 represents the Web page that contained the PowerPoint Tutorials. A tutorial for each of the body systems was created in order to provide students with knowledge of that body system. The information contained within the tutorials was necessary in order for students to understand the function of these body systems and the organs that are included in that system.

The PowerPoint Presentations served as an instructional tool for students in the web-based learning environment. The students were instructed the order in which to complete each system. At the end of each PowerPoint Presentation there was a direct link to the activities following that lesson. The students were instructed to complete the activities for each system following the completion of the tutorial.

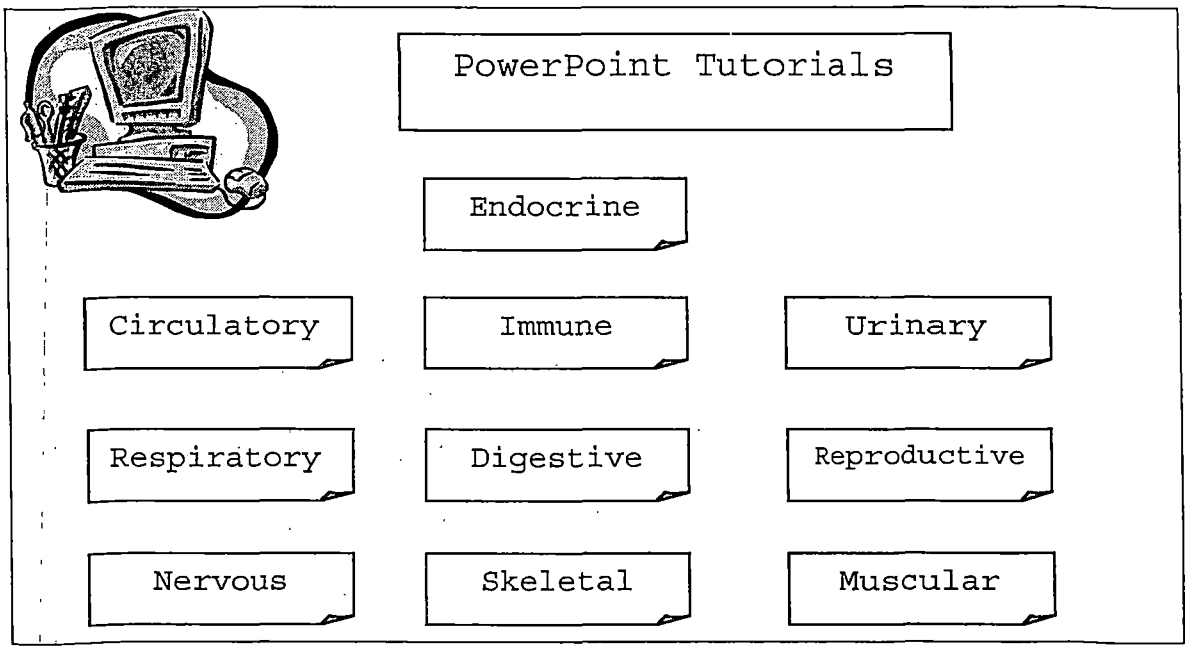


Figure 3. PowerPoint Tutorials

The activity page can be accessed from the index page or through individual links that have been placed at the end of the corresponding tutorials. The activity page, similar to the tutorial, provided both a lab activity and a printable activity for students in order to reinforce concepts on human body systems.

Figure 4 is an example of the Body Systems Activity page. The students accessed an activity for each body system following the completion of the PowerPoint tutorials.

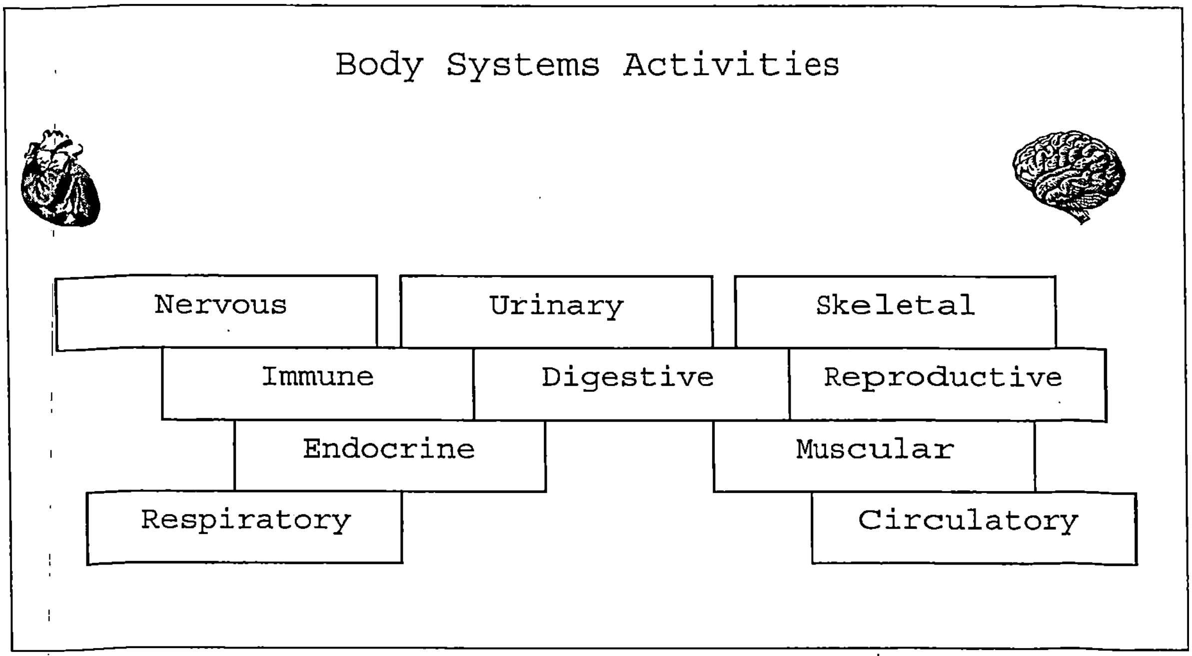


Figure 4. Body System Activity Page

The activities were developed to enhance the learning process and reinforce knowledge gained from the tutorial. The information contained in the activities page ran parallel with the information presented in the PowerPoint tutorials. Upon completion of the activities, the students submitted the completed activity to an e-mail address that was linked to these pages. For each system, two activities were developed and integrated. The first activity was an online activity that was linked to a specific web URL.

Upon completion of the first activity, the students were prompted to continue to the next. The second activity was an interactive activity where students were asked to identify organs within a body system and their functions, as well as the importance of each to the system as a whole. The activities within the activity page served as lab activities in a traditional-based science class.

The assessment page provided students with a cumulative assessment of each system. Students were instructed to access upon completion of the PowerPoint tutorial, as well as corresponding activities. Figure 5 is the Assessment opening page of the web-based learning environment. This page is where students accessed the assessment that ran parallel to the system they were learning about. The students were instructed to complete the assessment following the completion of the tutorial, activities, and supplements. Students could access the assessments two ways; first, they could access the assessment following the completion of the activity for that system. Second, they could access the assessment by going to the assessment page link and then clicking on the system they wished to take the assessment for. The assessments that were linked to the assessment page were strictly online assessments. Using the Hot Potato software, downloaded, the assessments were created and then uploaded to the Internet using an FTP program. The assessments were matching, multiple choice, fill-in-the-blank, and open-ended. The assessments were created to assess all levels of Bloom's Taxonomy.

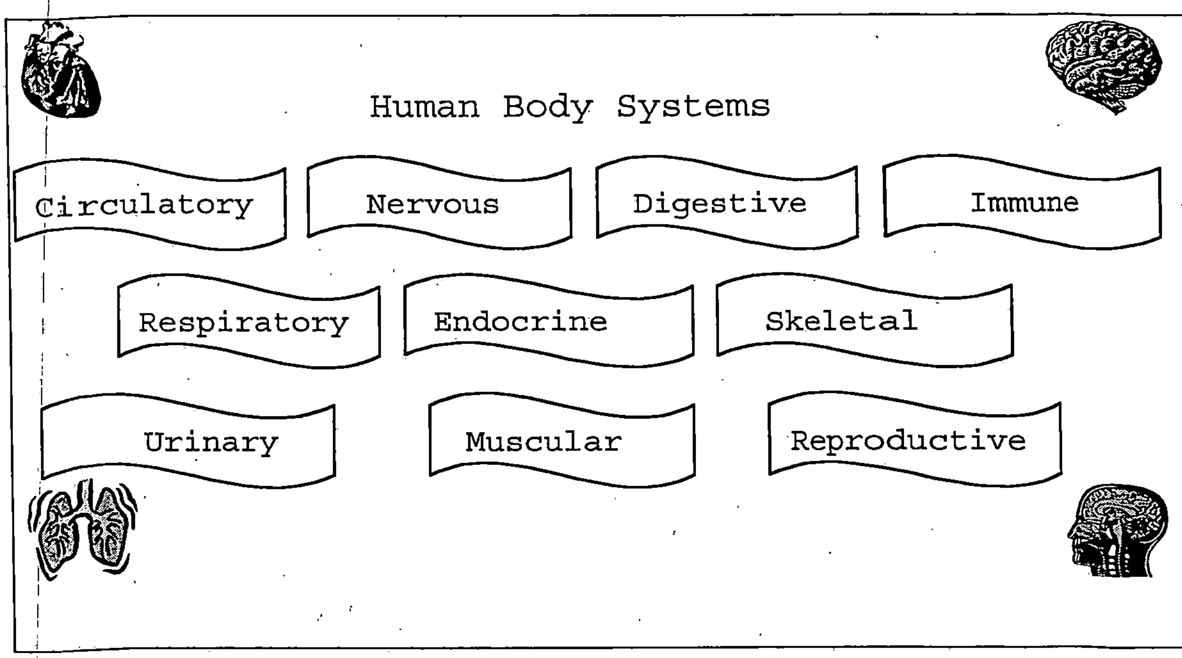


Figure 5. Assessment Page

Implementation

When the implementation of this project began, first, the teacher presented the materials related in the content area to the students. A large group discussion took place about the concepts that would be covered, as well as the responsibilities of the students throughout the implementation of this project into the curriculum. Next, those students interacting with the web-based environment were introduced to the learning environment and the teacher demonstrated for students how to navigate throughout the web-based learning environment.

Upon accessing the web-based learning environment, the students took on the role of active learners. The students reviewed the material and took part in activities presented in the learning environment. The students completed activities for each topic covered throughout the Structure and Functions of Human Body Systems unit following the outline presented in class. The students worked independently, and used the guidelines as a tool for learning. The students were not permitted to work ahead to another body system, but were encouraged to review the material presented in the lesson.

The guidelines and schedule for this project have been outlined below. The outline applied to both the traditional-based learning environment and the web-based learning environment for the 9-week instructional period (see Table 3).

Table 3. Project Outline

I. Pre-test (1-week prior to instruction)

II. Introduction

   A. Presentation of Related Materials

   B. Concepts to be covered, as well as responsibilities of students

   C. Outline presented to students

   D. Students in the web-based learning group will be introduced to web-based environment (the students will be shown navigation tips.

   E. Web-based learning group will navigate and familiarize themselves with web-based environment. The control group will be introduced to introduction of human body systems, as well.

III. Overview of Systems

   A. Circulatory System

      1. PowerPoint Tutorial
      2. Activity 1
      3. Activity 2
      4. Websites outlined for Circulatory System (see Appendix D)
      5. Assessment

   B. Respiratory System

      1. PowerPoint Tutorial
      2. Activity 1
      3. Activity 2
      4. Websites outlined for Respiratory System (see Appendix D)
      5. Assessment

   C. Nervous System

      1. PowerPoint Tutorial
      2. Activity 1
      3. Activity 2
      4. Websites outlined for Nervous System (see Appendix D)
      5. Assessment

   D. Endocrine System

      1. PowerPoint Tutorial
      2. Activity 1
      3. Activity 2
      4. Websites for Endocrine System (see Appendix D)
      5. Assessment

   E. Immune System

      1. PowerPoint Tutorial
      2. Activity 1
      3. Activity 2
      4. Websites for Immune System (see Appendix D)
      5. Assessment

   F. Digestive System

      1. PowerPoint Tutorial
      2. Activity 1

3. Activity 2
4. Websites for Digestive System (see Appendix D)
5. Assessment

G. Skeletal System
1. PowerPoint Tutorial
2. Activity 1
3. Activity 2
4. Websites for Digestive System (see Appendix D)
5. Assessment

H. Urinary System
1. PowerPoint Tutorial
2. Activity 1
3. Activity 2
4. Websites for Urinary System (Appendix D)
5. Assessment

I. Reproductive System
1. PowerPoint Tutorial
2. Activity 1
3. Activity 2
4. Websites for Reproductive System (Appendix D)
5. Assessment

J. Muscular System
1. PowerPoint Tutorial
2. Activity 1
3. Activity 2
4. Websites for Muscular System (Appendix D)
5. Assessment

IV. Post-test

Evaluation

In the past, the author has had difficulty motivating students to complete both class work and homework. Another concern presented by the author, was the ability to design and deliver instructional questions that address higher order thinking skills. Through the implementation of this project, one of the biggest goals ascertained, was to address instructional needs and roadblocks in the traditional classroom setting.

For evaluation purposes, the author focused the evaluation on the effectiveness of the learning environment and the ability of the author to develop and deliver instruction in a manner that addressed both lower and higher order thinking skills. The evaluation of the project, focused on three central ideas presented by the author. They are as follows:

1. Does integrating a web-based learning environment into science education motivate students to be more active participants in the classroom, as well as raise student accountability?
2. Does the author design instructional materials that address lower and higher order thinking skills, when enhanced by a web-based learning environment?
3. Does the author present students with instructional materials that allow them to progress through each phase of Bloom's taxonomy?

The first area of interest was to determine if integrating the web-based learning environment into instruction stimulated student's interest in a way that increased motivation and raised student accountability. In assessing the area of motivation, the instructor kept a record using the Activity Log Completion chart (see

Appendix C), marking the number of assignments completed by students over the course of instruction. When students completed an activity, it was submitted for grading. The results were tallied for each student at the end of a 9-week period and calculated to determine on average how many students completed the required activities for both learning environments (see Table 4).

Table 4. Results of Activity Log Completion Chart

	Total Number Activities	Mean % Completed Web-based	Mean % Completed Traditional-based
Act. 1	20	86%	79%
Act. 2	20	82%	64%

For the evaluation portion of this project, the week prior to implementation, the students were given a pre-test to assess their knowledge of the human body systems prior to receiving instruction. The test was developed using Bloom's taxonomy in order to address both lower and higher order thinking skills. One week preceding the completion of the Human Body Systems unit, the students were given a post-test. The purpose of both the pre-test and post-test was not to assess the student's ability, but to assess the effectiveness of this project, as well as the instructor's ability to deliver instruction in a way that activates higher order thinking.

In order to evaluate the effectiveness of the project, the author compared the pre-test and post-test results. The results also allowed the author to track students progress through Bloom's taxonomy in order to determine if instruction was being delivered in a manner that addressed higher order thinking. The results indicated that the instructor developed and delivered instruction in a manner that allowed the students to successfully master lower order thinking. However, the instructor did not develop/deliver instruction in a method that promoted higher order thinking. The results from both the web-based learning environment and the traditional-based learning environment were compared and presented. (see Table 5 & 6).

Table 5. Students Progression Through Bloom's Taxonomy

Level of Bloom's Taxonomy	Pre-Test		Post-Test		Difference	
	Trad-ition	Web-Based	Trad-ition	Web-based	Trad-ition	Web-based
Knowledge	89%	82%	92%	94%	>3%	>12%
Comprehension	78%	78%	89%	75%	>11%	<11%
Application	58%	62%	57%	63%	<1%	>1%
Analysis	56%	57%	57%	61%	>1%	>4%
Synthesis	42%	41%	41%	49%	>1%	>8%
Evaluation	21%	38%	23%	42%	>2%	>4%

Table 6. Student Achievement Pre-test versus Post-test

Bloom's Taxonomy	# of Students Progressed		Avg. Mean Percentage			
	Traditional (30 total)	Web-Based (30 total)	Traditional		Web-Based	
			Pre-Test	Post-Test	Pre-Test	Post-Test
Knowledge	28	29	86%	97%	86%	99%
Comprehension	24	26	40%	84%	20%	78%
Application	17	20	13%	43%	19%	24%
Analysis	11	13	6%	21%	6%	52%
Synthesis	8	12	49%	47%	67%	45%
Evaluation	3	9	0%	11%	0%	9%

Summary

In conclusion, development and implementation of the web-based learning environment into instruction were both important aspects of the project. The goal of the project was to reflect a development plan that provided students with the opportunity to move about with versatility and confidence. Another aspect taken into consideration was that students were active learners. Therefore, lessons had to keep students on-task and learning throughout the entire period. The evaluation of the project provided feedback on the instructor's ability to address higher order thinking skills, as well as provides students with a learning environment that stimulated their interest.

CHAPTER FOUR

CONCLUSION AND RECOMMENDATIONS

Conclusions

The conclusions extracted from the project follows.

1. The results obtained from this project indicated that the web-based learning environment did stimulate student's interest and increased motivation with regards to completion of assignments and eagerness to participate in class.
2. The results obtained indicated the author created a learning environment and delivered instruction that addressed lower order thinking. However, the web-based learning environment and instructional materials presented by the author did not foster a learning environment that promoted higher order thinking.
3. The results obtained indicated that the author developed and delivered instruction in a manner that aided students to progress through the early phases of Bloom's taxonomy. However, the learning environment did not challenge students in the area of higher order thinking.

Recommendations

The recommendations resulting from the project follows:

1. Technology should be integrated into traditional-based science education in order to enhance the material being presented and stimulate student's interest. Integrating technology into science education in this project, motivated students, making them more active participants in their learning process.
2. The author needs to re-evaluate the structure of the material contained within the learning environment so that, it not only allows for lower order thinking, but fosters a learning environment where students are able to problem-solve and higher order thinking skills are addressed.
3. During the delivery of instruction, the author/instructor should allow for more discovery learning, instead of telling students what will happen. When creating material, the author should create instructional materials that focus on the higher end of Bloom's taxonomy, thus activating student's higher order thinking skills.

Summary

Obtaining the goal of scientific literacy is a critical objective of modern schooling. There are a number of promising approaches to effective science learning. Among these are newly evolving computer technologies and their applications. Modern technology can strengthen the understanding of concepts if we recognize the experience students bring to the classroom and use technology to clarify misconceptions and stimulate proper concept formation.

The web-based learning environment provided a great opportunity for restructuring the learning process to promote content that is rich and stimulating. Exposing student's to information literacy is invaluable, in that it ties science and reading together. Exposing users to this web-based learning environment, taught students about human body systems, and also enabled them to use technology. In this instance, infusing technology into science education has provided students with endless possibilities, thus imposing a positive impact on student learning.

APPENDIX A:

PRE-TEST FOR HUMAN BODY SYSTEMS

A. Knowledge

______	1. Abdomen	A. Male reproductive organ
______	2. Liver	B. Secretes insulin and pancreatic juice
______	3. Ovary	C. Produces the egg cells needed for reproduction
______	4. Pancreas	D. Tube that carries urine to the bladder
______	5. Penis	E. Female organ where fertilized eggs grows
______	6. Esophagus	F. Organ where the most food is absorbed into the bloodstream
______	7. Gall Bladder	G. Organ that secretes bile
______	8. Kidney	H. Part of the digestive tract where solid waste forms
______	9. Large Intestine	I. The major organ of excretion in the body
______	10. Small Intestine	J. Organ that stores bile
______	11. Ureter	K. Hollow tube that connects the back of the throat to the stomach
______	12. Uterus	L. Muscular sac that holds urine before it is expelled from the body
______	13. Aorta	M. The main artery of the heart that carries blood to other parts of the body
______	14. Cerebellum	N. Thin-walled chamber of the heart that receives blood
______	15. Cornea	O. Tough elastic material that is more flexible than bone

B. Comprehension

1. Summarize the four functions of your skeleton.

____
____
____

2. State the four moveable joints and describe their movements.

____
____
____
____

3. Trace the path of a drop of blood through the heart, lungs, and blood vessels.

____

____

____

C. Application

1. Give an example why skeletal muscles work in opposing pairs.

____

____

____

2. Each kind of joint offers a different kind of movement. Draw an example of each kind of movement.

D. Analysis

1. Distinguish among zygote, embryo, and fetus.

____

____

____

2. Specify all the functions of your skin.

____

____

____

E. Synthesis

1. Predict how the lungs and skin help remove waste from the body.

____

____

____

F. Evaluation

1. Give your opinion on why you think blood is important.

____
____
____

2. Justify a reason why the amount of activity you take part in can affect your heart rate.

____
____
____

APPENDIX B:

POST-TEST FOR HUMAN BODY SYSTEMS

A. Knowledge: In each group, identify and circle the item that does not belong.

1.	triceps	satorius	biceps
2.	cochlea	cornea	retina
3.	humerus	fibula	radius
4.	hammer	pivot	hinge
5.	estrogen	thyroxin	dermis
6.	marrow	periosteum	pleura
7.	stomach	liver	bladder
8.	anvil	iris	stirrup
9.	ovary	uterus	aorta
10.	thymus	cerebrum	medulla

B. Comprehension: Explain why the word circled in part A does not belong to that group of words.

1. _______ - ____

____

2. _______ - ____

____

3. _______ - ____

____

4. _______ - ____

____

5. _______ - ____

____

6. _______ - ____

____

7. _______ - ____

____

8. _______ - ____

____

9. _______ - ____

____

C. Application: Below each of the body systems have been listed. In the space provided, conclude how this system is interrelated to other systems in the human body.

1. Circulatory-
2. Reproductive-
3. Endocrine System-
4. Excretory-
5. Digestive-
6. Respiratory-
7. Nervous-
8. Muscular-
9. Skeletal-
10. Immune-

D. Analysis: Categorize each of the following body parts into the Correct Body System.

Circulatory	Endocrine	Digestive	Respiratory	Nervous	Muscular	Skeletal

urethra septum liver thyroid vein

bladder brain stomach esophagus scapula artery

spine ventricle small intestine clavicle mandible

E. Synthesis

1. Predict how the lungs and skin help remove waste from the body.

F. Evaluation

1. Give your opinion on why you think blood is important.

2. Justify a reason why the amount of activity you take part in can affect your heart rate.

APPENDIX C:

ACTIVITY LOG COMPLETION CHART

Students Name	Date Completed	Ck One		Body System	Act. 1	Act. 2
		T.B	W.B			

Total # of Students who completed Activity 1 ____________
Total # of Students who completed Activity 2 __________

APPENDIX D:

WEB SITE RESOURCES

Body Systems:

http://www.kidsconnect.com/HumanBody/BodySystems.html

A Look Inside the Human Body:

http://bart.northnet.com.au/~amcgann/A%20Look%20Inside%20the%20Human%20Body%20%20website/Index.html

Science Fact File: Inside the Human Body:

http://www.imcpl.lib.in.us/kids_body.htm

Tour of the Human Body:

http://www.thinkquest.org/library/lib/site_sum_outside.html?tname=5777&cid=2&url=5777/tour.htm

A Look Inside the Human Body:

http://bart.northnet.com.au/~amcgann/body

The Human Body:

http://www.negia.net/~hilsman/sam/P3systems.htm

The Digestive System: http://www.imcpl.org/kids_diges.htm

Brain Pop: The Digestive System:

http://www.brainpop.com/health/digestive/digestion/

Digestive System:

http://www.innerbody.com/image/digeov.html

Food Factory: http://www.imcpl.org/kids_diges.htm

How the Body Works: The Digestive System:

http://kidshealth.org/misc_pages/bodyworks/digest.html

My Body:

http://www.ashland.k12.or.us/morgan_cottle/body/body.htm

Science World: The Large Intestine:

http://collections.ic.gc.ca/science_world/english/exhibits/body/lg_intestine.html

The Digestive System:

http://www.msms.doe.k12.ms.us/biology/anatomy/digestive/digestive.html

The Excretory System: http://www.imcpl.org/kids_kidny.htm

Excretory System:

http://library.thinkquest.org/10348/find/content/excretory.html

Poison Protection:

http://sln.fi.edu/biosci/systems/excretion.html

Urinary System:

http://tqjunior.thinkquest.org/5777/urin1.htm?tqskip=1

The Muscular System: http://www.imcpl.org/kids_musc.htm

Back View of the Muscular System:

http://www.innerbody.com/image/musbov.html

Brain Pop: The Muscular System:

http://www.brainpop.com/health/muscular/muscular/index.asp

Bundles of Energy: The Muscular System:

http://www.brainpop.com/health/muscular/muscular/index.asp

Muscular System (front view):

http://www.innerbody.com/image/musfov.html

Welcome to Muscles:

http://www.innerbody.com/image/musfov.html

The Nervous System: http://www.imcpl.org/kids_nerv.htm

Brain Pop: Nervous System

http://www.brainpop.com/health/nervous/

Nervous System:

http://tqjunior.thinkquest.org/5777/ner1.htm?tqskip=1

Neuroscience for Kids:

http://faculty.washington.edu/chudler/neurok.html

Seeing, Hearing, Smelling the World:

http://www.hhmi.org/senses/

The Control Center: The Nervous System:

http://www.imcpl.org/kids_nerv.htm

Types of Neurons:

http://faculty.washington.edu/chudler/cells.html

Welcome to the Nervous System:

http://tqjunior.thinkquest.org/5777/ner1.htm

The Respiratory System: http://www.imcpl.org/kids_resp.htm

Air Bags: The Respiratory System

http://tqjunior.thinkquest.org/5777/ner1.htm

Brain Pop: Respiratory System:

http://www.brainpop.com/health/respiratory/

How the Body Works: The Respiratory System:

http://kidshealth.org/misc_pages/bodyworks/resp.html

Welcome to the Respiratory System:

http://kidshealth.org/misc_pages/bodyworks/resp.html

The Skeletal System: http://www.imcpl.org/kids_skel.htm

Bone Zone: The Skeletal System:

http://www.medtropolis.com/vbody/

Brain Pop: Skeletal System:

http://www.brainpop.com/health/skeletal/skeleton/

Skeletal System (front view):

http://www.innerbody.com/image/skelfov.html

Welcome to the Skeletal System:

http://tqjunior.advanced.org/5777/ske1.htm

The Circulatory System: http://www.imcpl.org/kids_circ.htm

Circle of Blood:

http://sln.fi.edu/biosci/systems/circulation.html

Circulatory System:

http://tqjunior.advanced.org/5777/cir1.htm

Circulatory System: Life Pump

http://tqjunior.advanced.org/5777/cir1.htm

Heart: An Online Exploration:

http://sln.fi.edu/biosci/heart.html

Preview of the Heart:

http://sln2.fi.edu/biosci/preview/heartpreview.html

Brain Pop: The Immune System:

http://www.brainpop.com/health/immune/immune/

Some Problems with Your Immune System:

http://www.kidsconnect.org/porch/immuneprobs.html

Understanding the Immune System:

http://rex.nci.nih.gov/PATIENTS/INFO_TEACHER/bookshelf/NIH_immune/

The Endocrine System:

Brain Pop: The Endocrine System:

http://www.brainpop.com/health/endocrine/endocrine/

Endocrine System:

http://www.innerbody.com/image/endoov.html

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