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University of Alberta

The Development and Implementation of Web-Based Instruction to Create a Self-Paced Learning Environment in Career and Technology Studies

by
Norman F. Mathew

A dissertation submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements for the degree of Doctor of Education

Department of Secondary Education

Edmonton, Alberta
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Norman Mathew

January 21, 1999

7012 - 185 Street
Edmonton, AB Canada
T5T 2L8

University of Alberta

Faculty of Graduate Studies and Research

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a dissertation entitled The Development and Implementation of Web-Based Instruction to Create a Self-Paced Learning Environment in Career and Technology Studies submitted by Norman Fraser Mathew in partial fulfilment of the requirements for the degree of Doctor of Education.

Dr. Maryanne Doherty-Poirier
Supervisor

Dr. George Buck
Chairman

Dr. Margaret Haughey

Dr. Craig Montgomerie

Dr. Norma Nocente

Dr. Sandra Ubelacker

Dr. Dennis Sharpe
External Examiner

January 19, 1999
Date

ABSTRACT

The purpose of this study was to examine the development and implementation of a Web site and how it created a self-paced learning environment for the Information Processing strand of Career and Technology Studies.

This study was conducted using a narrative approach. Participants were 167 Grade 7 students using Web-Based Instruction for the first time in this school; the research was conducted by the classroom teacher. As part of the study, a Web site was developed that was used as an instructional strategy to facilitate the delivery of the curriculum in the Information Processing Strand of the Alberta Career and Technology Studies program. As the teacher-researcher, I was interested in determining whether the Web site changed my teaching from a teacher-centered classroom to one which was more student centric. Data collection was through the use of a journal. Additionally, students responded to a series of statements regarding their use of the Web site in order determine whether my perceptions of the use of the Web site were congruent with those of the students. The third source of data used was the interaction with a colleague who also used the Web site.

The use of the Web site served a number of purposes, including the reduction of management time and repetitive teaching tasks, therefore increasing the amount of time I was able to spend with students one-on-one and in small groups.

Recommendations for further study were generated from the findings.

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CHAPTER ONE

Introduction

As I look back over the past three decades, it becomes evident that computers have touched nearly every aspect of our lives. Some (Gillette, 1996; Logan, 1995; Tapscott, 1998; Whitesel, 1998) have claimed that the use of computers is clearly shaping the ways in which we learn, work, and spend our leisure time; and that our success as individuals and as a nation is dependent upon our ability to understand and use computers. Although the World Wide Web (WWW) contains an enormous amount of information to help teachers teach, the potential of the WWW as a resource for classroom instruction has been largely untapped. Some (Logan, 1995; NAESP Communicator, 1997; Tapscott, 1998) would consider the Web a passing fad, just as some maintained that television was a fad. However, the use of television as a powerful teaching and educational learning tool has proven itself over the years in terms of educational programming which became available in the home through public television channels and within schools through the same source, along with the extensive use of prerecorded videotapes on a myriad of topics. For example, Zenor (1996) supported the use of the Internet in classrooms:

> The Internet and its World Wide Web represent the fastest growing resource available to educators today. Teachers can locate lesson plans and curriculum support materials for every subject. Students can research papers and projects, finding materials that will not be available in traditional printed form for months or even years. (p. 2)

Using the Internet in classroom teaching is a relatively new concept, but one that has considerable potential. Bennett (1996) claimed that using computers "could bring advances that would improve education dramatically–illiteracy would be eliminated, ordinary students would make massive gains, and restraints on bright students would dissolve" (retrieved May 23, 1997, from the World Wide Web: http://www.cris.com/~faben1/fullbook.shtml). This could happen because using a Web site for classroom instruction can facilitate self-paced learning, allowing some students to progress faster, whereas others may need to move at a pace slower than their peers in order to review certain concepts. In addition, this method of instruction allows students to explore concepts in a variety of ways and enables teachers to meet the diverse needs of students in single classrooms. Bennet (1996) also supported this concept by stating, "Although teachers will have to alter their accustomed practices, they will reach a new level of importance, will accomplish more, and will have greater job satisfaction when schools take advantage of the power of computers." He continued by saying that "computerized education, properly used, can provide a personal side to education that is impossible today" (retrieved May 23, 1997, from the World Wide Web: http://www.cris.com/~faben1/fullbook.shtml). The personal side becomes possible when

teachers are released from repetitive tasks, enabling them to focus their attention on individuals and small groups of students.

The Information Highway Advisory Council (1995) stated that in Canada it is "both an economic imperative and a means of empowerment [that] a learning culture . . . be created within the new knowledge based society" (p. 86). In other words, to enhance teaching and learning, the use of computers should be incorporated into learning activities whenever appropriate. Bennet (1996) explained why he supported the use of computers in schools:

> In their brief time, computers have driven, with blazing speed, radical upheavals everywhere. These machines have literally upended traditional practices. Without their guidance, the space program would cease and modern telephone networks would collapse; scientific advances are dependent upon them; businesses of every size have discovered their power and versatility and would now find it painfully difficult to operate as they did before these machines arrived; financial markets grind to a crawl whenever their computers are shut down temporarily. The list of beneficiaries of this modern technology is almost endless (retrieved May 23, 1997, from the World Wide Web: http://www.cris.com/~faben1/fullbook.shtml).

As a result of new technologies available for presenting curriculum to students, the role of the teacher must be redefined. Teachers could become less the dispensers of factual information and act more as facilitators, helping students navigate in a world of virtually limitless resources. For example, using a computer to present curriculum to

students makes it an easy task to create self-paced instruction and may provide teachers with more time to work with individual students. Computers offer students the possibility of exploring information, satisfying their curiosity, recovering from mistakes without embarrassment in front of their peers, and working at a pace that is comfortable for them. Warren (1995) endorsed the use of computers in classrooms:

> Without question, [computers] will alter the way we experience and record our world. Just as printing presses put scribes and scriptoria out of business and revolutionized our world by giving access and availability of information to many, so will information technologies force some highly priced and specialized publishers to rethink how they deliver documents. Having access to specialized document delivery on demand may, in turn, create whole new audiences for this type of material. What this means for learning is that a chance now exists to explore sources of information previously confined to large research facilities and universities. It moves learning outside the envelope constructed by the classroom, the textbook and the teacher (retrieved December 3, 1996, from the World Wide Web: http://educ.queensu.ca/~warrenp/project/intro.html).

When used as an instructional tool, the Internet through the computer has the potential to meet the needs of a variety of students by presenting instructional materials to them in different ways, including a traditional linear form; or, with the addition of illustrations, video clips, and even sound, in such a manner that students can review or move ahead through the content. Students need not follow a lock-step regimen to learning

but, rather, are able to pursue learning in a self-paced manner. Bennet (1995) advocated this approach to teaching when he discussed the possibilities that computers in classrooms offer:

> Teaching to differing ability, background and interest has posed an eternal dilemma to educators. Instruction that is appropriate and beneficial to one student may have a negative effect on another. Teachers with a classroom of children know it is impractical to try to tailor lessons to each student. Personal attention, however, would be immensely helpful because of the varied needs of pupils. Some students require additional explanations, while others have grasped the material and are ready to go on. Since having forty million private instructors is impossible, compromises are necessary and teaching usually progresses at the average level of the class. Poorer students are left hanging in their confusion and the brightest students miss exciting challenges. With computers as tutors, the learning of one individual will never be hindered by the abilities and weaknesses of others. Each student will move at his or her own pace, unaffected by the rate of learning of any other student. (p. 31)

As teachers, we accept that students will learn at different rates and in different ways. Using a Web-Based Instructional method is one means of meeting the diverse needs of students while providing self-paced instruction for them.

Purpose of the Study

In public schools today, a class is usually a combination of students of differing knowledge, skills, attitudes, and career goals. In addition, the behavior of students differs

from individual to individual. It is important that attempts be made by the teacher to address the characteristics of individual students. There are many ways of achieving this goal, including reducing class sizes, grouping by ability, or hiring additional staff. None of these alternatives seems possible considering the current levels of educational funding practices in Alberta, so another solution must be found. One solution is using "virtual teachers" to present curricular concepts. An Internet Web site could help make this possible by increasing the amount of time one teacher has to spend with individual students. Furthermore, the Internet allows for a richness of presentation which can include visual, audio, and print forms–and a variety of presentation methods. Logan (1995) supported the use of computers to supplement classroom teaching when he stated that

> the only way individualized education can still be provided in the context of the increased demand on the education system is to make wholesale use of computers and integrate them with classroom instruction so that the important social exchanges of peer interaction and teaching can be maintained. (p. 255)

Given that we are seeing increasingly diverse populations of students in classrooms, that class sizes are not declining, that we need to find ways for teachers to work more closely with students on an individual basis, and that the Internet can be used to present information to students, **the purpose of this study was to describe the development and implementation of a Web site and to examine its usefulness in offering the Information Processing strand of Career and Technology Studies (CTS) in a junior high school setting.** The perceptions of students and teachers were collected to determine

the Web site's usefulness. In this study, the Web site was used to meet a variety of student knowledge, skills, and attitudes in a single class; or, in other words, to help students learn through self-paced instruction.

Definitions

For the purpose of this study, terms have been defined; these definitions are generally found in computer and educational lexicons. Those terms that refer to computers and computer parts are not defined in this study. The terms that are included are, in alphabetical order: *browser, browsing, Computer-Assisted Instruction, Computer-Based Learning, Computer-Managed Learning, Graphical User Interface, distance learning, home page, Hypermedia, Hyper Text Markup Language, just-in-time-learning, Internet, Universal Resource Locator, Web-Based Instruction, Web site,* and *World Wide Web.*

Browser

In order to view information contained on the World Wide Web, a browser application is required. Schlegel (1996) defined a *browser* as "a software program that enables the user to access and pass through an information space. Graphical browsers allow for a visual display of information and employ a graphical interface, non-graphical browsers can only display text" (retrieved December 4, 1996, from the World Wide Web: http://www.netspot.unisa.edu.au/eduWeb/). Examples of graphical browsers include Netscape, Mosaic, and Microsoft Explorer.

Browsing

The term *browsing* is often used in connection with hypertext; and for the purpose of this study, browsing is defined as looking for information on the Web in a casual way, or without a definite purpose.

Computer-Assisted Instruction

Munden (1996) offers the following definition: *Computer-Assisted Instruction* (CAI) is:

> an educational medium in which instructional content or activities are delivered by a computer. Students learn by interacting with the computer and appropriate feedback is provided. Several acronyms represent the use of computers in educating students, including Computer-Assisted Instruction (CAI), Computer-Assisted Learning (CAL), Computer-Aided Instruction (CaI); Computer-Aided Learning (CaL); Computer-Based Instruction (CBI), and Computer-Based Learning (CBL) (retrieved December 23, 1998, from the World Wide Web: http://www/auburn.edu/~mundecd.cai.html).

Computer-Based Instruction

Computer-Based Instruction (CBI) is a broad term that encompasses multiple uses of computers in the learning and teaching process, including Computer-Assisted Instruction, Computer-Managed Instruction, and Web-Based Instruction. O'Neil and Paris (1981) supported this definition when they stated that computer-based "is sufficiently broad to cover multiple uses, . . . and 'instruction' can refer to either education or training" (p. 1). According to O'Neil and Paris, the term Computer-Based

Instruction is used to mean the same as Computer-Based Training.

Computer-Managed Instruction

Baker (1981) states that *Computer-Managed Instruction* (CMI) adds an element to Computer-Based Instruction through the use of "automated data collection, data processing, and reporting capability needed to cope with the management demands of individualized instruction" (p. 23). CMI includes the elements of Computer-Based Instruction or Computer-Assisted Instruction, but with added student and curriculum management tools for the teacher. Baker stated that the terms Computer-Managed Instruction and Computer-Managed Learning (CML) can be used synonymously.

Distance Learning

Distance learning has been used in Canada for over 100 years and was defined by Haughey (1995) as "education that takes place in a situation where the teacher and student are physically separated and where learners study appropriately designed materials at a place, time and pace of their own choosing" (retrieved from the World Book Encyclopedia CD-ROM Edition, 1996).

Graphical User Interface

Schlegel (1996) defined a *Graphical User Interface* (GUI) as "an interface that relies on the visual organization of information and works though direct manipulation (point and click) rather than command prompts" (retrieved December 4, 1996, from the World Wide Web: http://www.netspot.unisa.edu.au/eduWeb/). Examples of GUIs include Windows and Macintosh operating systems.

Home Page

The definition of a *home page* provided by Hill and Misic (1996) is suitable for the purposes of this study:

> The original purpose of the World Wide Web was to distribute information to many people in an easy manner. To do this, computer screens called home pages were developed. The home page can only be viewed–no changes can be made by the viewer. . . . Home pages are written in HTML and provide links to other home pages. (p. 13)

Hypermedia

Hypermedia, Maddux (1996) explained, "is not linear. Students using hypermedia instructional materials are not required to follow a particular pattern. Hypermedia provides the student with options that allow them to create their own paths though the material" (p. 25).

Hyper Text Markup Language (HTML)

Hyper Text Markup Language is the scripting language, or code, that is used by Web browsers to convert data into a graphical presentation for Web users. HTML is a relatively simple language with which to program, because it uses English-like commands enclosed in pointed brackets (< >). The brackets and the enclosed code are called *tags*.

Just-in-Time Learning

Just-in-time-learning is a term borrowed from the manufacturing industry that means having product parts delivered just before they are needed in order to save on

warehousing expenses. When applied to education, Schlegel (1996) stated that "just-in-time-learning refers to the fact that any given area of expertise will keep expanding and that there will be a need to keep updated on the newest developments just in time" (retrieved December 4, 1996, from the World Wide Web http://www.netspot.unisa.edu.au/eduWeb/).

Internet

The term *Internet* has only recently been introduced to the realm of secondary education, although it was first proposed in the 1960s as a military safeguard of communications during a nuclear attack and later as a method of sharing academic research among institutions of higher learning. The Internet is a vast collection of computer networks that are accessed through various security protocols. These networks contain information in the forms of text, images, and sounds. Most computers on the Internet can be accessed through the use of various protocols such as FTP, GOPHER, TELNET, and the World Wide Web. The specifics of these protocols, however, are beyond the scope of this study. For the purpose of this study, whenever Internet is used, it is assumed that a computer is also used; therefore the use of the term Interent implies the use of a computer.

Web-Based Instruction

Simbandumwe (1997) defined *Web-Based Instruction*

> as using the World Wide Web as a medium to deliver course material, administer tutorials and quizzes, or communicate with students. This also encompasses using the Web for communication in the process of teaching a

class. Other terms in use include Internet Based Training (IBT) and Web-Based Training (WBT) (retrieved April 21, 1997, from the World Wide Web: http://www.umanitoba.ca/ip/tools/courseware/model.html).

For the purpose of this study, the delivery method used will be referred to as Web-Based Instruction (WBI), and the Internet is used as a method of distributing the curriculum materials that were on the Web site.

Web Site

Jenkins (1999) defines *Web site* as "a group of Web Pages that collectively represent a company, or individual on the WWW. A group of Web pages that have been developed together to present information on a specific subject(s) is also a Web Site" (retrieved January 11, 1999, from the World Wide Web: http://homepages.enterprise.net/jenko/Glossary/GW.htm#WEBSITE).

Universal Resource Locator (URL)

The *Universal Resource Locator* (URL, pronounced "earl") is the complete location at which any particular Web site can be found and contains the protocol (ftp, http, etc.) and a series of names, letters, and/or numbers from which the file can be downloaded. URL is defined by Castro (1997) as "a fancy name for *address*. It contains information about where a file is and what a browser should do with it. Each file on the Internet has a unique URL" (p. 19).

World Wide Web

The *World Wide Web*, or the Web as it is more commonly referred to, is one protocol of accessing other computers that are connected to the Internet. A computer user

sees the World Wide Web on a computer monitor using a Browser, which is a Graphical User Interface (GUI) to the Internet. A Web browser allows the user to see text and images presented on a monitor rather than as straight text. Various aspects of the Web are accessed with a browser by using a mouse to click icons.

Rationale

The purpose of this study was to describe the development and implementation of a Web site and to examine its usefulness in offering Information Processing in my junior high school classes. To establish a need for this research, a literature review was completed of available Web sites related to using the Web for classroom instruction. Although numerous training sites were located while I searched the Internet, the majority of the sites found were designed for adult or specifically for industrial training. As well, there were many sites using distance learning in K-12 education in Canada, the United Kingdom, Australia, and the United States. However, few of these were teacher-supervised, in-school models. No sites were found that were related to the 22 strands within the Career and Technology Studies program. Giagnocavo (1995) supported the rationale for this study when he stated:

> The Internet isn't a fad. It isn't just another new piece of technology such as a fax machine or laser disk player. And it isn't a "thing" or a "place" or "something to do." It's much more, almost indescribably more. It's as if it were a living, breathing organism, and in a way it is. To me and to hundreds of thousands of "curious" educators, the Internet is the world's largest community of users dedicated to common goals: the free exchange of

information and the enrichment of the lifelong (K-99) education experience for millions of students and adults everywhere.

> The Internet is here and it is available now. It isn't magical. But, it has the power to enhance and transform the educational process. As an educator, parent, or student, you simply must get involved with the Internet. (p. x)

Although the Internet has been used at the postsecondary level for research purposes since the 1960s, it has seen very little use in secondary schools until recently. At the postsecondary level one of the initial purposes of forming the Internet was to exchange research ideas, and this purpose has continued to flourish. There are also numerous postsecondary education sites that offer distance education programs, including at least one at the University of Alberta in the Educational Psychology Department in the Faculty of Education, which can be retrieved from the World Wide Web: http://www.quasar.ualberta.ca/nethowto/.

During the literature review phase of the study, numerous Web searches and print materials were reviewed for information on using Web-Based Instruction for in-class instruction. In addition, a general request was sent to the World Wide Developers Forum asking for information. At the time the review was conducted, no information was retrieved from any of the searches, Internet or print, on this topic. It was concluded either that there was no information available or that no one was reporting on the use of this instructional method. It became clear that there was a need for this study, which included the need to develop a Web site that could be used by teachers to develop similar learning

and teaching systems for Information Processing classes.

At the completion of the study, the Web site used in this study will be available on the World Wide Web for other teachers and students to use. One of the founding purposes of the Internet was to allow the free sharing of academic pursuits. Educators who use the Web site will be invited to contribute their curricular materials in order to expand this site. When teachers create excellent learning materials for students to use, those materials are generally shared only with the students the teacher instructs. It is difficult for teachers in typical school settings to share and build upon one another's work. The use of the Web and the Web site developed during this study will encourage teachers to share materials so that more effective educational practices are made available. The Internet is an excellent medium for the sharing of resources by educators because, "the Internet, where individuals can post materials as completed, and where profit need not be an issue, is an ideal medium for such utilitarian and ephemeral materials" (Wehmeyer, 1996, p. 26).

Objectives of the Study

The purpose of this study was to describe the development and implementation of Web-Based Instruction and examine its usefulness in offering the Information Processing strand of Career and Technology Studies, in a junior high school setting, as reported by students and teachers. The study had the following objectives:

- to relate the story of the development and implementation of Web-Based Instruction, and
- to examine the usefulness of the Web-Based Instruction

Chapter Two is a review of the literature related to using Web sites, the WWW, and

Web-Based Instruction. The methodology used to guide this study is the topic of Chapter Three, and the defining characteristics of Career and Technology Studies are presented in Chapter Four. The development, implementation, and maintenance of the Web site are discussed in Chapter Five. The findings and discussion of the findings are presented in Chapter Six; and in Chapter Seven the summary, conclusions, and recommendations for further study are discussed.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

A review of the literature available on Web-Based Instruction was completed in order to support the need for this study. During the review, both print resources and resources available on the Internet were consulted. Print materials were addressed in the research because they are universally available and contain much historical data on the growth of the use of computers in schools. Internet resources were used for two reasons: (a) Many current resources and much information about the use of the Internet and Web-based Instruction are available on the Internet before it is available in print, and (b) because this study is an Internet based one, it is appropriate to use Internet resources.

Print Resources

The following sources were used to collect information related to this study: net searches on the Internet, periodicals related to the Internet, periodicals related to educational technology, CD-ROM resources related to education, print materials related to education and the Internet, and publications that discussed using the Internet for teaching and learning. Certain limitations were imposed at the outset of the literature

review. For example, because references about using computers in school that were published prior to 1993 did not generally mention the use of the Internet in schools, those with earlier publication dates were eliminated. In general, articles and books with publication dates prior to 1990 dealt with the issue of whether computer technology should be used in schools. These references often referred to Apple II computers, early Macintosh computers, and DOS platforms that preceded the Intel 80386 processor. Few of the references even mentioned the use of CD-ROM resources, which could be considered the educational innovation just prior to the Internet. For these reasons, resources published in these years were not included. Even as recently as 1995, references to the Internet were scarce in educational periodicals, and those that mentioned it referred to Gopher, Telnet, and FTP of files and data, rather than the World Wide Web.

Several books dealt with the sociology of computers in schools (Bozeman, 1996; Collis, 1996; Maddux, 1997; Muffoletto, 1993), but few mentioned the use of the Internet as an instructional resource. Others referred to emerging technologies such as computer networks (Evans, 1986) and hyper-media (Heinrich, 1989; Maurer, 1995). In general, a study of the Table of Contents and Indexes of books related to the use of computers in schools published prior to 1993 revealed little or no mention of the Internet or of the World Wide Web.

Available periodical literature made reference to several curriculum projects undertaken by school districts, provincial or state education researchers, and individual teachers. Although hundreds of worthwhile projects were identified during the literature search, they tended to be collaborative projects using the Internet as a communication

channel, rather than sites to provide curriculum materials. Because the technology related to this study changes so quickly, the Internet and periodical searches provided the majority of existing information.

Internet Resources

A search of Internet resources was completed by using the various search engines available on-line on the Internet. It should be noted that the World Wide Web is a dynamic and ever-changing resource, and some of the sites mentioned in this review may no longer be available at the Universal Resource Locator (URL) indicated. Two popular Internet search engines, InfoSeek (http://www.infoseek.com) and Yahoo (http://www.yahoo.com), when typical Web search techniques for education, learning, and Internet, were used turned up more than 11 million sites. In a review of a selection of these sites, most of them were eliminated because they were unrelated to this study. Examples of Web sites found during the literature review are described in the next section.

During the literature review, additional databases on the Web that provided information related to this study were located. Examples of such sites include Hotbot (http:www.hotbot.com), *Syllabus* magazine (http://www.syllabus.com), and *Classroom Connect* (http://www.wentworth.com/classroom/). These sites contained information useful to the study, and they also provided links to other relevant Web sites, some of which are included below.

In addition to Web sites that included information about how to use the Web for intruction, there were numerous sites that contained information about individual schools

or school programs and initiatives. Kindergarten to Grade 12 Web sites are generally aimed at providing a collaborative learning experience for students. These sites host projects that can be accessed and shared by students around the globe, similar to writing to pen pals, except that more information can be exchanged. The information could include graphics, sounds, and pictures if desired. An example of such a site is the Global Education Classroom project at Delmar Elementary School in Maryland (http://www.intercon.net/local/weeg).

Another example is Montgomery Blair High School (http://www.mbhs.edu) in Silver Springs, Maryland. It is an example of a secondary school that uses the Web for a number of purposes. This collection of home pages provides information about the school, school programs, school events, and student projects. The Montgomery Blair High School does not contain curricular materials, but it does provide a show case for student projects completed on a variety of topics related to subject areas offered at the school.

A third example exists in Edmonton, Alberta, at John D. Bracco School (http://www/epsb/edmonton.ab.ca/schools/jdbracco/index.html). It is a technology school in the Edmonton Public School District that offers a distance education program called *LearnNET*. This program is monitored by a teacher in the school and is offered to students who prefer to study at home. The LearnNET program is based on a distance education model, and it uses the Internet to facilitate teacher and student communication, but it does not make use of a Web site to provide curriculum materials.

A fourth example is the Alberta Distance Learning Centre (ADLC). This organization maintains a Web site (http://ednet.edc.gov.ab.ca/level3/adlc/300/adlchome.html) that provides information about the center and programs that it offers. The ADLC offers home study courses for many programs prescribed by Alberta Education and is designed as an alternative to in-school programs. Course materials are generally available to students in print form, although some of the assignments require the use of a computer. Students proceed through the assignment booklets and mail completed lessons to a teacher at the ADLC. Feedback to students is provided through a traditional teacher-written response and graded assignments.

A fifth example of a Web site related to education is the Alberta Education Web site (http://ednet.gov.ab.ca/) maintained by the Department of Education for the Province of Alberta. It provides information on Alberta Education programs, its mission, and its policies.

A sixth example is Academy One (http://nptn.org/cyber.serv/AOneP/). This organization offers "cyber-projects" for students in K-12 schools. It is international in nature, and students are able to participate in a number of projects, including simulations and key-pal exchanges on the Internet.

At the postsecondary education level, students attending the University of Alberta can enroll in Educational Psychology 597 and receive their course materials, including instructional materials, from a Web site on the Internet (http://www.quasar/ualberta.ca/nethowto/). This is an example of using a Web site to provide curricular materials to students. The site is organized around curriculum modules, and students

work through the modules, submitting assignments electronically and receiving assessment feedback from the instructor via e-mail.

A second postsecondary site is located at the University of Southern Australia (http://www.netspot.unisa.edu.au/eduWeb/). That site is called *EduWeb* and deals with four main issues involved in using the Web for learning: theory, practice, media, and interaction. This site provides excellent information about issues concerning the Internet, but does not provide curriculum materials.

In addition to school- and university-based Web sites, educational organizations in the United States also provide curricular information on Web sites. One such foundation is the JASON Project (http://www.jasonproject.org/), which offers a number of on-line activities, including virtual field trips for students' participation, as well as lesson plans and project ideas for teachers and parents.

Professional organizations such as the National Education Association (http://www.nea.org/) offer information about their respective organizations, information for teachers and the general public about education, and ideas and tips to help students learn. Available on this site are reprints of articles related to teaching, learning, and public education. Visitors to this site can download or print the information for future reference or research purposes.

An example of a Canadian site for professional development is Canada's SchoolNET (http://www.schoolnet.ca/). It consists of resources for educators; links to other agencies, institutions, and provincial education networks; and news and information about projects in which students, schools, or teachers could become involved.

Other organizations provide public television programming as well as hosting Web sites. An example of one such site is the Discovery Channel (http://www.discovery.com/). This site does not provide instructional materials, but serves as a starting place for students to search for information about the organization. A similar Web site is available for the Public Broadcasting Service (http://www.pbs.org/).

Other groups using the Web are commercial groups. An example of this type of site includes Prep Web@ssessor (http://www.computerprep.com), in Phoenix, Arizona. The home page for this group provides information on the training programs they offer. This site offers an on-line catalogue of products and prices. The training materials are similar to a distance learning model, and use is made of print materials such as student learning guides. Oz NewMedia (http://www.oznewmedia.com), a company in Edmonton, Alberta, is developing curricular materials for the Career and Technology Studies strands of the Alberta curriculum and charges a per-student fee for use of their combination of CD-ROM and Web site access. It is called Wisdom Bridge.

On the Web there are numerous sites to teach users about the Internet. One such site is called "Exploring Life on the Internet" (http://www.screen.com/understand/explore.html); it contains information about a variety of topics, including getting started, using various Internet applications, and creating a home page. Although this site does not contain curriculum, teachers using the Information Highway course in the Information Processing strand of Career and Technology Studies (CTS) could create a link to the site to help students learn about the use of home pages and home-page design.

There is a site on the Web for almost every interest. For example, students of the Japanese language may wish to visit the Japanese language site (http://www.ntt.jp/japan/japanese/) hosted by the Nippon Telegraph and Telephone Company. This site provides Japanese language essentials as well as links to other Japanese sites.

In summary, there are numerous Web sites on any number of topics related to education available on the World Wide Web. However, none of the sites mentioned as examples in this section embrace the concept of this study, which is to use a Web site for classroom instruction.

The Use of Computers in Schools

In the previous section it was noted that there were no sites available on the Internet that used the Internet for classroom instruction. Rather, the majority of sites used for educational purposes were used either for off-campus learning or as a communications channel to exchange ideas, to showcase student work, or as a marketing tool for schools, thereby demonstrating a need to develop and implement such a site. The purpose of this section is to review the literature available on the use of computers and Web sites for classroom instruction. Logan (1995) wrote:

> [The computer's] role in the general classroom is extremely promising and still emerging. It is already clear, however, that the microcomputer's capacity to motivate students, encourage peer teaching, individualize instruction, and increase user interactivity hold the potential to revitalize education at both the grass-roots level of the student, as well as at the curricular level throughout

the whole system. (p. 238)

After a review of the literature on the effectiveness of computers in classrooms, Computer-Assisted Instruction (CAI), and Web-Based Instruction (WBI), collectively called Computer-Based Education (CBE), many of these studies indicated that there was no significant increase in student achievement when such tools were used. For example Williams and Brown (1990) cited a meta-analysis of studies related to CBE completed by Kulik and Kulik (1987). In their study, these two researchers stated that there was no significant increase in student achievement on standardized tests as indicated in their analysis of 198 studies (p. 215). This research was also supported by Russell (1997a), who looked at 248 studies, and reported in the National Association of Elementary School Principals (NAESP) *Communicator* (1997) "Link Between Computer Use" which stated, "The major concern is that the increase in technology in the nation's schools has not fully correlated with an increase in achievement. . . . In sum, if computers make a difference, it has yet to show up in achievement" (p. 1). However, as Williams and Brown (1990) pointed out, "The literature continues to draw on these older studies. All but two of the over 200 studies in the Kulik, Kulik and Bangert-Drowns, and the Niemiec and Walberg meta-analysis were published before 1983" (p. 218). However, there is disagreement with respect to the issue of achievement. For example, the U.S. Department of Education (1996), in a report titled "Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge," provided evidence that student achievement, in areas other than achievement results, does increase in technology-rich classrooms:

> A 10-year study supported by Apple Computer, Inc. concluded that students provided with technology-rich learning environments continued to perform well on standardized testing but were also developing a variety of competencies not usually measured. Students explored and represented information dynamically and in many forms; became socially aware and more confident; communicated effectively about complex processes; became independent learners and self starters; knew their areas of expertise and shared that expertise spontaneously. (n.p.)

The Department of Education further supported the use of computers in schools by suggesting that

> in successful technology-rich schools, these measures of student success are not simply limited to achievement scores, but also include indicators of other important school processes, such as student motivation and engagement, job placement, attendance rates, dropout rates, and level of family involvement. (n.p.)

As pointed out in the documents previously mentioned, achievement scores in schools that used computers did not necessarily increase, but other aspects of student learning, such as motivation and focus, did. Furthermore, the early studies also indicated that there was no drop in student achievement.

Support for the instructional use of computers in classrooms was evident in a number of writings (Bennet, 1997; Maddux, Johnson, & Walter, 1997; Maurer, 1995; Tapscott, 1998), although Gillette (1996) cautioned that "computers should not be viewed

as a solution to every classroom challenge or teaching goal an instructor might encounter or strive for. Ideally, computers and electronic media should serve as one of several tools available" (p. 61). Therefore, when appropriate, computer related-tools should be used for classroom instruction.

Throughout history teachers have used available technology for instructional purposes, including the use of slates and stylus, blackboards and chalk, video presentations and television, and computer-based instruction. In a report to the U.S. Congress titled "Teachers and Technology: Making the Connection," the Office of Technology Assessment (1995) made this statement:

> First and foremost, teachers want to ensure that their students are learning. If technology can be a resource to enhance student achievement and interest in learning, teachers are more likely to invest the time and energy to learn to use it in their teaching. However, the relationship between technology and student learning is too often framed as a seemingly simple question: is teaching with computers and other technologies better than teaching without them? (p. 8)

Teachers choose to use new technologies in order to enhance their teaching. Just as we added the written word to oratory, added books, began to use pen and paper, film and video tape, so shall teachers add computer technology and the Internet to their repertoire. Further, the Office of Technology Assessment (1995) stated:

> Teachers use new technologies for the same reason they use books, worksheets, and other teaching tools to help students learn. Evidence from an array of studies indicates that technology in the classroom can have a positive

impact on student learning, in terms of achievement in certain subject areas, development of skills, and attitudes towards school. (p. 57)

The central question for any teacher, and indeed the main one for undertaking this study is, "How can this help my students?" As the Office of Technology Assessment (1995) report above mentioned: "Although early research tended to focus on 'the computer' as an independent variable that somehow affects the learning process, it is becoming increasingly clear that technology, in and of itself, does not directly change teaching or learning. Rather, the critical element is how technology is incorporated into instruction" (p. 57). From the literature presented in this section, it is clear that there is lack of consensus as to whether the use of computer-based instruction can improve student achievement; nor is there overwhelming indication that it can help teachers improve their effectiveness. Williams and Brown (1990) suggested that although "computers are beneficial adjuncts to instruction at various educational levels, we are just beginning to explore how computer-related technologies for instruction can best be utilized and for what kinds of learning tasks" (p. 222). Logan (1995), on the other hand, wrote:

> Many cases can be cited where the use of computers has not led to any significant educational or cognitive gains, but this is most often due to the misuse of the technology by the teacher. There is little doubt that computers offer an important alternative to the traditional approaches of teaching the 3 Rs. (p. 253)

In consulting with an expert in the Department of Secondary Education in the area of using computers as instructional tools, this opinion was confirmed in an electronic mail exchange. The author of that e-mail espoused:

> The findings were that in using CAI or variants, there was no significant difference in achievement between traditional methods and CAI. This does not mean that CAI is inferior. On the contrary, it means that it is as effective as traditional classroom instruction. So, there will be no deficit if CAI is used.
>
> Additionally, in some situations, especially in what might be considered special ed, CAI is more effective than traditional methods. The point is that CAI is a great adjunct to classroom teaching, and helps to make teaching more effective as one can put students with particular difficulties on a computer, or gifted students for that matter, which frees up time for assisting other students. (G. Buck, personal communication, February 23, 1998)

Perhaps the issue of no significant difference is best summarized in this electronic mail message:

> What's significant about the "no significant difference" is that there's no degradation to the educational quality of the content if it's delivered/distributed in this manner. People don't learn any more or less from net delivered content than they do from any other type of delivery/deployment system." (D. Adams. personal communication, April 23, 1998)

Summary

Following the review of the literature, it became clear that there was limited research regarding the use of Web-Based Instruction in junior high classrooms. A search of the Internet provided many sites about issues related to computer-based instruction, but none were located that made specific reference to the use of Web-Based Instruction when used for classroom instruction. The studies that were reviewed reported that there is no significant difference in student achievement when computers are used in classrooms. However, these same studies, which included at least two meta-analyses, concluded that computer-based instruction did not lower student achievement. In conclusion, the paucity of both print and electronic literature that is currently available on using Web-Based Instruction for classroom teaching further supported the need for this study.

CHAPTER THREE

METHODS

Purpose of the Research

As mentioned in Chapter One, this study had two objectives. They were:

- to relate the story of the development and implementation of Web-Based Instruction, and
- to examine the usefulness of Web-Based Instruction in offering the Information Processing strand of Career and Technology Studies in a junior high school.

It was my intention throughout this study to examine critically the Web site, to determine how students were using it, and to determine how I as a teacher could continue to develop it as a component of Web-Based Instruction for classroom teaching and learning.

Personal Ground

I embarked on the journey to create a Web site for my students many years ago, although I did not designate it as research at that time. I have always tried to ensure that I focused on student learning activities and helped students' taking responsibility for their learning. I tried to provide a variety of instructional materials to accommodate students

who might not have grasped all the concepts taught during a particular lesson or demonstration or who might have been absent from a class. At the time, my instructional materials were in print form; therefore the development of the Web site was simply an evolution of my teaching practice.

How did I experience the use of computers in my daily life and in learning? As a high school student I had an interest in the printing and publishing industry and completed several courses in that area. The printing and publishing industry has always been a leader in the use of new technologies, as far back as the 15th century, when Johannes Gutenberg made it possible for the masses to have access to published works when he invented the printing press and moveable type. The industry has maintained a lead in the use of technology by inventing faster and more efficient machines to produce words. One of the most common machines, which was invented in the 19th century, called a *Linotype*, produced words one line at a time, compared to Gutenberg's method of one letter at a time, making it possible to print more words on paper in much less time. The Linotype was in common use until the 1980s, and it was on such a machine that I had my first "word-processing" experience. Many of the early word-processing machines were developed by the printing industry specifically for the printing industry. When desktop publishing became of sufficient quality for the industry, it was embraced to the point where virtually no producer in this sector is without a microcomputer system that is used for the production of printed materials.

In my undergraduate studies I completed a course that was delivered through Computer-Assisted Instruction (CAI). Compared to current computer-based instruction

systems, it was very primitive; and although an instructor was not readily available, I recall enjoying the course because I was able to work at my own speed and ability–reviewing concepts when necessary and moving faster than my peers when I was able. I enjoyed being able to learn at my own speed and not always being required to listen to lectures and watch demonstrations. This self-paced method of learning appealed to me, but the technology was not available in public schools, and I was unable to consider such a system when I entered the classroom as a teacher.

However, it was possible for me to prepare a print version of CAI type material by breaking learner expectations or objectives from the curriculum into small, easy-to-grasp concepts. By illustrating the print material with graphics related to the concepts and presenting this information to students, I was able to create a similar, self-paced environment in my classrooms. Of course, the quality of the materials was inferior to and the time required much greater than that which can be produced now, but my ability to conceptualize Web-Based Instruction clearly emerged from my affinity for self-paced or personal learning, which developed over more than two decades of teaching. In my observations, first as an Industrial Education teacher and more recently as a Career and Technology Studies (CTS) teacher, I find that many students enjoy this type of learning. In CTS very seldom are all students learning the same concepts at the same time.

To teach CTS it is necessary, by the very nature of the curriculum, to have instructional materials available for many courses, at different levels, at the same time. In a print-based course, CTS organization can become problematic due to the large amount of paper filing and distributing; and many teachers, myself included, have developed

ingenious methods of becoming and remaining organized. Some of the methods used include color coding instructional materials based on level or course, complex filing-cabinet systems, and binders with instructional materials. Over the years I have tried many methods of instructional organization, and it was not until the Internet and the World Wide Web (WWW) became readily accessible to schools that I found one that was truly versatile and useful for me as a teacher.

When I learned of the WWW, I wondered how I would be able to make use of it in my teaching practice. After exploring the Internet, I was able to see the potential in terms of presenting information to students in a variety of ways, and the possibility of spending less time on management issues and repetitive tasks and more time with students who needed additional instructional time and teacher attention. Additionally, the use of the Web site had the potential of providing for students who wished to work ahead the flexibility of doing so. It was with this realization that I knew that I had to develop the Web site; thus began my journey into the world of "cyber-learning."

My description of this journey will illuminate my study, which is to develop a Web site for my classroom teaching of the Information Processing strand of the CTS Program and to describe the implementation of it through Web-Based Instruction. In addition, I will examine the usefulness of the Web site and Web-Based Instruction as perceived by my students, a colleague, and myself.

Methodology

Reflective Teaching and Pedagogy

As a teacher, I have always reflected on what I did in my classroom on a day-to-day basis with my students, but I had never formalized the process, and I had not recognized the practice as a legitimate method of looking at the craft of teaching; nor had I reviewed the literature about reflective teaching to determine if it was a practical method of researching about teaching and learning. As Zeichner and Liston (1996) pointed out, "As teachers, it is through reflection on our teaching that we become more skilled, more capable, and in general better teachers" (p. xvii). A reflective practice, by its very nature, must be hermeneutic. Gall, Borg, and Gall (1996) explained, "In doing reflective analysis from a hermeneutical perspective, the researcher carefully examines and then re-examines *all* the data that have been collected" (p. 571). The relationship between the teacher and the student–a relationship known as *pedagogy*–is the important data to me.

In order to discuss pedagogy, it is first necessary to define the term. In the teaching profession, we often use the term pedagogy to describe the quality of teaching, or how we teach. For example, we might say that teaching a math concept in a particular way is effective or not effective pedagogy. We are referring to the quality of teaching or the strategies that a teacher might employ while teaching. However, pedagogy, in the professional literature, referred to the student-teacher relationship. For example, van Manen (1991) provided an interesting definition: "In order to explore, study and describe the influences that are at the heart of the special interactions, situations, and relations between educators and students, parents and children, I will use the term *pedagogy"*

(p. 16). In other words, pedagogy is that *special* relationship that exists and develops between teachers and students. Van Manen reminded teachers:

> Children are not empty vessels who come to school merely to be filled with curricular content by means of special instructional methods. Moreover, children who come to school come from somewhere. Teachers need to have some sense of what it is that children bring with them, what defines their present understandings, mood, emotional state, and readiness to deal with the subject matter and the world of the school. (p. 7)

Pedagogy, according to van Manen (1991), is the relationship viewed from the perspective of how it affects the child; in order to see this point of view, we must reflect on what we do with children in a classroom. In the busy atmosphere of a classroom, it is often difficult to reflect on our actions at the time; however, as Lasley and Matcynski (1995) pointed out "Reflection is now considered both personally and professionally efficacious. To be reflective about classroom practice, especially among those concerned with teacher development, is viewed as a pedagogical imperative" (p. 307). Van Manen also supported this point of view: "Thus, pedagogy first calls upon us to act and afterwards it calls upon us to reflect upon our actions" (p. 27). It follows, then, that teachers who engage in pedagogy are, by definition, reflective practitioners.

A concept that became important while I researched reflective practice was that of curriculum. In teaching situations we are usually required to teach a certain amount of prescribed information, and often teacher and school effectiveness are measured by standardized tests on that curriculum. With imposed standards it is difficult to continue to

remember that teaching is a uniquely human and social activity. For this reason, it concerns me that *curriculum* has become the operative word in the teaching profession, and the term *pedagogy* is seldom mentioned unless it is used to refer to how we teach. It is important, then, to understand the difference between curriculum and pedagogy, or, more important, the relationship between them. If we refer to curriculum as what we teach, then pedagogy must refer to how we teach: the relationship between student and teacher of how the how is done–the relationship between adult and child. Zeichner and Liston (1996) best described the relationship between curriculum and pedagogy thus:

> Although some types of reflection have us focus more on the content that we teach, others tend to highlight either our students and their learning, or the contexts in which we teach. These are not mutually exclusive conceptions of reflective teaching, they differ in degrees and types of emphasis. (p. xvii)

In this section I described how pedagogy can be a reflection of the relationships involved in teaching and how reflective practice can improve our craft. The next section will outline the research approach that was selected to guide this research.

Research Approach

There are numerous approaches to research that can be taken. In general, research can be, for example, historical, quantitative, or qualitative. Usually, qualitative research is concerned with the nature of the events being studied and therefore provides depth and detail about those events. I will be using a qualitative approach in my study on Web-Based Instruction. Data in a qualitative research study are collected using a variety of methods such as field notes, journals, and conversations. The methods of data collection

for my study will be discussed later in greater detail. According to Patterson, Santa and Short (1993), in qualitative research, "the questions come from real-world observations and dilemmas" (p. 19). The use of qualitative research was further described by Levitt (1995), who stated that "qualitative researchers do not concern themselves with every measurable detail. The methodology is much more the capturing of the flavor of an event or action" (retrieved October 29, 1997, from the World Wide Web: http://Web.syr.edu/~mlevitt/604term.html).

One type of qualitative research is the narrative approach. Gall, Borg, and Gall (1996) defined a narrative as "the use of a communication format to organize representations and explanations of personal and social experience" (p. 629). Furthermore, Connelly and Clandinin (1994b) suggested that it is suitable for educational research that reports on the human aspects of a study. These authors further refined the definition of the narrative approach by stating that

> narrativists believe that the best way to study human beings is to come to grips with the storied quality of human experience, to record stories of educational experience, and to write still other interpretive stories of education experience. The complex written stories are called narratives. (p. 4046)

In this study I have elected to use the narrative approach. As a research method, the narrative approach was validated by Bruner (1986), Clandinin (1986), Riessman (1993), Clandinin and Connelly (1995), and Gough (n.d.), who used this method to analyze and present findings of their research on educational issues. Clandinin and Connolly (1995)

argued that the narrative approach is an effective research methodology based on the premise that humans are storytelling creatures who, individually or socially, lead storied lives and tell stories of those lives (p. 154). She continued by stating, "The evidence is that teachers must, of necessity, tell stories. . . . It is a way, perhaps the most basic way, that humans make meaning of their experiences" (p. 154).

It is evident in the writings of researchers who applied a narrative perspective that stories of lived experiences are a very powerful form of research; and this genre of research is built upon a concern that teachers constantly seek to improve the human condition through continuous improvement to their craft. For example, Riessman (1993) asserted that "narrative analysis allows for systematic study of personal experience and meaning: how events have been constructed by active subjects" (p. 70). Cortazzi (1993) strengthened the argument for the use of the narrative approach by declaring that "clearly the [narratives] have much to offer for this purpose. In general, the research emphasizes how narratives play an important role in teachers' pedagogical development and career history, also that narratives are key data for investigations of the teachers' world" (p. 23). Cortazzi continued by advocating that

> teachers' narratives provide stories of their actual experiences–these we need to know about, for reasons theoretical and practical. Teachers' narratives tell us about their ways of seeing and thinking–these, also, we need to know about. Narrative analysis is one way to find out. (p. 139)

The use of the narrative approach in educational research is gaining popularity and validity because more often teachers are being seen as agents of change in the

improvement of the practice of teaching. This conclusion was validated by Clandinin and Connolly (1986, 1991, 1995), Cortazzi (1993), Hevern (1996), and Riessman (1993). One reason that I undertook this research was to help me to think about and question my own practices in order to explain those practices and reflect upon them. As Clandinin and Connelly (1991) wrote:

> One purpose of reflective research is to have other readers raise questions about their practices, their ways of knowing. Narrative inquiries are shared in ways that help readers question their own stories, raise their own questions about practices, and see in their own narrative accounts stories of their own stories. The intent is to foster reflection, storying, and restorying for readers. (p. 277)

The narrative approach is one way of looking at the human condition, as Bruner (1986) pointed out when he said, "Narrative is built upon concern for the human condition" (p. 14). Because humans are learning animals, it is important that we understand teaching-learning relationships; one way of accomplishing this is by chronicling school situations. Thus, writing a first-hand account of my experiences about implementing a Web-Based Instruction site for the Information Processing strand of Career and Technology Studies added dimension to my student-teacher by encouraging me to ask myself the following questions: How did this happen? What was the cause of that? What might have happened if . . . ?

Hopkins (1985) supported the role of the teacher as a researcher when he stated that classroom-based research

> enables teachers to become more self-conscious, systematic and critical about their teaching with the aim of improving it. By so doing teachers will develop more power over their professional lives and be better able to create classrooms and schools more responsive to the vision they and we have for our children's future. (p. 129)

A narrative approach may include several sources of data (Casey, 1996, pp. 211-253; Connolly & Clandinin, 1994a, pp. 4046-4051) including personal accounts, stories, journals, and conversations with participants. These are known as field text in narrative research. Field texts may take many forms, including written responses or other stories. According to Connolly and Clandinin, field texts written by participants "tend to be close to experience, descriptive, and shaped around specific events" (p. 4049).

In educational studies we work with people in a social context; therefore, the classroom cannot be ignored in this research, and, for this reason, the conversations with students are included. Gover (n.d.) wrote that narrative researchers "identify with or partake in the stories of others, we constitute and reconstitute our identities within their physical, cultural, and historical contexts" (p. 7). In other words, narrative researchers build meaning from the stories of others. As students, participated in this study they built meaning; therefore their stories became part of my story. Their stories were captured in conversations with them and are further described later in this chapter in the section titled "Data Collection."

Schiffrin (1994) wrote that "narratives have a linear structure in which different sections present different kinds of information" (p. 284). For example, as will be

discussed in the section titled "Data Collection," I used a journal, conversations with students, and conversations with a colleague; and together the three sources were used to triangulate the findings. Schiffrin added further support for the use of multiple data sources within a narrative when she wrote: "Narratives are autonomous textual units whose internal parts stand in systematic relationship with one another" (p. 285).

In citing the previous references, it is clear that the use of the narrative approach has become a legitimate method of research in the field of education. This research method is the most appropriate one for guiding the study of my experience of developing and implementing Web-Based Instruction and examining its usefulness in offering the Information Processing strand of the CTS program. In the next section I reflect on the assumptions I held prior to conducting this study.

A Reflection on Reflective Teaching

As I previously mentioned, my interest in reflective analysis came from a need to conduct my study of designing and implementing a Web site with a critical look at how it worked and how it helped me to teach. By designing and implementing a Web site to help me teach my subject area, I had two goals in mind: (a) to use the Web site in classroom teaching, and (b) to allow me to spend more time working with individual students to develop more personal relationships (pedagogy). The central question was, "Is the Web site useful for student learning and my teaching?" I wondered how I would be able to answer that question; the obvious response was "through reflective teaching," but I needed to validate this approach in research and to determine if I was, or could be, a reflective teacher by looking back on the activities of the day to identify how students

used the Web site, how I used the Web site, how I could have improved it, what questions arose repeatedly in class, and how those questions could be answered through the Web site.

Reflective teaching was supported by Grant (1984), van Manen (1991), Eby (1992), Lasley and Matcynski (1995), and Lovat and Smith (1995), who all suggested that, in order to improve upon one's teaching skills, one must reflect upon all aspects of one's practice. Those authors cautioned that reflective teaching is more about the relationships established in teaching than about a technique that might increase student achievement. Furthermore, they suggested that reflective teaching may increase a teacher's personal feeling of fulfillment and professional self-worth because it involves many traits that are uniquely human. Some of these traits include the exploration of classroom practice, intuition, emotion, and passion. As an example, Zeichner and Liston (1996) defined a reflective teacher as one who

- examines, frames, and attempts to solve the dilemmas of classroom practice;
- develops an awareness of and questions the assumptions and values he or she brings to teaching;
- attends to the institutional and cultural contexts in which he or she teaches;
- takes part in curriculum development and is involved in school change efforts; and
- takes responsibility for his or her own professional development (p. 6).

In conclusion, the literature suggested that one way to improve the practice of teaching is through professional reflection and that teachers who participate in such

behaviour provide themselves with the opportunity to think, rethink, and revise the manner in which they teach.

Assumptions

In conducting my study from a narrative perspective, it was necessary for me to examine my assumptions and beliefs. This study is a personal reflection of my experiences while I was developing and implementing the Web site. The Web-Based Instruction was an attempt to facilitate learning and teaching by using the Web site for classroom instruction. I believe that my best teaching occurs when I can spend more time with individuals or small groups of students. One assumption that I made, therefore, was that Web-Based Instruction would allow me to spend more time with individual students.

A second assumption that I made was that teaching is hermeneutic. That is to say, effective teachers reflect on their activities, methods, and approaches and make continual modifications to improve their craft. My assumption, therefore, was that teaching is a reflective craft which needed to be documented and reported in order to improve that craft.

A third assumption that I made prior to this study was that, in order to be successful, students will require some basic knowledge of computer use and operations. It is my hope that students can transfer generic computer skills to other aspects of their lives.

The fourth assumption that I made was that humans, as learning beings, engage in lifelong learning activities. This assumption applied to me as a researcher, and I believe that this research was a learning experience and that the story of my experiences needed

to be told.

The fifth assumption that I made was that, as classrooms become filled with students of increasing diversity, teachers will become less the dispensers of knowledge in the classroom and will become increasingly guides to students who explore multiple sources of information, and that they will become the ones to find, evaluate, and synthesize information.

Although the debate as to whether computers need to be in schools at all continues, the sixth assumption that I made was that computers are here to stay, that they will become ubiquitous in classrooms, and that teachers will find creative ways to use computers for learning and teaching.

Research Site

The research site was my place of employment. As researcher, I had full control over how each class was instructed. This provided continuity amongst the six classes that participated in the study. Enrolment at the school during the study period was approximately 700 students in Grades 7 to 9. The school offered traditional programming of the junior high school curriculum as prescribed by Alberta Education, including complementary courses such as CTS. The study sample consisted of approximately 162 students who were enrolled in Grade 7. Class composition consisted of heterogeneous groupings representing a diversity of student knowledge, skills, and attitudes. The study was confined to Grade 7 students because they had not had any instruction at the research site and therefore were not familiar with the learning activities that I used. Students whom I had previously taught–that is, Grade 8 students–were familiar with the print

version of my program and with my method of teaching and might have been challenged in adjusting to the Web-Based Instruction site. For this reason, my study focused only on Grade 7 students, who had not used the Web-Based Instruction in my school.

Data Collection

Previously, the rationale behind my decision to use narrative as the methodology for this research on the development and implementation of Web-Based Instruction was discussed. The purpose of this section is to describe the methods of data collection that were employed.

It should be noted that the involvement of a researcher in a qualitative study is more personal than the involvement of a researcher in a quantitative study. The research for this study took place with students in my classroom. For this reason, I was highly involved with many aspects of student learning and with the learning environment.

Clandinin (1986) further supported the use of teachers as researchers. She stated that "theory, in the dialectical view, is not separate and distinct from practice, but inseparable from practice" (p. 167). Both Clandinin and Kopkins (1985) said that the theory of education and the practice of education are so closely tied as to be inseparable. It is for this reason that I was the teacher-researcher in my study on Web-Based Instruction. Therefore, the major source of data for this study was my journal. The other two data sources were conversations with students and conversations with a colleague. Each of these three data-collection methods is described separately in the following paragraphs.

Journal

One source of data used for this study was a research journal. My journal consisted of a series of field notes that chronicled events, questions, and observations that I made as the Web-Based Instruction system was used by the students and me. Some of the advantages of keeping field notes were that they

- were very simple to keep; no outside researcher was required;
- provided a good, ongoing record; and when used as a diary, they provided good continuity;
- provided first-hand information that could be studied conveniently in my own time;
- acted as memory aids when I analyzed the entries;
- helped to relate incidents and explore emerging trends; and
- were very useful as I wrote my narrative (adapted from Hopkins, 1985).

Conversations

The second and third sources adopted for collecting data were conversations with students involved in the study and a colleague who used the Web site. According to Connelly and Clandinin (1994a), "Conversation covers many kinds of activities, including letter writing. Usually conversation refers to nonhierarchical oral exchanges among researchers and participants in collaborative inquiries" (p. 4049). Therefore, I encouraged my students to engage in conversation through electronic letter writing and forward their thoughts and feelings about Web-Based Instruction from the beginning of the study to the end of it. However, only the students' comments from a series of six

statements, sent to them in May, are reported in this document.

To ensure anonymity, I requested that student letters not be identified with names and that return addresses on electronic mail be deleted. Students had the opportunity to request that their responses not be used in this study, and they were informed that they could opt out of the study at any time. The conversations throughout the study helped me to edit and revise the Web pages.

The students' comments at the completion of the study in May of 1998 were solicited so I could learn about their specific views related to using the Information Processing Web site. I wanted to determine how the students felt about the use of Web-Based Instruction for instructional purposes. Students were asked to respond, using electronic mail, to an open-ended series of five statements and one question to determine how they felt about using the Information Processing Web site to help them complete the course. The responses received were saved as text files, and I did not read the responses until the school year ended and Progress Reports had been issued. The purpose was to ensure that student marks were in no way affected by the responses. Additionally, students could choose not to submit a response. Because there were a number of activities happening during class, whether or not students submitted a response would probably not be noticed by their peers. The students were asked to submit an electronic mail response because I wanted as many students to submit a response as possible, and interviewing the students involved in the study was not possible because of time constraints in both their schedules and mine. In addition, I felt the students would find an electronic mail response less stressful than an in-person interview.

Prior to seeking input from the students in the study group, I administered the statements to a group of Grade 8 students to determine if students would understand the nature of the statements. I reviewed the responses received from this group of students, after which I revised one of the statements that would be presented to the study group. The statement "Describe and give three examples of how you used the Information Processing Web site" was not clear to students because many of the responses referred to how they used the Internet rather than how they used the Information Processing Web site. The Grade 8 responses were subsequently destroyed.

In addition to conversations with my students, I engaged in conversations with a colleague who was using the Web site to supplement her instruction. These conversations took place over the length of the study, and in May of the study year I asked her to provide me with a written response describing her experience with Web-Based Instruction. This response is included in Chapter Six. The purpose of soliciting this information from her was to use it as another means of validating my findings.

Data Analysis

When qualitative researchers begin to analyze the data, they need to ensure the trustworthiness of their findings. As stated by Altheide and Johnson (1998): "How a researcher accounts for his or her approach to certain aspects of research, including the routine sources of problems, is key for evaluating the work substantively and methodologically" (p. 295). Those same researchers also pointed out that researchers who used a qualitative method were "providing a 'text,' which in turn is read and interpreted

by readers and audiences, who, because of their own interpretive and sense-making capacities, will derive their own unique meanings or 'readings' of the text" (p. 286). They further pointed out that validity is added when the researcher clearly states the conditions under which the research was conducted and the findings were reported; that is to say, a researcher must describe the context of the research. As a result, the reader is able to interpret the results as they are presented. The conditions under which this research was conducted were presented earlier in this chapter. Further, Althiede and Johnson wrote:

> The perspectival nature of knowledge is an obdurate fact of ethnography. The approach of the ethnographic ethic acknowledges this, and provides the reader with a explicit statement about "where the author is coming from," which is the ethnographic version of truth in advertising, an ethical responsibility for those who elect to exercise the social science power and authorial voice. (p. 294)

Informing the reader of where I was "coming from" was the topic of the "Personal Ground" section of this chapter.

One source of data that I used in this study was my journal consisting of comments entered at the end of each day. After collecting the data, I reviewed the journal entries and analyzed them for consistent themes. The themes that emerged were related to those activities and challenges related to teaching in a classroom, such as development, implementation, and revision of the Web site; teacher administration time; teacher time with students; and teacher-student relationships. The themes are presented as part of the findings in Chapter Six.

Information accrued from the conversations with students and a colleague was analyzed for common themes. In some cases, quotations were used to enhance the information presented. A discussion of these results is also presented in Chapter Six.

The purpose of using multiple sources of data was to provide triangulation while analyzing the data. Cohen and Manion (1994) stated that "triangulation may be defined as the use of two or more methods of data collection in the study of some aspect of human behavior" (p. 233). These authors further suggested that reliance on a single method of data "may bias or distort the researcher's picture of the particular slice of reality she is investigating" (p. 250). This method of using multiple sources for data collection was also supported by Gall, Borg, and Gall (1996) in their discussion on collaborative evidence (p. 574).

Even though three data sources were used in the collection of data for this study, it is the nature of qualitative research that the researcher must declare all the conditions under which the research was completed. The conditions for this study are described throughout this chapter.

When referring to the qualitative researcher, Richardson (1998) wrote that "qualitative researchers commonly speak of the individual researcher's skills and aptitudes. The researcher–rather than the survey, the questionnaire, or the census tape–is the "instrument" (p. 347); this opinion was further supported by Manning and Cullum-Swan (1998), who wrote: "To a striking extent, narrative analysis is rather loosely formulated, almost intuitive, using terms defined by the analyst. . . . Narrative analysis

typically takes the perspective of the teller, rather than that of the society" (p. 250). As I conducted this study, and as I wrote about the results, I constructed personal meaning from the research. In order to establish trustworthiness and validity of the findings, I ensured that I made ongoing entries in my journal. In addition, I questioned the students about their feelings on using the Web site as described in the methods section. I also had my findings reviewed by a colleague who was using Web-Based Instruction. This same colleague became my critical friend. Furthermore, I involved my supervisor throughout the study.

Ethical Review

An ethical review is required when humans are being studied for research. An ethical review was approved by the Department of Secondary Education Ethical Review Committee. The purpose of the review was to ensure that the students involved in the study school would in no way be harmed by participating in the study.

Ethical Issues

In any study a number of ethical issues may be raised, one of which is that I am the researcher as well as the developer of the Web site being used. To ensure that information presented is trustworthy under the conditions postulated, the advisor for this study was consulted on an ongoing basis. Also, according to Janesick (as cited in Denzin & Lincoln, 1994), "The qualitative researcher uses inductive analysis, which means that categories, themes, and patterns come from the data. The categories that emerge from field notes, documents, and interviews are not imposed prior to data collection" (p. 215). To ensure the reliability of the data collected, I used data triangulation as described by Janesick and

by Cohen and Manion (1994). This type of reliability check uses several types of data collection to ascertain if the data collected are consistent.

Prior to students' involvement in the study, their parents were required to sign a consent form. The parents had the option of withdrawing their children from participating in the study at any time, and students also had the right to opt out.

Limitations

Research such as that undertaken for this study has certain limitations. The first limitation included the technical aspects of computer-network equipment, work-station capabilities, and Internet connection. Although these are very interesting topics, the actual technical aspects of preparing, mounting, and hosting Web-Based Instruction were not within the scope of this study. The second limitation included the socio-economic background of the students; the study school was predominantly a middle-class mix of children from blue-collar and professional families. A third limitation was the issue of the use of home computers by students. Although approximately 85% of the students in the study had computers at home, they reported that they did not use them to access Web-Based Instruction. A fourth limitation was the CTS curriculum. As will be discussed in Chapter Four, this curriculum includes prescribed learner expectations that students must meet for successful completion of a course. Although these are mandated, the instructional strategies used to implement the curriculum are selected by the teacher.

Delimitations

In any study there are a number of delimitations imposed by the researcher to make the study manageable and therefore to be able to report more concisely on a narrow field

of study. The first delimitation was the selection of the population that will be part of the study. The population was delimited to Grade 7 students enroled in the Information Processing course. This delimitation was imposed in order to control the following: previous exposure to my teaching, exposure to the Internet in a classroom setting, and formal school instruction in computer literacy.

A second delimitation that I placed on this study was to avoid discussion of the philosophy of computers in education: the if and why of computer use in schools. I believe that computers will be used in schools into the foreseeable future and that they can be used as one more resource in one's teaching repertoire.

The third delimitation placed on this study was my intent to describe my personal journey of the development and implementation of a Web site to describe the practice of my craft. For this reason, the focus of the study was a narrative about the design and implementation of a Web site for teaching, rather than an evaluation about the effectiveness of the Web site. The latter will be a recommendation for further study.

CHAPTER FOUR

CHARACTERISTICS OF CAREER AND TECHNOLOGY STUDIES

Introduction

In 1984 the Alberta government undertook a review of secondary education, the result of which was the Secondary Education Review and the School Act of 1988. The most notable result of the Secondary Education Review was the re-implementation of standardized government exams. The final report of the Review suggested major changes in the secondary school system, some of which impacted the predecessors of Career and Technology Studies. As a result, the Practical Arts Review was initiated in 1988. Prior to the Practical Arts Review, the curriculum offered through Business, Home Economics, Industrial, Vocational, and Work Experience Education were discrete subject areas.

Practical Arts Review

As a result of the Secondary Education Review, personnel in Alberta Education (1989) saw a need to review the Practical Arts curriculum and stated, "The present curriculum must be reassessed in order to respond to a changing society. With the recent changes in the education environment, the role of Practical Arts must be redefined in the context of a 'broad general education'" (p. 4) as described in *the Proposed Directions for*

Changes for Practical Arts Programs in Secondary Schools in Alberta. The major goals of the Practical Arts Review were to establish the best possible Practical Arts program by

- ensuring the relevance of the programs,
- promoting equity of access to programs, and
- enhancing the credibility of the programs.

In 1989, the Practical Arts Review recommended that the name of these programs be changed to Career and Technology Studies (CTS), and a task force was assembled to re-engineer this curriculum area.

CTS Curriculum Implementation

In an information society characterized by rapid change in the social and economic environment, students must use information and technology effectively and efficiently. Within the context of students' personal life and work life, Career and Technology Studies provides an opportunity for students to link the concrete and psychomotor to the abstract, cognitive elements of learning. With this vision established, the task force began to develop the framework for Career and Technology Studies.

The concept of *career* is integral to CTS. A career not only relates to a person's job or occupation, but also involves one's personal life in both local and global contexts; for example, as a family member, a friend, a community volunteer, or a citizen. Each of these contexts helps open doors to many occupational, employment, and vocational opportunities that will enrich students' opportunities within their families, communities, and the world throughout their life span. With practical, career-related experiences, students will be able to make more effective career decisions and better target their

learning efforts. CTS development was one of the largest projects undertaken by Alberta Education. The development of this program included the involvement of industry, students, practising teachers, administrators, and Alberta Education personnel. The curriculum for CTS was ready for mandatory implementation in September of 1997.

CTS Curriculum Organization

Alberta Education (1996) defined *Career and Technology Studies* as "a competency based, modular curriculum designed as a complementary program for Alberta's secondary schools" (p. A-4). CTS was initiated to help secondary students develop the competencies they need to

- build personal living skills, and
- successfully enter the workplace or a postsecondary education program. (Alberta Education, 1997, p. A-1)

In addition, the curriculum documents advocate that students in CTS will:

- develop skills they can apply in their personal and work lives now and in the future,
- refine their career-planning skills,
- develop technological literacy skills,
- enhance employability skills, and
- apply and reinforce CORE subject learnings. (Alberta Education, 1996, p. A-1)

Figure 1 illustrates how CTS impacts the many aspects of a student's life and education in the progress towards their career goals.

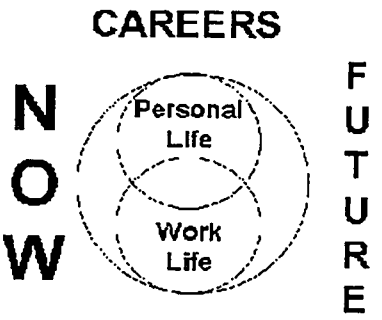

Figure 1: CTS affects students now and in the future as they progress towards their career goals.
(retrieved October 20, 1998, from the World Wide Web: http://ednet.edc.gov.ab.ca/cts/act/actfront.pdf).

As well as helping students on their way to achieving their career goals, CTS helps students in their schooling by building basic and transferable knowledge, skills, and attitudes. Students learn flexibility in adapting to changing situations and develop confidence in their ability to respond to change and to better meet the challenges in their personal and work lives. CTS is designed to provide kinesthetic learning strategies to achieve the desired outcomes of all schooling. Learning how to use resources that are available as part of developing a solution to a need or want has become important to the students who will be living and working beyond the year 2000. Career and Technology Studies was designed to enable students to

- develop awareness and literacy,
- develop technological literacy skills,
- develop critical-thinking and problem-solving skills,
- experience technological applications,

- identify the impacts of technological change in their lives,
- explore further education and career opportunities,
- apply problem-solving skills, and
- integrate courses through technological pursuits.

CTS is organized into 22 career-related strands. These strands are based on the economic sectors in Alberta's economy and are listed below in alphabetical order:

- Agriculture,
- Career Transitions,
- Communications Technology,
- Community Health,
- Construction Technologies,
- Cosmetology,
- Design Studies,
- Electro-Technologies,
- Energy and Mines,
- Enterprise and Innovation,
- Fabrication Studies,
- Fashion Studies,
- Foods,
- Forestry,
- Information Processing,
- Legal Studies,

- Logistics,
- Management & Marketing,
- Mechanics,
- Tourism Studies, and
- Wildlife.

Within each strand are a number of courses which consist of related learning concepts. Each course defines what a student is expected to know and be able to do. In total, approximately 660 one-credit courses are available to schools. Each course contains a number of Module Learner expectations, or MLEs, which are further broken down into Specific Learner Expectations, or SLEs. The MLEs and SLEs describe the competencies that students are expected to demonstrate before being granted the credit or credits. CTS emphasizes

- career awareness;
- consumer knowledge;
- the affects and consequences of technology;
- creative problem-solving techniques;
- understanding technical systems;
- application of science, mathematics, language arts, and computers;
- activity-oriented experiences in technology; and
- a multidisciplinary approach to education.

The courses are organized into three levels: introductory, intermediate, and advanced. Each level builds upon the concepts learned in the previous level, and students

are expected to demonstrate higher degrees of competency as they progress through the courses (retrieved October 20, 1998, from the World Wide Web: http://ednet.edc.gov.ab.ca/cts/act/actfront.pdf). However, the number of prerequisite courses is very limited. CTS is a results-based curriculum, and there are no boundaries between the junior and senior high school programs. In general, junior high schools offer the introductory level courses. Figure 2 shows the continuous nature of the CTS curriculum.

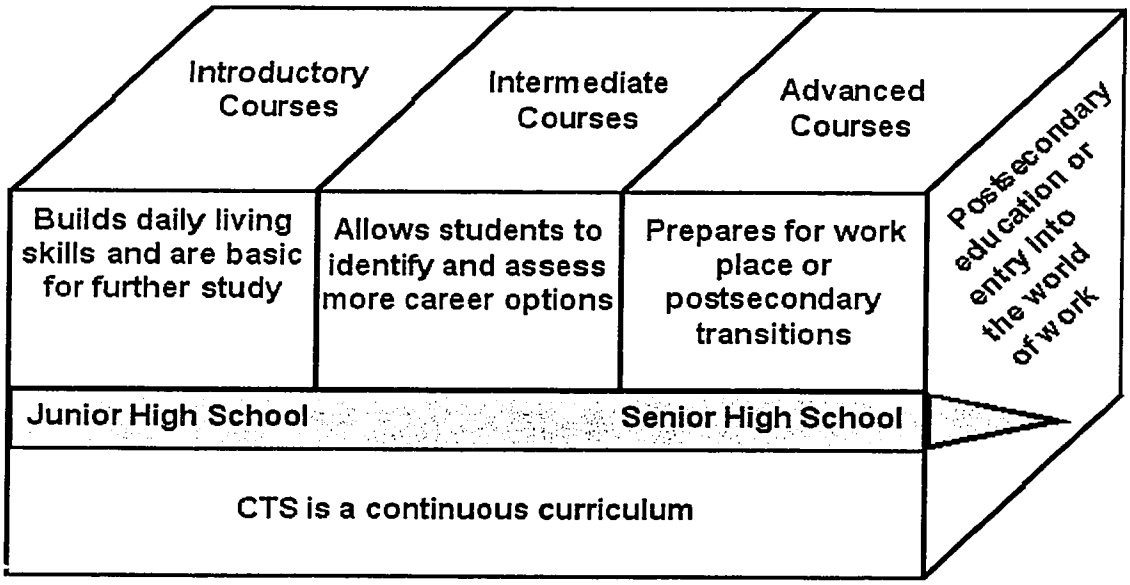

Figure 2: CTS is a continuous curriculum.

Where CTS Fits Within the Junior High School Curriculum

Junior high schools in Alberta must provide students with access to 950 hours of instruction per year in each of Grades 7, 8, and 9. At the junior high school level, schools are encouraged to offer a program that balances all aspects of CTS. In addition to the required core instruction, schools must offer two provincially authorized courses for a recommended time of 75 hours per year for each course. In addition to helping students

achieve the learning expectations outlined in the mission and mandate of education, complementary courses can reinforce learning in core subject areas.

CTS is part of junior high school complementary course choices, and students can access up to 450 hours of instruction in complementary courses during a three-year period in junior high school. Within this time allotment, students can develop the competencies for some CTS strands. Because the curriculum structure of CTS is organized into levels rather than grades, the competencies that students develop in junior high school could form the foundation for further development at senior high school, and challenge credits are available from some schools (Alberta Education, 1998b, p. 26).

Introductory courses are considered to be the most suitable choices for junior high schools to offer, because they are generally more focused on personal use and consumerism. From the 22 different strands, junior high schools can design courses which include

- complete courses from one strand,
- components of courses from one strand,
- courses from one or more strands, and
- components of courses from one or more strands.

When assembling courses for students at the junior high school level, the CTS courses selected do not have to be completed in a single year. The flexibility of the CTS program at the junior high school level allows individual schools to create courses that meet the needs of individual students, schools, and the community.

Characteristics of CTS

Many characteristics distinguish the delivery of CTS that may not be used in other subject areas. These characteristics are based on traditional methods of teaching this subject area and have their roots in the former subject areas of Business, Home Economics, and Industrial and Vocational Education. One characteristic of CTS is that it is a continuum from Grade 7 through Grade 12, and there is no delimitation between junior and senior high school, as is the case for core and other complementary subject areas. Because of this, there is no regulation on waiver of prerequisites as outlined in the *Guide to Education: Senior High School Handbook.* In other words, students may receive advance credits at high school if they can demonstrate CTS competencies in junior high school.

A second characteristic of CTS is the definition of discrete one-credit courses of instruction. It is important to note that CTS courses are results based rather than time based. Because the curriculum is organized in this manner, it sets curriculum standards that clearly define course learning expectations (MLE) or what students are expected to know and be able to do–what competencies or knowledge, skills, and attitudes are to be demonstrated. The CTS curriculum also sets assessment standards by establishing the criteria and conditions for assessing student performance. Within the 660 courses available to CTS teachers, there also are specific learning expectations (SLE). Each SLE further specifies the competencies from the MLE that students should demonstrate.

A third characteristic is that this curriculum in some strands is usually taught in a multiple-activity setting. This means that there may be a number of different courses

and/or strands being offered to students in the same laboratory or classroom. In addition, students may be working on several MLEs or SLEs in any class at the same time. Typically, this means that each student in each class is working on something different. In order to organize the CTS laboratory, there are several related areas, each containing the tools, equipment, and supplies required for projects in that area. Some teachers organize their classrooms or laboratories around learning centers. The projects within an area are related by course or strand similarities. In such a setting, the teacher circulates around the room, working with small groups and individual students, assisting students to solve problems by answering questions as they arise. Much of the instruction is offered to students "just-in-time," during a "teachable moment," or just prior to their needing the skills or knowledge needed to complete a particular task.

A fourth characteristic of CTS teaching methodology is the use of a multiple sensory, or kinaesthetic, approach. Because CTS courses are practical in nature, students complete numerous projects involving a variety of hands-on activities to reinforce the cognitive aspects of their learning. Through the use of hearing, feeling, and doing, students learn the knowledge, skills, and attitudes required by the CTS curriculum.

A fifth characteristic of CTS is the variety of strategies CTS teachers employ to provide CTS curriculum. One strategy is to create a series of electronic or printed student learning guides (SLGs) that provide students with step-by-step instructions. CTS teachers write the instructions in such a way that students can easily follow the steps. With properly written instructional materials, students are presented with a single operation in the same instruction. Many CTS teachers include illustrated instructional materials, in

which each step also has an accompanying illustration or photograph to better show the operation within SLGs. In the past, this may have been taught through the use of slide-tape productions, a video tape, or a pictorial programmed instruction booklet. In the case of the Web-Based Instruction site described in this study, illustrations and animations have been added to the text in order to meet the needs of a variety of learning styles.

With print materials, many CTS teachers color code the instructional and organizational materials based on grade level, course, or strand. This helps in identifying the course or level in which the student is working. Print materials are often filed in the classroom or laboratory, and students help themselves to the necessary instructional materials as they need them.

As previously mentioned, CTS is a competency-based curriculum, so students progress through the MLEs and SLEs based on their ability to demonstrate competency in the learning expectations, progressing until all those that are identified for a course have been demonstrated. Because students learn at different rates, CTS teachers can establish a self-paced progression system using the strategies discussed above.

Summary

The purpose of this chapter was to describe the characteristics of CTS programs by tracing the historical development of this subject area. The current state of CTS is a result of the integration of several former subject areas. All of these subject areas currently use similar methods of instruction, including student learning guides, course and specific learner expectations, multiple activities in a single classroom or laboratory, and self-paced progress by using SLGs. In addition, SLGs generally include step-by-step

instructions that students follow in order to demonstrate the knowledge, skills, and attitudes outlined within the curriculum documents. In most cases, teachers act more as facilitators of learning than as purveyors of knowledge. With this foundation in place, it is possible to design a Web-Based Instruction method for CTS instruction. The development and implementation of such a Web site for courses within the Information Processing strand of CTS is the topic of the next chapter.

CHAPTER FIVE

DESIGN, IMPLEMENTATION, MAINTENANCE, AND FUTURE DEVELOPMENTS OF THE WEB SITE

Introduction

The Information Processing Web site designed for this study can be viewed by using the companion CD-ROM included in Appendix A. As mentioned in Chapter One, the Web site was specifically designed to supplement my teaching of the Information Processing Strand of Career and Technology Studies (CTS) as prescribed by Alberta Education, as well as to incorporate the distinguishing features of the CTS program that were described in Chapter Four. The purpose of this chapter is to outline the elements that were used in designing the Web pages for this study. By using examples from and links to Web pages on the Web, the reasons for the final design choice will be outlined. It should be noted that the examples of other Web sites provided in this discussion are for illustration, and the evaluation of them is not part of this study.

In the design and development of Web pages for display on the Web, there were a number of design issues that needed to be addressed. This was especially true when creating Web-Based learning systems for junior high students, because the majority of

them may not be prepared to endure complicated navigation procedures. The WWW lends itself very well to the use of Web-Based Instruction, especially when considering the diverse computer platforms and array of software available to students and educators.

There were five distinct steps in the development of the Information Processing Web site:

- research and pilot,
- final development,
- implementation,
- review, revision, and maintenance, and
- future action.

The five steps mentioned above are based on Gustafson and Tillman (1991); they outlined the steps of instructional design. The first step incorporates the establishment of the objectives, methods, and evaluation criteria. Secondly, the instructional design process must use a planned approach in order to be effective. The third step is that the instructional design process must provide for an orderly but flexible sequence. Fourthly, the instructional design procedure must be based on research. The fifth step states that the design process must be hermeneutic; testing and improvement must be built into the design. Finally, the sixth step requires that the final version of the instructional product must result in an acceptable level of performance by the learners (p. 6). Although the steps listed above for the design process involved in the Web site used in this study are not identical to the steps involved in the instructional design process as described by Gustafson and Tillman, they were utilized throughout.

Another important factor in the instructional design process is the focus of the product; Gustafson and Tillman (1991) stated "Instructional design focuses on the learner rather than the teacher. The goal is changes in learner knowledge, skill, and attitude. The teacher is seen as only one instrument in achieving these ends" (p. 8). This focus was evident throughout the study.

Each of the five phases listed for the development and implementation of the Web site had unique problems and concerns that needed to be dealt with, and they are discussed next in this chapter.

Research and Pilot

In order to put the Web page design in perspective, the goals of the Web site must be restated. The goal was simplicity in design and code. Although complex code could have been used, I chose the easy-to-understand-and-use Hyper Text Markup Language (HTML) code. One of the features of scripting in HTML is the short learning curve involved: HTML uses English-like commands enclosed in brackets, and the commands relate directly to the function desired. For example, the HTML tag to center a line of text is <CENTER>, and the code to discontinue the use the center function is </CENTER>. In reality, teachers receive little or no time for the preparation of course materials, let alone for research into and development of new ways of teaching, so it was important to design Web pages that could be easily modified by teachers. Teachers usually do not have an instructional materials preparation staff; therefore, simplifying the task of preparing learning materials is welcomed. Another factor in the design of the Web pages was the

intended audience of the Web site. Students who used the Information Processing Web site in the study school were junior high school students. In general, adolescents enjoy, and are accustomed to, watching active multimedia. For this reason, elements placed on the Web pages must appeal to this group, even though a business Web page might not make the same use of some of the features.

The Internet itself is not a panacea for curriculum reform, but it can enhance classroom activities when appropriately planned and implemented; it can allow the teacher to step back from always being "on show" and help students take more responsibility for their learning. In such cases, teachers participate in more one-on-one teaching and less direct, whole-class instruction. Thus, Web-Based Instruction can offer an enhancement to classroom instruction when used as an adjunct.

To Frame or Not to Frame

As with any visual production, the placement of the various elements on a Web page must be carefully thought out by the creator. Pages must be appealing, yet convey the necessary information. Perhaps the area of most controversy during the research and pilot phase was the issue of the use of frames in Web Page design. According to Nielsen (1996; http://www.useit.com/alertbox/9612.html), frames break the simplicity model of Web design and make navigation more difficult, because such actions as "Back" and "Forward" on Web Browsers do not always produce the expected or consistent results in frame-designed pages. In addition, Nielsen mentioned that creating bookmarks for Web pages that use frames is often difficult, or not possible at all, because the user may be bookmarking a frame of lesser importance than the intended frame. Another concern

raised by Nielsen was that many people who use the World Wide Web continue to use browsers that will not display frames properly. In the case of this study, however, that was not a concern. First, the test site used the latest version of Netscape Navigator, which does display frames. Secondly, the project is aimed at schools, and Netscape Navigator is available at no cost to educational institutions. For this reason, the ability to display frames was not a factor in the design issue.

As previously noted, the first issue that arose during the research and pilot phase was related to the basic elements of the design of the Web site. Initially, concern arose over whether or not to use frames. On a Web site, information is typically presented in a one-column format, much like information in a book. However, it is possible to present information in column-like fashion, using independent frames. When presented in such a manner, information presented in one frame may be linked to information in another frame, but both frames work independently. The issue with frames is related to their ability to present information on a Web page more efficiently than on a Web page without frames. Amongst Web designers this is a huge issue, and, generally, either designers like frames or they do not. In order to determine which method of presentation was going to be the most appropriate, I undertook two activities. First, I contacted the World Wide Web Developers' Forum, a listserve based out of the University of New Brunswick, and posed the question of whether frames should be used. Some of the respondents stated that frames should never be used, whereas others said that they should be used. However, the most common piece of advice was that the purpose of the Web site should drive the design. In other words, most respondents agreed that frames should be

used if they enhance the functionality of the Web site by making it more efficient or easier for students to use.

Secondly, I examined hundreds of sites around the world to see how other Web site authors employed frames. Perhaps the best example of an educational Web site using frames is the Educational Psychology 597 (http://www.quasar.ualberta.ca/nethowto/) The Internet: Communicating, Accessing, and Providing Information course offered at the University of Alberta. This Web site incorporates a side bar to the left of the main frame for course navigation and a ledger bar across the bottom of the page for general navigation tools such as e-mail and help. As previously mentioned, frames need to be used with moderation, because too many frames make a page difficult to read and reduce the amount of space available for the primary information. An example of a site that used several frames was the Wits Deverge Site (http://user.itl.net/~hewitt/main.html). In my opinion, the overuse of frames in this case left very little room for the main content frame.

Once the basic issues of design were dealt with, I mounted the initial Web pages on a server and asked several students to review three different versions: one version without frames, one version with two frames, and a third version with three frames. The students had mixed responses to the two- and three-frame versions, but they were very clear in saying that they did not like the no-frame version. It then became a matter for me, as the teacher-as-Web-page-designer, to synthesize the information and make a decision as to the best educational design of the Web pages to achieve the purpose of the Web site. I chose a two-frame design, with the left-hand frame occupying 15% and the right hand

frame occupying 85% of the monitor area. The left-hand frame was used for navigation purposes–that is, getting around the Web site–whereas the right-hand frame was used for presentation of curricular materials. I discarded the three-frame version because it did not leave enough room for content on most monitors. An example of the page design is shown below:

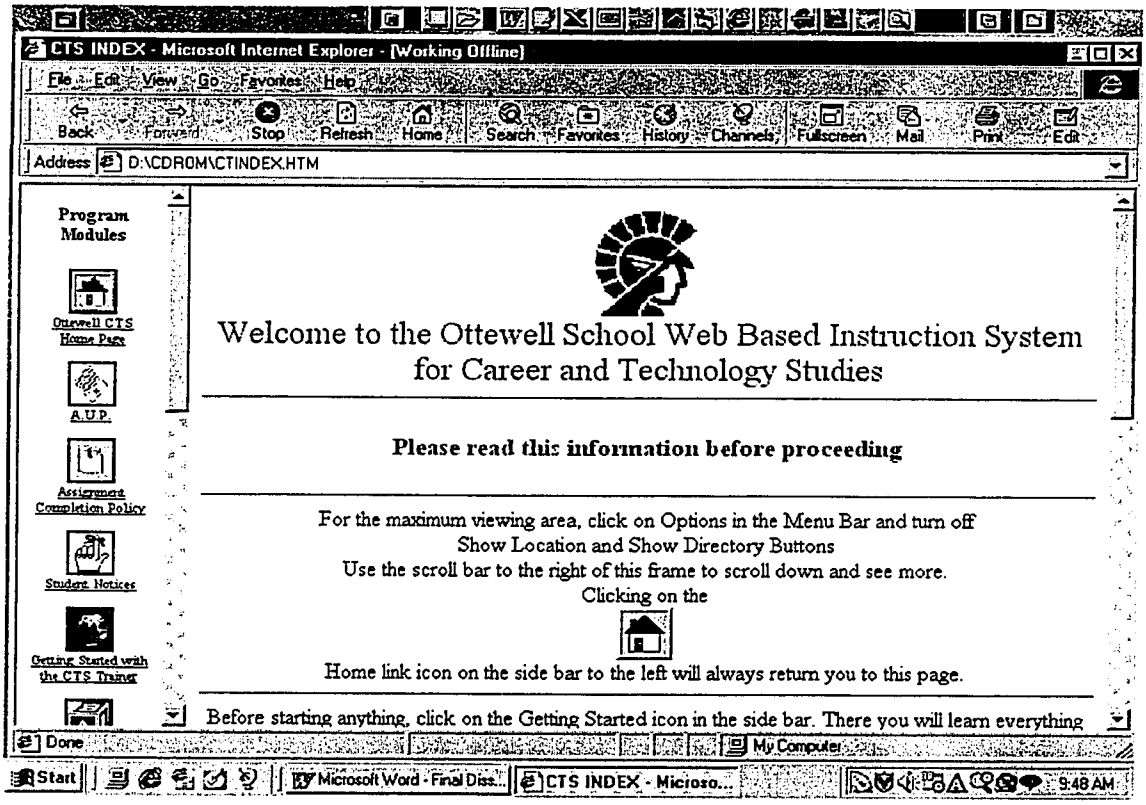

Figure 3: Design of the information processing Web page.

Animated or Static Icons

A second issue that arose while I researched Web page design was the use of animated, or moving, icons. Icons are the graphic symbols on which students click to link from one page to another page on a Web site. Animated icons, as well as the use of

graphics and color, all play an important role in attracting and keeping the students' attention. These features need to be used without being overly distracting to the curriculum being presented. Once again students were asked their opinions, and they agreed that the moving icons were desirable. For this reason, animated icons were used, even though this type of feature might not appeal to, or be effective in, Web sites designed for the adult business community.

Final Development

With the basic design features decided upon, content was added to the Web pages. One purpose of this section is to describe my experiences while I implemented and used the Web site for classroom instruction. Initially, I began by looking at what I was currently doing with my Information Processing classes and used that as a starting point. It should be noted that this Web site was used with regular teaching and not as an off-site or distance education model. As mentioned in Chapter Two, research on using a Web site for classroom instruction was lacking, which therefore was one factor in determining the topic of my study.

Another purpose of this section is to describe the nature of the students and the classroom environment in which they worked. It is important to know this information because it was critical to understanding how using a Web site could be most useful for classroom instruction.

Classroom Makeup

All classes in the school in which I taught were fully integrated, and therefore each class consisted of students with various knowledge, skills, and attitudes. The classes that

participated in the study were Grade 7 students taking Information Processing. Each class had an enrollment of between 27 and 30 students, and they met once a week for 48 minutes in the computer classroom. Figure 4 illustrates the layout of the classroom.

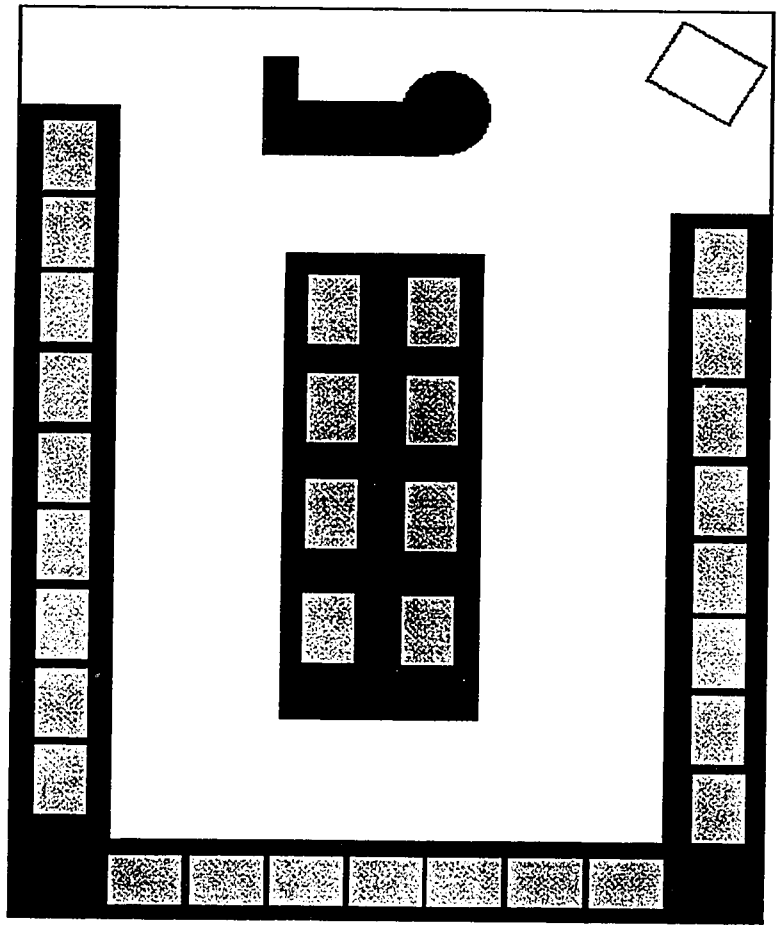

Figure 4: Layout of the information processing classroom.

The layout of any classroom is an important factor for effective teaching; this is no less so in a CTS classroom. All workstations were highly visible from the teacher's station, and all monitors could be easily seen by me. This ensured supervision of student work from anywhere within the classroom. A large monitor cabled to my workstation was located in the front corner of the room where all students could see it, watch, and follow

along while I demonstrated concepts or introduced new skills on the teacher workstation.

Course Organization

One of the positive features of the study site was the computer program, which was a two-tiered program that consisted of (a) a mandatory, once-a-week class in Information Processing which all students take once in both Grades 7 and 8; and (b) a complementary program that students may take in any or all three grades. Each tier included different skills, so there was no duplication. Students in all computer classes were enroled in the CTS strand called Information Processing. Within the Information Processing strand there are approximately 43 one-credit courses that cover different aspects of information technology and computer use, and there are general and specific learner expectations (which included mandatory computer skills). I organized my program around those learner expectations; for example, students taking the Grade 7 Information Processing program were taught the following skills:

- basic computer operations,
- using a network,
- using a graphic user interface (Windows),
- using on-line resources (CD-ROMs, library search system),
- using the Internet (basic navigation and search techniques),
- file management,
- introduction to word processing, and
- integration with academic subjects.

The Print Model

In Chapter Four the distinguishing characteristics of the CTS program were discussed. CTS courses in general are designed to be offered on a competency based, self-paced model of instruction. This means that students progress through various courses largely at their own rate as they demonstrate competencies that are required. For this reason, students in a single class are usually working on different projects or assignments. Because of this, CTS teachers usually have many projects designed and available for students to access at any one time, and there is much "just-in-time" teaching in many CTS courses.

The print model of my courses consisted of assignment sheets which provided step-by-step instruction, and an assessment rubric for each project that the students were required to complete. All of this paperwork was kept in a file system, and each grade level was color coded for ease of management. Typically, I would introduce a new skill or concept, then hand out the assignment sheets to students. Often, assignment sheets would be left behind, thrown out, or lost in students' lockers (or dropped on the floor); and during the next class students might ask for an additional copy. Once students completed a project, they would print their work and submit it for marking. In total, I used approximately 50,000 sheets of paper to teach my Information Processing Program and spent hundreds of hours managing the resulting "paper chase."

The Web Model

In 1995 my school was connected to the Internet, and at that point it was a novelty. There were little direction and little use of the Internet in the school at that time.

However, I soon came to realize the potential of the WWW component of the Internet, how it could help me teach, and how curriculum materials could be presented to students in a variety of ways to appeal to individual differences. I set out to convert print-based materials to Web-Based materials. The nature of the Web site will be described in the next section, and my experiences with respect to teaching with the Web site will be related in the section titled "Using the Web Site."

The Nature of the Web Site

When students opened the Web site, they saw two frames on their monitor (see Figure 3). The two frames remained consistent throughout the Web site. The left frame was for navigation, and the larger right-hand frame was the instructional or content frame. Students navigated through the Web site by clicking on the appropriate icon in the left frame, and the linked instructional materials were presented in the right frame.

The Web site was organized first into grade levels, then into specific projects that students completed. One of the immediate advantages of the Web site was the reduction of paper used to manage my program. For example, students e-mailed assignments to me, and I marked them; assignments were never printed. Having marked the assignments, I returned e-mail to students with marks and constructive comments. Students were encouraged to make corrections and resubmit all assignments for possible mark changes. The Web site was available on the public side of the Internet, so students could access the Information Processing Web site from home if they had an Internet connection. A reflective journal was used to document the implementation and characteristics of the Web site; it will be discussed in the "Implementation" section of this chapter.

One reason I used Web-Based Instruction was the ability of Web pages to provide additional stimuli for students, such as the addition of color and graphics in the design and presentation of the instructional materials. In a print-based method of presentation, graphics and illustrations could be used; but the use of color, other than colored paper, was prohibitive due to the cost of color reproduction. However, the use of digital technology and a computer monitor allowed for the use of color to emphasize certain points, to capture student attention, or to indicate steps in a procedure. In addition, movement could be added to the Web site in the form of moving icons, screen animation, or video clips to provide additional information or emphasis.

Considerable effort was put into the reformatting of the print version of my instructional materials in order to develop a presentable Web site. Arguments suggest that simply converting print materials does not use the power of the World Wide Web and that such instructional materials would be more appropriately copied to and distributed on a CD-ROM. However, the Internet is available in most schools and certainly was easily accessible in the school used for this study. In addition, the Web site was mounted on the school network, making it a less expensive alternative to CD-ROM. Furthermore, the CD-ROM would have involved duplication and in-class management issues that were not present when the Web site was mounted on the school server. Another argument against simple conversion of print materials was that this process involved simply repackaging the same instructional methods. With the Web site, however, it was possible to add color and animation that would not be available in traditionally printed instructional materials. The first version of the Web site used in this study should be considered a starting point

for the use of Web-Based Instruction for classroom teaching; and, further, refinement and sophistication would be added as the implementation was monitored and refined.

Implementation

The design of the Web site spanned a year, and the gestation period to research, test, and mount the Web site was about eight months. An expert in Web instruction in the Department of Educational Psychology at the University of Alberta was consulted regarding the design of the Web site, and his comments and suggestions were incorporated within the final design. Once the basic elements of design, as described earlier, were decided upon and piloted with students, the final design was developed and accompanying instructional materials were prepared and mounted. The Web site was ready for classroom implementation in September of 1997.

Implementation of the Web site consisted of two phases: (a) mounting and making it available to the students, and, (b) having the students use it.

Mounting the Web Site

Mounting the Web site was purely a technical matter. The Web pages and associated graphic files were developed off-line and tested using the local hard drive on a computer. Once the operation of all aspects of the Web site were ensured, the entire set of files was copied to the school's Local Area Network (LAN) server. The files, once on the LAN server, were protected from tampering by users by restricting the access to read only. Consequently, students could access the files as required for their classroom work, but could not delete or modify files. The Web site was mounted on the LAN server rather than on individual workstations for ease of maintenance. Any revisions or modifications

required to any of the files could be made on the off-line version, then copied to the LAN server and made available to all students. By using a centralized management method, there was no need to visit all of the workstations in the school. Once the Web site files were made available on the LAN server, an icon was created on the students' desktops, and access to the Web site was gained by clicking the icon. This started the primary Web site file, which in turn linked to other necessary files in typical WWW fashion. What the students were actually using, however, was an Intranet version of the Web site, rather than an Internet version. The purpose of the Intranet was to ensure that the Web site would always be available for students to use and that the speed of downloading various files to the students' computers would not be affected by the bandwidth of the Internet connection.

The Web site files were also copied to the District Web server in a directory reserved for the school. This directory resided on the public side of the District firewall, and so was available to anyone knowing the Internet URL of the Web site. The purpose of mirroring the site on the Internet was to allow students access to the Web site, should they have chosen to work from their homes. In order to do this, students required their own Internet Service Provider (ISP). There was no requirement for students to have the ability to access the Internet version of the Web site; it was posted and maintained strictly as a convenience.

Once the Web site was running on the Intranet and the Internet, the only changes required to the files were modifications and revisions on an occasional basis for correcting mistakes or clarifying instruction. This maintenance aspect of the Web site will

be discussed in the section titled "Maintenance."

Using the Web Site

The use of the Web site by students was ubiquitous with other functions of the computers. Students accessed the Web site as they would any other application available on the LAN server. Students would often have the Web site active, as well as another application, as they worked through the instructional materials on the Web site and completed exercises in the other application. Students learned how to switch between active applications by using a task list or hot-key combination.

One strategy that I implemented as part of the Web-Based Instruction was electronic mail submission of student assignments. Once I received an assignment, I was able to mark it on my monitor and send it back via return e-mail with a mark and an assessment rubric indicating areas for improvement. All students were encouraged to correct mistakes and resubmit the assignment for marking and potential mark changes.

Some researchers have criticized the use of a Web site for instructional practices. One such criticism of Web-Based Instruction is that it usually requires the learner to do little more than click and follow links from one page to another. This fault of Web-Based Instruction was acknowledged by Ritchie and Hoffman (1996):

> Most educators would agree that for learning to take place, the learner must actively process and make sense of available information. Generally speaking, a more active learner will integrate new knowledge more readily than a passive learner. Unfortunately, active learning is seldom required when learners access the Web. It's true that a user makes decisions as to which link

to pursue, but too often users merely browse information before jumping to another site. (p. 2)

These researchers suggested that one method of overcoming this shortfall of Web-Based Instruction is to require learners to create some type of "artifact" of their learning, some proof or exhibition that students have learned what was intended. Although the authors suggested that students search the Web and synthesize information they have found, it appears that students need to produce a commodity in order to internalize learning. The Web-Based Instruction site used in this study included this idea by requiring students to complete a project for each concept that was introduced.

As a result of using the Web site, students learned to employ computers for dual functions: (a) using the computer as a tool for learning, and (b) using the computer as a tool for productivity.

Review, Revision, and Maintenance

One reason for presenting curriculum to students using a Web site is the ease of revision of curriculum materials. If students were having difficulty understanding a procedure, if there was a spelling error in the instructional materials, or if an additional illustration or graphic was required, it was a relatively minor process to edit and repost. In a situation where the method of instruction used print materials, the revisions would be made in a similar fashion, but there would be the added requirement of duplicating the revised materials and subsequently discarding the former ones. When using paper-based instructional materials, I often found that such revisions where left until the end of the year, and subsequently I had to explain the corrections to each class, as well as to several

students individually in each class. Posting the revised instructional materials to the Web site provided students with the revisions as soon as they were posted; this procedure saved me time during my teaching day. The findings and the discussion of them related to maintenance of the Web site are presented in Chapter Six.

Suggestions for Future Development of the Web Site

One of the overriding design features of the Web site was simplicity in design and production. Therefore, many of the features of the Internet were not incorporated into the original design of the Web site because many schools have access only to slower Internet connections and older computers. The use of high-end capabilities of the Internet, such as full-motion video, would slow down the Web site considerably, and students might not be willing to wait for images to be downloaded to their computers. Another example of features to be avoided are those that made use of the latest multimedia features that can be used on more sophisticated systems. Many schools were using 16-bit operating systems, and because some of the Internet features work only on the 32-bit operating system, it was important to avoid such features.

The potential of the Information Processing Web site for teaching and learning is limited by the current technology and software available. Limitations initially imposed on the Web site determined the features and functionality of the Web site. For example, some schools were still using the Windows 3.1 operating system, and some Web features require Windows 95; for this reason some features could not be built into the Web site. A second example is the bandwidth–the speed of the telecommunications connection–of the connection between the school and the Internet. Many schools used a modem speed of

14.4 kilobytes per second, and large graphics, video, and sound files take far too long to download. Consequently, students would quickly lose interest and probably discontinue use of the Web site.

However, features can be added as the technology available in schools increases. One such feature is the addition of screen snapshots using a program that can capture mouse movements and selections. By using such a program, students are able to see the actual steps they need to follow in order to complete an assignment. Another feature that should be added is the use of video clips. This would be beneficial for introductory portions of the course and for each new concept. A video recording of the teacher–a greeting, for example–could be made and saved on the Web site. Then a link could be made to the video clip, and when the student selects the link, the video would appear on their monitor. With the addition of such a video, the Web site could become more personal. The changing nature of instruction technology will allow more personalized activities to be used in the instructional process.

Duchastel (1996) referred to the changing nature of instructional technology and the fact that it is always in a state of change. Teachers want what is best for students and try numerous approaches to present curriculum. Describing the use of various technologies, he wrote:

> Learning technologies are in evolution. Education television has given way to CAI, which in turn has lead to ICAI (Intelligent CAI), and parallel technology developments have led to the videodisk, to hypermedia, to hand-held computer access and so on. As ever-new technological possibilities turn into

> concrete and economically accessible realities, instructional designers push the envelope of what is practically feasible in new learning designs. The field is thus continually confronted with change, sometimes mildly and sometimes radically. On the whole, that is an excellent position to be in. (p. 2)

Other features that could personalize the Web site would be the use of an applet that requires students to log-in to the Web site. Once students have completed the log-in procedure, instructions could then be personalized with their names. In addition to personalization by using the students' names, some customization according to students' learning styles is also desirable. Personalizing of instruction was supported by Benyon, Stone, and Woodcroffe (1997) as they discussed networked courseware:

> The user needs to be able to state the equivalent of "slow down a minute" or "skip the details." Like in a conversation, the user needs to be able to interrupt. This relationship between providing user control over the amount of detail required and the granularity of the objects is an important consideration. (p. 199)

Although the Web site used for this study was basic in terms of functionality, it allowed for additional multimedia capabilities and personalization of the instructional process as additional expertise was gained in the use of this type of instructional technology.

Summary

According to Ritchie and Hoffman (1996):

> Web pages have the potential to be more than a compendium of information. When properly structured, pages can guide users through a series of instructional activities which present information, afford practice, and provide feedback to inform users of their strengths, weaknesses, and suggestions for enrichment or remediation. Venturing into this new dimension, however, will require thoughtful analysis and investigation of how to use the Web's potential in concert with instructional design principles. If these two forces can be integrated, it may produce a distributed, instructional medium with characteristics unlike previous methods of distance learning. (p. 1)

As stated in Chapter One, the purpose of this study was to describe the development and implementation of a Web site and examine its usefulness in offering the Information Processing course of Career and Technology Studies as outlined in Alberta Education curriculum documents. The study had the following objectives:

- to relate the development and implementation of the Web site, and
- to examine the usefulness of the Web site and Web-Based Instruction.

Chapter Five presented information with respect to the research, design, and implementation of the Web-Based Instruction site. A comprehensive discussion describing the findings from this study is presented in Chapter Six.

CHAPTER SIX

FINDINGS AND DISCUSSION OF FINDINGS

Introduction

The purpose of this study was to describe the development and implementation of a Web site that was used to supplement classroom instruction of the Information Processing Strand of the Career and Technology Studies curriculum as prescribed by Alberta Education. The study had the following objectives:

- to relate the story of the development and implementation of Web-Based Instruction, and
- to examine the usefulness of the Web-Based Instruction

The first purpose was discussed in previous chapters. The purpose of this chapter is to present and discuss the findings. The development and implementation of the Web site was the topic of Chapter Five. The usefulness of the Web site and Web-Based Instruction as perceived by students and teachers emerged within the findings and therefore that phase of the Web site is also presented in this chapter.

Findings

As mentioned in Chapter Three, the following three methods of data collection were employed in this study: personal journal and conversations with both my students and a colleague. The findings presented in this chapter emerged from an analysis of the data collected by each of the three methods.

Personal Journal

Data analysis commenced with an examination of the journal. In a review of the journal entries, the following four themes, in no significant order, emerged:

- maintenance of the Web site,
- types of teacher activity,
- continuity of instruction, and
- learning characteristics of students.

These four themes recurred throughout the journal, and each is interwoven with the other. However, in order to add clarity, each theme is presented separately. Finally, the themes are synthesized to summarize the findings that emerged from the use of Web-Based Instruction for classroom teaching.

Maintenance of the Web site. In Chapter Five the process involved in the design and implementation of the Web site was presented. Once the Web site was mounted and available to students, the major activity with respect to the Web site was maintenance.

In analyzing my journal, I recognized that one of the most important aspects of the Web site was my ability to respond to areas in which students needed more help or which

needed to be revised. An example of such a case was recorded in the October 22, 1997, entry of my journal:

> *Today the students pointed out some errors on the Web site–a misplaced decimal and two errors on the worksheets. It was a simple matter to edit the Web pages to correct these and instantly have the corrections available. This is much different than a print model, where I would have had to make the correction, then duplicate the instructional material. In fact, it would have been a full year before the corrections would be available to the students, because I always duplicated an entire year's worth of sheets for the students.*

The November 25, 1997, journal entry confirmed how much easier maintenance of instructional materials was when using the Web site:

> *Over the weekend, I was able to make some corrections to the Web site. This involved the method of handing in assignments. The Web instructions told the students to leave the files on their personal drives. What I really want is for students to attach their documents to an e-mail. If this was a print version of my course, then I would have to live with this mistake for the balance of the year, or explain it repeatedly to the students. Using WBI, I simply edited the Web documents and reposted them to the Web site. The next time students accessed the pages, the instructions were correct.*

The ability to revise the Web site efficiently so that students always had clear and concise instructions continued throughout the year. Occasionally, instructions written by a teacher are not as clear to learners as might be anticipated, and this created a source of

confusion for the students. This is clearly illustrated in the March 12, 1998, entry in my journal:

> *During one assignment students were having some difficulty with one particular step. At first I thought it was the way I demonstrated the lesson, but after more than half the class experienced the same problem, I took a closer look at the Web site, and it turned out there was some confusion in my instructions. Using a print method of instruction, I would have written a correction to the instructions on the white board and pointed the correction out to each class. However, with the Web instruction, I made a quick modification to the instructions, mounted the corrected page on the server, and the next class to access the instructions saw the corrected versions. The confusion that existed in the original instructions was not demonstrated by students using the revised instructions.*

On June 15, 1998, I included this entry:

> *At this time of the year I would usually be making revisions and corrections to my paper handouts and trying to find some time to duplicate the many instruction sheets in preparation for next year. However, this has all been done, and in fact, I am ready to start next year with little administrative preparation in terms of organizing and duplicating.*

With the use of a Web site, maintenance of this nature was simple and easy. Revisions were done by editing the text file and then remounting it on the Web site. In many cases this was done as the students were working, so finding updated information

was not a major challenge for students. In cases where students had recurring difficulty understanding a concept or many students were asking the same question, the revision was made and posted to the Web site in a timely fashion. Overall, I saw an increase in efficiency in managing the instructional materials required to teach the course. That is, the time required to duplicate instructional materials and to file those materials was reduced, resulting in an increase in management efficiency and in my having more time to work differently in my classroom.

Types of teacher activity. Over the course of this study, the second theme that emerged was the type of teacher activity. I noticed that the types of activities in which I participated changed from what I had experienced at the beginning of the study. For example, I noticed that my journal entries showed that I was spending substantially less time in teacher-directed activities–the "sage on the stage"–and more time guiding the students–"the guide on the side." This is evidenced in my journal entry of November 27, 1997:

> *I am very pleased with the demonstration/work time procedure that I follow to get students started on new assignments. While this is typical of my teaching, even with the print version, students were able to find points they had missed and access the information by looking on the Web site without having to see me. Once again, I was able to move around the room and help students with specific problems they were having.*

Further, on December 11, 1997, I recorded in my journal that

> *because students were using the Web site, I was able to visit several others*

who needed some help. One student was a recent transfer in and missed some of the introductory information on how to copy worksheets from the network. I was able to spend some time with her showing her how this was done. I was also able to work with her to help her become more familiar with the Web site. Another student didn't understand the fonts assignments, so I was able to give her some one-on-one direction for that.

The ability to spend less time reteaching concepts to students who were absent and teaching whole-class groupings had the benefit of creating more time to spend with individual students. The May 5, 1998, journal entry supported this observation:

I find myself spending less and less time direct-teaching a whole class and more time being able to work with individual students. This has also allowed me to accept more students from outside my class who need to come in to use spare computers. Because the instructional materials are available on the Web site, I am able to walk around the class ensuring students are always on task and are able to work through all of the parts of the assignment. I am also able to help the visiting students with problems that arise while they are using the computers.

In September I found classes requiring teacher direction to use the Web site, find project instructions, and start working. The majority of my time during the beginning months of the school year was spent helping students become independent learners and learning how to accomplish this. As the year progressed, my journal entries reflected that the time I used for this type of direct teaching decreased and that students began to take

increasing responsibility for directing their own learning. I found myself spending more time circulating, watching students, facilitating, questioning, and redirecting them, as well as encouraging them as they worked.

Continuity of instruction. The third theme emerging from the data was continuity of instruction. Continuity of instruction occurs when there is little interruption in the progression of student learning from one class to the next or when the teacher is unable to be in class at any particular time, meaning that the class is able to continue without disruption, even without the regular teacher present. In the first instance it is important that students be able to start the next class where they left off in the previous one. When students are able to continue their work with minimal interruption, that is, come into class and start work as quickly as possible, instructional integrity is increased.

Because the Web site was available at all times, students were able to enter the class and access instructional materials without waiting for me to get them started. This is evidenced in the November 26, 1997, entry of the journal:

> *It was great to see students come into the room, sit down, and get straight to work. Two students were absent last class and were able to get the assignment from the Web site. Once again, this allowed time to be able to work with other students, rather than trying to reteach a missed lesson to two students. The Web site instructions must be effective, because neither of the students needed help getting started on the assignment. In addition, another six students have progressed to the next assignment and have been able to receive their instructions by using the Web site.*

A second example of continuity of instruction occurred when the learning process continued even when I was away from class. Typically, a substitute teacher is available during such times, and as qualified as they are to carry on duties in the absence of the regular teacher, there are always some aspects of the class operation that a substitute teacher may not know. The Web site played an important role in providing that continuity when I needed to attend a district committee meeting. Students were able to continue their work, even though the substitute teacher had little knowledge of my program and classroom operation. The journal provided evidence of this, when, on March 9, 1998, I wrote:

> *I was absent from school attending a District meeting this afternoon, so had to leave the class with a teacher on call. The Web site works well for times like this as I can leave minimal lesson plans for the teacher on call. The students can all go to the Web site and find their instructional material really easily, and there is no loss of instructional time. Nor do I require a substitute teacher who is knowledgeable about computers–I simply require one who has excellent classroom management skills. These students are no further behind than my other classes, and so continuity is maintained.*

Again, the May 4, 1998, journal entry supports the ability of the Web site to contribute to continuity of instruction when the teacher is away:

> *I was absent this morning attending a district committee meeting and therefore had a substitute teacher. It was a joy to be able to leave plans describing where students were to find their work. Because students are quite*

spread out, leaving detailed plans would have been time consuming and difficult. In this case, I simply had the substitute teacher direct the students to the Web site, and he was able to maintain continuity of instruction, even though I was not in class.

Therefore, Web-Based Instruction as a supplement for teaching helped to maintain the all-important continuity of instruction for students.

Learning characteristics of students. The fourth theme that emerged from the analysis was learning characteristics of students. One of the most interesting aspects of the study was to discover the changes in the way in which students worked during the length of the study. At the beginning of the study, journal entries indicated that students were generally very dependent learners and often asked, "What is the next step?" or "What do I do now?" However, as they became more familiar with the Web-Based Instruction method and with my method of teaching, they learned to trust themselves to move on to the next step, check the Web site, put up their hand, or ask classmates for help. In other words, the students began learning through a variety of ways, rather than expecting all the information to be disseminated by the teacher. The September 8, 1997, entry in my journal emphasized the dependence which the students in the study group demonstrated: "*These Grade 7s are obviously used to a teacher-directed learning environment and they had a great deal of difficulty getting started on their own.*"

Ongoing entries in the journal indicated that I continued to try to develop independent student learning, but in the end I found that a balance between teacher-directed for the entire class and a completely student-directed class was necessary. For

this reason, I used a short lesson or demonstration when introducing a new concept and allowed for work time during the balance of the class time. Students who had forgotten the procedure that I taught were then able to consult the Web site, as could students who had been absent from the class. In addition, I reviewed with students the location of the information they required on the Web site. The demonstration plus work time seemed to be the most effective way of using the Web site and student time. This was supported in my journal entries of October and November. On October 3, 1997, I made the following entry

> *Things are really looking up! I noticed a student voluntarily checking the Web site for one of the assignment requirements;*

and on November 12, 1997:

> *I provided the students with an overview, but they needed to visit the Web site in order to fill in the details and to review information they had forgotten or missed during the demonstration. Some of what I am doing is paying off, because I did not have many questions during the class.*

Journal entries reported that increasing student independence occurred when I was away from my classes on some committee work and required a teacher-on-call to be in my classroom. The replacement teacher was not familiar with my program, nor was he skilled in using computer applications. The January 13, 1998, entry substantiated this

I was away at a District committee meeting yesterday afternoon. It was good to be able to leave teacher-on-call plans that stated, "The students can all access their assignment information from the Web site," and know that all of my instructional materials were available for the students.

The students demonstrated their independence by working on their projects even though I was away. Traditionally, I would have been required to prepare plans that might have had little to do with the current project. These additional lessons would have been necessary because the replacement teacher might have been unfamiliar with the use of computers and software or simply unfamiliar with the projects currently under way.

Summary. The journal provided a valuable method of reviewing the school year during various phases of the study. One of the most poignant moments of the journal was another entry on November 12, 1997: "*The more I use the Web site, the more I see its value as a supplement to classroom instruction. This is important, because I was never interested in using it as a replacement for my teaching.*"

As the year progressed, students continued to become more independent and consulted the Web site as a matter of course. Evidence of this type of student activity was shown as I wrote on March 10, 1998: "*This class worked well today, and it was good to see them on-task all period. Most of the students finished the assignment, and several took the initiative to start the next assignment by visiting the Web site.*" At the end of the school year, I commented on student characteristics on June 10, 1998: "*These classes worked very well, and I did not observe any off-task behavior. Students were talking to each other, but as peer supporters rather than causing a disturbance.*"

A journal was one of three methods of data collection used in this study. The findings of the second method, conversations with students, are presented in the next section.

Conversations With Students

Throughout the study students were invited to forward their views about using Web-Based Instruction to me. At the end of the study period students were asked to provide their views on the use of the Web site by responding to an electronic questionnaire that included a series of five statements and one question. In total, 167 responses were received from the 167 participants in the study group. Student responses for each of the items are summarized below, and some comments sent by the students are quoted.

Describe the three things that you liked the most about the Information Processing Web Site.

Student responses to this item were consistent throughout the 167 replies received. Although the students were asked to indicate the three things they liked the best about the Web site, not all students provided a response that included three items. However, an analysis of the responses revealed that the three items most frequently mentioned were:

- design of the Web site,
- ability to work on their own, and
- availability of the instructional material.

In general, students reported that they liked the design of the Web site and being able to access it at any time either in school or at home. Students also mentioned that they

liked the ability to be able to work ahead, as well as to review concepts they might have forgotten as they worked on their project. Other students mentioned that they liked being able to see a list of all of the assignments required for the term or year and were glad they could work ahead. Many students wrote that they liked the self-paced nature that the Web site provided.

More specifically, several students mentioned that they liked the layout of the Web pages, including the following characteristics. The icons and colors were attractive, the content was easy to find, and the Web pages were set up for easy navigation. For example, one student stated, "I liked the icons and how I could get [to various places on the Web site] easily." Another student wrote, "I could catch up on assignments when I wasn't at school." A third student liked the Information Processing Web site because

> it was easy to use, has the information you need, and is easy to go to . . . I liked the fact that if your assignment was late, the instructions wouldn't just disappear on the deadline. Also the steps were clear so you didn't have to get two sets of instructions.

The comment provided by a fourth student was, "I liked the way that the Web site used clear words and didn't make anything too confusing." Comments such as "how well it described the assignments," "it was easy to read," and "I liked how I could flip back and see what I had to do step by step," were consistent throughout the student responses. Similarly, students liked the self-paced aspect of the Web site and being able to work ahead or review work they might have missed. As one student wrote, "I could start new projects without waiting for instructions." This view was supported by another student

who stated, "I can go at my own pace; if I needed help, I didn't have to ask the teacher."

Describe three things that you liked the least about the Information Processing Web site.

Although students were requested to comment on three items they liked the least about the Web site, not all students provided three items. Overall, however, the following three items were most frequently indicated:

- insufficient use of color and movement,
- assignments, and
- becoming familiar with using the Web site.

Some students wrote that they would like to see more color and more movement on the Web site. They suggested using more animated icons. For example, students commented that "it's boring and the Web site doesn't really have any bright colors that catch your eye," and "It doesn't have enough color and the icons could have been more creative." Other responses to this statement varied from "The assignments were too easy" to "The assignments were too hard" to "There were too many assignments." Lastly, some student comments were related to gaining familiarization with the use of the Web site. For example, one student said, "When I was learning at the beginning it was hard because I was used to a teacher giving me instructions."

Describe and give three examples of how you used the Information Processing Web Site (please do not confuse this with the Internet in general).

Most frequently, student responses to this statement referred to the mechanics of the Web site and included reference to

- how they were able to work at their own pace,
- how they used the frames, and
- where they could find assignment due dates.

For example, students reported how they used the Web. Most of the students said they used the Web site to work at their own pace through the course materials. Student responses to this statement varied from "getting assignments when I was away" to "being able to go ahead of the rest of the class." One student wrote that she used the left-hand frame to find the assignment on which she was working and the right-hand frame to read the instructions for that assignment. Another student responded that he used the Web site to look up due dates for the assignments, and a third student used the Web site to work ahead.

Give one example of how using the Information Processing Web Site helped you become a more independent learner.

Students were requested to provide a single example when responding to this statement. Student responses varied, but most suggested that it helped them to become more independent because it was not necessary for the teacher to give instructions before they could start a project, and that they could visit the Web site for information whenever they needed. The next most frequently mentioned example was that students felt that the

Web site helped them become more independent because they were able to work ahead of the class and complete the assignments at their own speed. As one student stated, "It gave me the chance to find out everything for myself, and we could go there and find out all we needed to know." A second example is illustrated by another student who felt that she became more independent: "I don't have to rely on my classmates for information about how to complete assignments because the Information Processing Web site answers all my questions." "Being able to work without a teacher" was how a third student thought the Web site helped her become more independent. The fourth example was the concept of being self paced. That is, one student felt that the Web site helped him become more independent because it let him "work ahead and I didn't always have to wait for an explanation to get my work started."

Given the choice, would you prefer to use the Web site or to have your teacher give class lectures for your Information Processing course?

As with other statements, student responses to this question were important. Although a few students suggested that a combination of both teacher-led activities and Web-Based activities would be the best, most of the responses supported the use of the Web-Based approach. For example, one student wrote, "I would like [to use] the Information Processing Web site because it gives each student the chance to learn independently." Additional student comments included such responses as, "It is more exciting than listening to lectures," "You could get your work done faster," "I can read faster than someone can give a lecture," and "We also become more aware of our responsibilities because we have to find out what the assignments are by ourselves." One

student summarized this well when she wrote,

> I would prefer using the Information Processing Web site. I often find that when teachers are giving lectures it is hard to keep up. It takes much longer with the teacher giving lectures because everyone always has to stop working when someone else is having trouble. By trying to keep up with the teacher, I always feel incredibly rushed.

Overall, there was greater student support for Web-Based Instruction in Information Processing than for the teacher-lecture approach.

Describe why you liked or did not like using electronic mail to hand in your assignments.

As previously mentioned, students submitted their projects to be marked using the school electronic mail system. Students much preferred to hand in work electronically and receive teacher feedback. As one student stated, "I liked it because it seemed easier to do." Another student responded with this comment: "I liked using electronic mail because it saves paper and is faster." The paper-saving aspect of using electronic mail was mentioned by many students. Another response to this statement by one student was that she liked handing in projects using electronic mail because "even when the teacher was away you could still get the assignments handed in."

Summary of student responses. Overall, student comments were supportive of the Web-Based approach to learning Information Processing. The two aspects that students commented about most frequently were the ability to work at their own pace and the savings in paper and time that electronic mailing of assignments provided.

Conversation With a Colleague

As the teacher-researcher, and also as the designer of the Web site I used for my teaching, I wanted to add other data sources to triangulate the findings. Therefore I added conversations with students. An added source emerged, and that was a colleague in my school who chose to use the Web site to teach her Information Processing classes. The characteristics of her classes were similar to mine, and she used the same Web site. I now had a critical friend. Throughout the study I asked for her impression of the Web site and how it was useful to her teaching. Near the end of the study I invited her to provide me with a written description of how the Web site helped her teach. Conversations with my colleague–a critical friend–revealed that my findings were consistent with hers. My colleague's comments follow:

> *I have been using your lesson plans and your Web site for the past two years to teach my students and for that I am eternally grateful. Perhaps that's partially why I have enjoyed the experience of teaching computer classes so much–all I had to do was learn the lessons and then teach them to the kids. I didn't have to create the lessons and that reduced my stress significantly.*
>
> *Having the lessons last year [in print] was great but having the Web site is even better. From a teaching perspective, I really enjoy not having to handle the paper flow that I had last year. Previously, this always made me the person responsible for keeping and providing the access to assignments for my students. I didn't like the huge volume of paper that crossed my desk for Information Processing students either. Again, it seemed that the paper*

component somehow made me potentially responsible for any losses (i.e., I gave it to you but you must have lost it, or I gave it to Mr. Roberts to give to you).

Now students can go to the Web site over and over to refresh their memory of the assignment guidelines and directions and it can never get lost or need replacing. Also, they are accountable for knowing the parameters of each assignment and can check whenever they need to. They are responsible for attaching their assignments to e-mail and keeping the assignments until they hear back from me via e-mail, with their marks on that assignment. The subtler shifting of responsibility from me to the students that these changes have brought about is greatly appreciated and more appropriate than the paper approach.

The use of the Web site also requires students to learn new skills and strategies such as moving between two or three applications and integrating the information found there. This strikes me as an important skill and one that I am just mastering and appreciating myself.

Another great thing about the Web site is that it demonstrates our ability to progress technically and integrate new learning and uses into our Information Processing program. Sometimes, I think that to the kids, it seems school is very archaic and out of touch with the times. This is not true of our Information Processing classes. I feel that students are more independent using the Web site. Naturally, this is not true of all students but the ones who

wish to be independent can be, and the ones who don't want to be have fewer excuses than before for not being independent. Students can access and work on an assignment any time and they can look back at previous assignments at other times during the year or at other grade levels if they need to or are so inclined. In this way the Web site makes information at all grade levels available to students at any grade level.

The Web pages themselves are well designed so that parts of assignments that students need to refer to are highlighted with distinctive colors that make them easy to spot inside the Web site for quick reference. Also there are examples that "show" students who need that visual context what they will be doing and what their assignments should look like when they are finished. (L. Duncan, personal correspondence, February 11, 1998)

In summary, my colleague reported that she preferred the Web site as the instructional method for three reasons: (a) It reduced the amount of handling normally associated with the paper method of teaching; (b) it transferred some responsibilities from the teacher to the student; in other words, the students became more independent learners; and (c) she liked the opportunity the Web site provided for students to work ahead or review their assignments, or the self-paced nature of the Web site. Later, I once again requested her assistance by having her validate the findings as well as the discussion that appears next in this chapter.

Discussion of the Findings

The discussion of the findings of this study is organized under the three major methods of data collection, which were (a) personal journal entries, (b) conversations with students, and (c) conversation with a colleague. I was to be the only teacher using the Web site for my classroom instruction; however, this colleague chose to use the Web site for her teaching, adding an additional source of data to this study. The findings of the data from each of the three sources were presented earlier in this chapter. In addition, frequent dialogue with the advisor of this study was used as another verification method.

Personal Journal

During the data analysis phase of this study, four themes emerged from the review of the journal. These themes are:

- maintenance of the Web site,
- types of teacher activity,
- continuity of instruction, and
- learning characteristics of students.

The discussion of the findings for each of the themes that emerged is presented in the following section.

Maintenance of the Web site. Prior to the data collection, the Web site that was to teach Information Processing needed to be designed, produced, and mounted on a Web server in order to be available for students. Chapter Five presented the major issues involved in this process. However, the findings revealed that maintenance of the Web site was a continuing activity over the duration of the study. The reason for the frequency of

this activity is similar to the development of other curriculum materials that a teacher prepares. There is often the need for change, revision, or clarification. This is no less true when using a Web site for instruction. The difference is, however, that revision of Web-Based Instructional materials is easier than with print-based materials.

When using print-based materials, whether they are instruction sheets, worksheets, or workbooks, revision and correction of mistakes is a lengthy and time-consuming process. In general, the revision process for print-based instructional materials involves editing with a word processor, printing a copy, duplicating, and then filing or distributing the revised copy. In addition, there is the time-consuming aspect of managing a file system, ensuring that students who were away received the appropriate information, and subsequently picking up and refiling or recycling printed materials. If students were absent, they might never receive the identical information. As a result, teachers either often do not make minor corrections or leave any editing until the end of a term and make several revisions at once.

Revising Web-Based Instructional materials is more convenient. Whereas editing documents continues to require a word processor or some other type of text editor, electronic revisions do not need to be duplicated or the paper copies filed or distributed to students. Once the electronic editing is complete, the document is mounted on the Web site and is immediately available for students to use. Because this process is relatively simple, I found myself making minor revisions as necessary. One example of the ease of this process occurred when I had several students ask me the same question in a very short period of time. I reviewed the instructions and found that one series of directions

was quite vague–a step that I assumed students would know was not included. I revised the instructions and posted the corrected version within minutes; the next class had the improved directions. It is unlikely that I would have undertaken this same task with the print method.

As much as teachers like to produce perfectly spelled documents, spelling errors are often missed when preparing large quantities of instructional material. Using Web-Based documents makes this process easy to rectify, because the spelling error can be corrected and the document posted very quickly. In some cases, I have had students point out a typographical error to me, and I was able to correct it before the next class arrived. An added bonus to using e-mail in class is that students will often send me an e-mail message describing the error, which can be responded to in a timely manner.

Types of teacher activity. The second theme that emerged was concerned with types of teacher activity. The primary change in the use of teacher time during the study was from teacher-directed to student-facilitated activities. A few of the descriptors that I could use to report my changing mode of teaching, as identified by McKenzie (1998), included increased circulating, watching, facilitating, questioning, redirecting, and encouraging. I found that journal entries noted that I spent less time talking to the entire class and much more time guiding individual students and helping small groups.

The reasons for the decrease in the time I spent talking to the entire class were varied. One reason was that students were able to locate instructions from the Web site. Another reason was that students who were not experiencing difficulty with a procedure were able to proceed without waiting for me. Thus I had more time to spend with

individual students, and I came to know them better. This in itself is a pedagogically useful reason to use Web-Based Instruction.

Students required more attention in the early months of the study than they did later because of the nature of the instructional medium itself. As Sweany, McManus and Williams (1996, p. 3) reported, using an instruction medium not familiar to students may cause them to stop learning sooner than would normally be expected. In the case of this study, students called for teacher help early in their use of the Web site because they were not familiar with self-paced learning. A second reason that students may have had difficulty when first exposed to Web-Based Instruction, and therefore required more teacher time, is the feeling that they had more responsibility for their learning than they did in a teacher-directed class because they were able to view information about the complete course. For example, students may not always know how much of the information they have yet to see for a particular project in a print version; whereas, using the Web site, they can view the entire course.

The problem of students not understanding how to learn to use the medium of Web-Based Instruction can be easily overcome through the use of introductory activities that teach students to use the Web site; this approach was supported by Sweany et al. (1996), who wrote that "researchers in the hypermedia environment now need to focus on training students to use strategies directly related to this new medium" (p. 10). As students became more familiar with the Web site in this study, fewer instances of teacher direction were reported.

Teaching in an online environment–using Web-Based Instruction–was different from teaching in a traditional setting. The major way that using the Web site was different was in my activity: I spent less time presenting to the students, but much more time facilitating their learning, which, according to Kearsley (1997a), is typical:

> Online teaching does not involve a presentation or performance like classroom instruction. Instead, it involves the organization of the class, definition of assignments, responding to student questions and grading their work, troubleshooting technical problems. There is a lot of one-on-one discussion with students about their work and the course content via e-mail. (p. 3)

McKenzie (1998) described this type of teacher as "always on the move, checking over shoulders, asking questions and teaching mini-lessons for individuals and small groups who need a particular skill" (p. 3). As mentioned in the findings, one of the advantages to using the Web-Based Instruction approach is that it provides the teacher with more teaching options and students with alternative methods of securing instructional assistance. Baker, Hale, and Gifford (1997) also found this to be the case and provided support by concluding:

> More specifically, in the case of instructors this means more opportunities to engage students in small-group discussion, more opportunities to offer students one-on-one tutoring sessions, and more opportunities to engage in what some cognitive scientists have referred to as scaffold instruction, including coaching, mentoring and modelling activities. Similarly, in the case

> of learners this would mean that more students would have more opportunities to secure different types of instructional assistance, as well as the means to exercise greater control and sequencing of their own learning. (p. 3)

Clearly, the situation reported in the literature was the one in which I found myself, and I found it typical of other teachers who used Web-Based Instruction as well.

Continuity of instruction. The third theme related to findings from the journal data was continuity of instruction or instruction that can continue when either the teacher or the student is not present. If instructional materials are always available to students and they can access them continually, they can proceed with their work. Once students learned where to find the information they required, they used the Web site to continue their classroom work when I was away at an in-service or committee meeting. On the other hand, when students were absent for a period of time, they often required attention from the teacher that was difficult to give because the remainder of the class needed to continue with their work. As presented in the findings, both of these situations could be addressed using the Web site. In the first instance, teacher absences had the advantage of always having the Web site available. In other words, learning could continue, even when the regular teacher was absent and not able to present the materials. Student learning continued with a substitute teacher with excellent class-management skills, and there was no necessity for the substitute to be an expert in computer-related skills.

In the second situation, student absences, it was often inconvenient and disruptive for other students to provide individual instruction to students who missed a class. When

the Web site was used for instructional purposes, this concern was alleviated in two ways: (a) The student could consult the Web site upon return to class and simply continue where he or she had left off, and (b) because the remainder of the class could also access the Web site to continue their work, time could be spent with absentee students once they had returned to school.

Learning characteristics of students. The most significant change I noted from the findings related to the changes in student learning characteristics was that they became more independent learners over the course of the year. At the beginning of the school year students required a great deal of help and intervention from me. As the year progressed and they learned how to locate information and how to progress through the instructional materials on the Web site, they required less of my time for direct instruction. One reason for this, as pointed out earlier in the discussion, was that students became more familiar with this mode of instruction and therefore required less direction from me. A second reason was that students learned that the information they required was available on the Web site or that it was acceptable to consult peer experts, and subsequently chose these two other methods of learning.

As months passed, students became more independent, more often used peer expertise, and increasingly used the Web site. This is what I had been waiting for, and each day I noticed more students working in this way. In addition, students were seeking out peer expertise in their class and were beginning to look at the "Show me how" portions of the Web site. Obviously, I was no longer the sole source of information in the classroom. I had ceased to be the expert directing the class and had become the facilitator,

while the students increasingly took responsibility for organizing their learning.

During the course of the study the purpose for which students used the computers became ubiquitous; that is, students were not thinking about whether they were using the computers for learning about the computer, learning with the computer, or making a product. This was echoed by Whitesel (1998), who observed, "The ubiquity of technology in contemporary society means that learners attend classes, not just to learn about technologies, but to use them as a resource for learning" (p. 1). As students became more experienced with the Web site, they used it not only for finding information, but also for completing their projects, and they clearly did not separate the two activities.

As a teacher, I was pleased to see growth in the independence of my students. One of the values I try to instil in students is the thrill of learning throughout a lifetime. I believe that each of us is the main participant in a journey of learning, and I try to provide an educational landscape that will encourage this in students. This was reiterated by Blackburn (1998), as well as by Mather (1996): "A common goal [of the education system] is to create self-directed life-long learners who are well equipped to take up a productive role in society" (p. 1). This was best summarized by Kilian (1997), who wrote in the *Educom Review*:

> We should be helping [students] advance toward their own goals, not co-opting them for our own. This doesn't mean allowing them to fool around aimlessly; it means encouraging them to be self-propelled toward ambitious but realistic goals. "Cyerbernetics" comes form the Greek word for "steersman"; we should teach students how to steer for themselves. (p. 4)

Perhaps through providing my students with an experience in Web-Based Instruction, I have helped them gain some valuable life skills.

Conversations With Students

In the methodology section the process of soliciting information from students about their views of Web-Based Instruction was described. In the findings section student responses to a series of five statements and one question about their experience with Web-Based Instruction (WBI) were presented. Those responses will be discussed later in this section.

In preparing the discussion that follows, I searched for available research of others regarding student feelings and impressions of Web-Based Instruction. The lack of information available on this aspect of WBI indicates a need for further research in this area. As reported in Kahn (1997), there have been numerous studies aimed at determining how and what students learn when using Web-Based Instruction, as well as various strategies for increasing student motivation and engagement in the learning process, but it appears that the studies involved students as observable participants rather than as partners in the research process. One study looked at how students learned in a virtual community (McLellan, 1997) by using a listserve for electronic discussions; Hackbarth (1997) reported on how teachers selected and used Internet resources in K-12 education. Bostock (1997), Gillani and Relan (1997), and Jones and Farquhar (1997) studied the design issues involved in WBI, whereas such researchers as Descy (1997) and Goldberg (1997) looked at the delivery aspects. However, no research was available that looked at WBI from a student's perspective; therefore, it is hoped that the discussion presented

below will serve as a beginning for further study in this area, which is discussed in Chapter Seven.

Describe three things you liked the most about the Information Processing Web site.

The features that students liked the most about the Web site were the design, the ability to use it in a self-paced manner, and the availability of the Web site at any time. Students enjoyed the design of the Web page, suggesting that it was easy to navigate to where they needed to go and that they liked being able to see the entire course on the Web site. Many students would explore projects on which they were not yet ready to work, and then return to where they were in the course.

Students liked the independence of being able to use the Web site to progress through instructional materials at a rate that was comfortable for them. In addition, they mentioned that they liked to be able to catch up on their own time if they were absent from class. The most common comment in response to this question was the self-paced learning aspect of the Web site. Early adolescents enjoy increased independence in all aspects of their lives, and this may have been one reason they enjoyed the self-paced nature of the Web site. Another reason for enjoying the use of the Web site for learning could have been because the Web site was a new and different way of learning for the students.

Related to the above comments was that the Web site was available any time that students wished to access it. For example, students would make use of the computer lab during out-of-class time, such as prior to the commencement of classes, at lunch, or after school, at which time they could continue working on projects. Students seem to be

motivated to use computers, and this motivation continued with their computer assignments. These findings are congruent with my observations of students' learning in junior high school: Given the choice, most students would choose to use a computer to complete assignments.

Describe three things that you liked the least about the Information Processing Web site.

Students indicated design features, assignments, and familiarity with the Web site as some of the items they did not like. Included in the design features was the lack of color and movement. Whereas most students wrote in response to the first questions that they liked the design of the Web site, some students indicated that they would like to see more use of color and movement on the Web site. As the designer of the Web site, I wanted to ensure that there were as few distractions as possible for the students, while still wanting to hold their attention. For this reason, as well as to ensure good readability on the monitors, the background of all pages on the Web site was kept plain. With a contrasting background and text design, I was assured that even students who had difficulty reading or vision challenges would be able to see the words on the monitor clearly. With respect to the lack of movement, some students indicated that they would have liked to see more moving icons and animation than was included on the Web site. This is a useful comment, and plans for the next version of the Web site include the use of additional screen shots and animation.

A number of students commented that the number of assignments was one of the things that they did not like about using the Web site. However, it was difficult to draw

any conclusions from this response because there was a lack of consensus; some of the students wrote that there were too many assignments, whereas others wrote that there were too few.

The third most frequently mentioned comment that students made with respect to things they did not like was the difficulty that they experienced when first using the Web site. The students involved in the study had not used Web-Based Instruction previously, and at the beginning of the school year some had difficulty understanding how the Web site functioned. This could be eliminated by creating an introductory activity as an orientation exercise that includes a classroom display.

Describe and give three examples of how you used the Information Processing Web site (please do not confuse this with the Internet in general).

It appears that students' use is consistent with my design intentions for the Web site. The design of the Web site was intended to provide students not only with information not only about the projects they were to complete, but also about assignment due dates and clear navigation through the course content. Students used the navigation frame to find assignment information and to determine due dates for their work. In addition, the nature of the Web site was such that students could see the entire course at any time; students would often look ahead by using the icons in the navigation frame, then return to their current work. Although I did not directly teach the above uses to the students, I expected them to discover ways in which the Web site could be used as they gained experience with it.

Students used the Web site to find instructional material for assignments that others in the class may not have been completing. These students consulted the Web site in order to work ahead. This is congruent with the design of the Web site, which was to allow student access to all of the instructional materials for the class at any time.

Give one example of how using the Information Processing Web site helped you become a more independent learner.

Most frequently, students commented that it helped them become more independent because they did not always have to rely on the teacher to continue their learning. Others referred to the self-paced nature of the Web site, and still others mentioned that they did not have to wait for their classmates before continuing. These three examples were to be expected because the design of the CTS curriculum, and especially the delivery of it, help students become independent learners. I focused on this aspect of the delivery by encouraging students to think about what they needed to do and ways in which they could do it, by providing instruction on the Web site, and by continually pointing out to students that they could use a variety of resources to learn. For example, I directed them to various classroom resources, suggested that they ask a peer, or provided an Internet site that might answer their question.

Given the choice, would you prefer to use the Web site or have your to teacher give class lectures for your Information Processing course?

This statement served as a thermometer regarding students' feeling about whether they preferred a teacher-centered, whole-class, or self-paced approach to their Information Processing class. A majority of the students stated that they would prefer to

use the Web-Based approach in Information Processing; their reason for this was the ability to work at their own pace. This was corroborated by Cotton (1997), who provided a list of reasons that students like this type of instruction. Included in that list were that it: provides individualized learning and a self-paced approach, and it gives students a sense of control of learning (p. 8). Kearsley (1998) also found that students indicated that they enjoyed using Web-Based Instruction and found it to be a worthwhile method of learning (p. 5).

Describe why you liked or did not like using electronic mail to hand in your assignments.

In all cases, students preferred to hand in their assignments electronically by using the school electronic mail system. This procedure required that students prepare electronic mail, attach their work, and send it. Upon receiving the electronic mail from the students, I would review their work and send comments and their marks back to them in an electronic mail note. In this way, all students received some electronic mail. The students preferred this method because it gave them a sense of belonging to a different type of community. They may also have been aware that electronic mail is more representative of how business is conducted outside of school and that a business focus is an important component of the CTS curriculum. In addition, students felt that it was easier to e-mail an assignment than it was to print it and subsequently hand it in to the teacher.

Some students wrote that they liked using the e-mail system because it saved paper. Many adolescents have developed a social conscience with respect to environmental

issues, and this may have been a contributing factor to their response to this question.

Conversation With a Colleague

As I worked with the Web site in my teaching, I gained a sense that it was helping me to be more efficient in my teaching, but I needed to verify my opinion. I was fortunate to be working with a colleague who used the Web site to help her teach the same course. This provided me with the opportunity to reflect on the use of the Web site with another teacher, to hear her viewpoint, and to solicit feedback on ways of improving the Web site.

The themes mentioned in my colleague's description of the Web site recurred in my journal: reduced paper, independent learning on the part of the students, more efficient teaching and assessment, and shifting of responsibility from teacher to student. Further research of teachers using Web-Based Instruction would be informative; this recommendation is discussed in Chapter Seven.

Summary

The study had the following objectives:

- to relate the story of the development and implementation of Web-Based Instruction, and
- to examine the usefulness of the Web-Based Instruction

The findings for the first objective were presented and discussed in Chapter Five. The second research objective was to examine the usefulness of the Web site for teaching Information Processing. In other words, "Did the Web site function as I intended?" In short, the answer to this question is, "It was useful as intended, and it was so in a number of ways." Overall, the analysis of the findings from all data sources revealed that Web-

Based Instruction was useful for my teaching. For example, journal entries showed that during class time I felt less pressure to always be the director of learning and spent more time guiding students by asking such questions as, "How did you do this before?" "What do you think?" "How do you think you could do this?" "Where could you look to find this out?" or "Why did you use this procedure?" From a teacher's perspective, this made the teaching more pedagogically meaningful, because I was able to spend more quality time with more students because I was doing less whole-class instruction. Throughout the study–and I believe that individual instruction was applied in many learning situations–I wanted to ensure that the human side of learning was not lost. Regardless of how advanced a Web site may become, there is no substitute for the art of teaching; that is why, for the span of the study, an emphasis was placed on using the Web site for teaching, but not as a replacement for me as the teacher. This finding was sustained by Cotton (1997), who completed a meta-analysis of research on computer-based instruction. She summarized that

> the single best-supported finding in the research literature is that the use of CAI as a supplement to traditional, teacher-directed instruction produces achievement effects superior to those obtained with traditional instruction alone. Generally speaking, this finding holds true for students of different ages and abilities and for learning in different curricular areas. (p. 3)

The Web will not be an elixir for the craft of teaching, any more than educational television or computer-assisted instruction, but it can provide a valuable tool to help teachers work differently and students take increased responsibility for their learning.

Russell (1997b) lent support to this finding:

> Revisit many of the older technologies such as radio, television and videotapes to ascertain their viability for specific student populations. Rather than abandoning these tried-and-true instructional tools, educators must take the time to evaluate students' learning types, and match the technology used in their instruction accordingly. (p. 1)

He continued by emphasizing that "students are not alike. Individual differences in learning styles dictate that technology will facilitate learning for some, but will probably inhibit learning for others, while the remainder experience no significant difference" (p. 1). It is clear that as teachers we must continue to use a variety of methods to meet the needs of our diverse student populations.

Upon reflecting on the use of a Web site for classroom teaching, there are two perspectives need to be considered: those of the teacher and of the students. From my perspective as a teacher, the use of the Web site was a useful supplement for the following reasons:

- more time was available for working with individual and small groups of students,
- less time was dedicated to administration,
- revisions to the Web site were more efficient when compared to a paper-based system, and
- the Web site added richness and appeal to instructional materials.

Students, through their electronic responses, indicated that they liked the Web-Based Instructional method, but for different reasons. In particular, students liked

- the self-pacing nature of the Web site, and
- easily completing work they missed.

In summary, the use of Web-Based Instruction for classroom teaching was positively supported and enjoyed by both the students and me. My findings with respect to teaching with the Web site were corroborated by a critical friend. I preferred teaching with the Web site because it allowed me to interact more often with single students or small groups by freeing me from whole-class instruction and repetitive tasks. The students preferred Web-Based Instruction because it gave them a sense of having more control over their learning by creating a self-paced mode of instruction. Chapter Seven presents a summary of the study, conclusions, and recommendations for future research.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

Introduction

The purpose of this study was to describe the development and implementation of a Web site and to examine its usefulness in offering the Information Processing strand of Career and Technology Studies curriculum which is available in junior and senior high schools throughout Alberta. The study had the following objectives:

- to relate the story of the development and implementation of Web-Based Instruction, and
- to examine the usefulness of the Web-Based Instruction.

In Chapter Four the distinguishing characteristics of Career and Technology Studies courses were presented:

- Self-paced learning is encouraged,
- Students are presented with concepts in small pieces,
- Students demonstrate competency in one skill before moving on to the next,
- WBI is competency based rather than time based, and

- A variety of instructional methods are used to meet student needs.

Chapter Five discussed the design and implementation of the Web-Based Instruction that was used in this study to teach Information Processing. The key features of the Web-Based Instruction site include

- a simple code for ease of revision,
- minimal multimedia in order to function on basic systems,
- consistent interface throughout, and
- a sidebar for easy navigation around the Web site.

The findings of the study and a discussion of those findings were presented in Chapter Six. A summary of the study, conclusions, and recommendations for future study follow in the respective sections.

Summary

In the past three decades there have been numerous advancements in information technology that have impacted teaching. K-12 teachers who use the World Wide Web today to facilitate teaching or the presentation of curriculum are the exception rather than the rule. However, the Web has an important role to play in the classroom because of its ability to help teachers meet the varied needs of students. Cotton (1997) discussed computer use and student achievement:

> The single best-supported finding in the research literature is that the use of CAI as a supplement to traditional, teacher-directed instruction produces achievement effects superior to those obtained with traditional instruction alone. Generally speaking, this finding holds true for students of different

ages and abilities and for learning in different curricular areas. (p. 3)

In the Province of Alberta, a Career and Technology Studies classroom typically consists of students with different levels of knowledge, skills, and attitudes. However, the curriculum is designed to enable students to progress through the curriculum at their own pace. The challenge, from a teacher's perspective, is to create a method of meeting a wide variety of student needs in a single class grouping. Funding for smaller classes or for additional staff for a single classroom is unlikely, so an alternative must be found. Web-Based Instruction is one solution to meet individual learning needs by encouraging students to view curriculum at their own pace, freeing teachers to spend more time with students on an individual basis or in small groups. The method of instruction that was used in this study was supported by Baker and Hale (1997):

> The basic idea behind [Web-Based Instruction] was to employ technology to provide instructors [with] more teaching options and to provide students with more options to secure more forms of instructional assistance. More specifically, in the case of instructors this means more opportunities to engage students in small-group instruction, more opportunities to offer students one-on-one tutoring sessions, and more opportunities to engage in what some cognitive scientists have referred to as scaffold instruction, including coaching, mentoring and modelling activities. Similarly, in the case of learners this would mean that more students would have more opportunities to secure different types of instructional assistance, as well as the means to exercise greater control over the pacing and sequencing of their

own learning. (p. 3)

It is common knowledge that adolescents learn through a variety of methods and strategies and that it is becoming increasingly difficult for teachers to meet the needs of all children in a single classroom. Class personalities include highly motivated students and students who are less motivated to learn, students who behave well and students who do not, and students who are exceptionally intelligent and those who have difficulty learning. The question becomes one of meeting the needs of all of these students and of obtaining the resources, human and otherwise, that will help teachers accomplish their goals.

Prior to implementing the Web-Based Instruction system in my Information Processing classes, it was difficult to provide multiple approaches in a single learning environment. However, the use of the Internet has changed that by providing another approach to teaching a single concept. For example, it is possible to present a concept through step-by-step instructions. For those students who learn through a combination of instructions and illustrations, a concept can also be presented to them in that manner; and for those who like to see moving examples, animations and screen captures can be presented. Thus students can choose the method best suited to their learning styles. The Internet allows for, and encourages, multimedia methods of presenting information. The Web-Based Instruction described in this study was designed as an on-campus, class-oriented program; and although it is accessible from outside of the school, it is not being used as a distance-education program. In an electronic mail message discussion of computer-based learning, Kerlin (1998) emphasized the importance of the teacher in the

learning process: "I believe there is both an art and a science to effective uses of on-line resources in teaching situations, but the instructor is still the key player in making the entire process successful for students" (S. Kerlin, personal communication, April 20, 1998).

Having placed my Information Processing Program "on-line" on the school's network has allowed me to spend less time on repetitive tasks and the "paper chase" of the classroom and to spend more time working one-on-one and in small groups with students. After receiving a demonstration of a new concept, students are directed to the Web site, where they will find assignment information, worksheets, and projects related to the concept. Students use their computers to answer the questions and/or complete projects. Students use the computers not only to obtain information, but also to hand in their assignments. The internal electronic mail system allows students to e-mail their assignments to me, as well as to receive evaluative feedback. There is an added benefit of reducing the paper required to operate the program by tens of thousands of sheets of paper.

As the year progressed I found students spending more time on task, progressing to subsequent assignments more quickly, enjoying their school work more, and making increased use of peer support. I was able to spend more time with individual students who were able to advance, as well as those who required additional help.

Another advantage of using Web-Based Instruction was the ease and speed of updating or changing individual assignments. In a print-based model errors or omissions were generally ignored for the year, or at least until there was time to make the change

and duplicate additional copies. With the Web-Based Instruction site, changes can be made immediately and are available to the students with minimal time delay.

Not only is it important for the use of Web-Based Instruction systems to be validated within individual schools, but also the general approach of using a Web site to supplement in-class instruction needs to be validated. I am a member of an electronic forum, titled WWWDEV Forum, consisting of about 1,200 members world-wide. The members of the forum are all Web developers; that is, they all use a Web site in some manner to fulfil teaching responsibilities. On February 9, 1998, I posted an e-mail to the forum asking for information on the specific use of Web sites for classroom instruction. Although most of the members of the forum develop Web sites that are used for distance education, T received a number of responses to my topic. For example, Heasley (1998) wrote:

> *I have been using Netscape based instruction "in the classroom" for three years now. My philosophy is that this approach is an excellent supplement to our traditional form of educational delivery.* (J. Heasley, personal communication, February 9, 1998)

Similarly, Mitchell (1998) concluded:

> *A couple of final comments from my student evaluations: the key attributes which they find positive:*
>
> *a) they can do the assignments/exercises in their own time in most cases*
>
> *b) they can do them at their own speed–i.e., if they know something, they can go over that quickly and then slow down for the difficult parts (something they*

can't do with a teacher!).

c) the material is always there for their further consultation/reference later in the course when something prompts a thought of possible connection–and that can be done by them when it occurs to them, not having to await a class time/instructor's free moment. (P. Mitchell, personal communication, February 10, 1998)

It is clear from the e-mail messages above, and from the testimony of my colleague, that some teachers and students use a Web-Based Instruction system as an adjunct to classroom instruction. In addition, researchers have concluded that using computers in the instructional process can enhance the learning rate, as pointed out by Cotton (1997):

> Student learning rate is faster with CAI than with conventional instruction. In some research studies, the students learned the same amount of material in less time than the traditionally instructed students; in others, they learned more material in the same time.
>
> (p. 5)

The students in this study have reacted positively to Web-Based Instruction. Knowing that they can access their course work at any time–even if they make use of the computer lab at lunch or after school–was reported as an added benefit for them. Most important, I believe that it has allowed me to reach more students more often because I spend less time on repetitive administrative tasks.

Conclusions

Web-Based Instruction is certainly not the panacea for all our teaching woes, but it is one more strategy that can used to help teachers teach more effectively and efficiently. There is one point that all teachers must remember, and that is that technology does not teach students–dedicated teachers do, and they do so by using any number of methods and strategies, of which Web-Based Instruction is one. As Whitesel (1998) stated:

> Learning is no longer simply what one does to prepare for the future. It is a complex and adaptive process in which the roles of teacher, learner, and content are constantly changing, open and flexible. Learning is not defined as what happens when a learner has access to information, it is the consequence of processing and acting on that information.
>
> The educational challenges are clear. Can we as instructors keep up with changing technologies and opportunities? Can our educational institutions–where classrooms, concepts of place, classroom socialization, and interaction are very important–reconcile with the Internet where time, place, and diversity are not terribly significant? How will our teaching change? How can we adapt what works in our classrooms to cyberspace? How can we keep our teaching interactive, dynamic, and vital? (p. 3)

In addition to the points mentioned above, the use of Web-Based Instruction could provide another opportunity in schools. Web-Based Instruction could allow for multilevel programming in a single classroom. Providing such an environment would allow several related, appropriate courses to be offered concurrently by the same teacher in the same

classroom. This would maximize the use of the teacher and the facilities and could help accommodate students' diverse needs. In addition, students in more advanced levels of the course could be mentors and tutors for students who are at the beginning levels.

As was discussed in the findings in Chapter Six, the role of the teacher using Web-Based Instruction will change from predominantly the leader of the class to the facilitator in the classroom. This changing role was substantiated by Robinson (1994):

> Another study of the successful use of technology found that technology permits teachers to assume new roles in creating learning opportunities for their students; encourages individualization of learning to accommodate various learning styles; allows learning experiences far beyond anything currently available; provides strong motivation for students; reduces time-consuming paperwork; and allows teachers more time to take advantage of the opportunities of technology. (p. 6)

Teaching can improve if teachers have the desire and ability to try a variety of methods of instruction, and this study is my attempt to improve my craft through the use of one method–Web-Based Instruction. By reflecting, I was able to take a critical look at all aspects of the Web site implementation and examine if and how it was useful. After looking at all aspects of the Web site, I would conclude that it was useful because it allowed me to spend more time doing important teacher tasks such as assessment and curriculum development and to spend more time with students and less time managing day-to-day tasks such as duplicating, sorting, filing, and cleaning. It is my sincere wish that other teachers will continue to research Web-Based Instruction.

Recommendations for Further Study

I consider this research as a starting point for future study. In completing this study, I studied my own teaching in a single curricular area in my school. In order to determine whether Web-Based Instruction is useful in other teaching/learning situations, I recommend that it be used not only in other Career and Technology Studies strands, but also in other subject areas and grade levels. For example, how could Web-Based Instruction be used to teach science or mathematics? Another recommendation for further study would be to use Web-Based Instruction with elementary and senior high grade levels.

A second recommendation for further study is to examine of the classroom configuration within which Web-Based Instruction is implemented. In this study one computer was available for each student in every Information Processing class. If such a configuration were not available, how effective and efficient would Web-Based Instruction be with fewer computers? For example, if a science teacher had a cluster of five or six computers, would it be useful to place the curricular materials on a Web site and have students access that information sometime during the class, then return to their work area to complete the assignment? It is a recommendation that this avenue of research be pursued.

A third recommendation for future study is to look at the students and teachers using Web-Based Instruction and to complete a study of their impressions and feelings about this mode of teaching and learning. While analyzing the data gathered during this study, and in attempting to find support in the research and literature, I found a paucity of

publications in this area. Much research has been conducted on student achievement when using computers and on methods of creating and using Web pages and the Internet in classrooms, but little or no research is available about those whom it affects the most. Similarly, little research is available about teachers who use this mode of teaching. Studies have been conducted on different methods of using Web-Based Instruction, such as distance learning, but none of them reported on the teachers.

A fourth recommendation for study is be to examine student learning styles in order to determine if there is a relationship between Web-Based Instruction and learning styles. This would enable teachers to use Web-Based Instruction as an instructional strategy for those students whom learn best from it.

A Final Word

In the past the role of the student was to absorb information that was viewed as static and unchanging, usually from a teacher using a lecture-and-blackboard presentation. Success was measured by the amount of content absorbed and retained. Because not all students in the class learned at the same rate, and because fixed amounts of time were allocated during which learning was to occur, one could best describe this learning environment as a "fixed time-variable achievement" model of learning. In this case all students spent approximately the same amount of time exposed to the teachings of the teacher. Because individuals differed in their capacity to retain what they had been taught within that fixed time, a small number of students excelled, and a small number failed. The majority learned enough to "pass," but probably never achieved mastery.

Self-paced instruction provides students with choice–it does not mean that students

are necessarily isolated and confined to work individually. Indeed, students will work at their own pace, but in company and in social interaction with a small group of other students. Because not every learner pursues the same sequence of activities while learning and not every learner requires the same amount of time to achieve mastery, students can become independent learners. An evolving "fixed achievement-variable time" model provides every student with the opportunity to master what is being learned, though the time taken to achieve mastery varies from student to student.

Increasingly, the computer studies curriculum will need to be interdisciplinary and global in nature, have challenging standards, and develop thinking and problem-solving skills and other habits of the mind. Attention to the development of interpersonal skills such as team work, collaboration, and communication will help to provide educational experiences for developing ethics and citizens. Students will need to be active learners, and the curriculum must address what students should be able to know and demonstrate. Using more effective instructional and technological processes will enable higher levels of achievement for all students. Every student can and will learn if presented with the appropriate opportunity to do so. Learning opportunities are determined by the nature of the work that students undertake. It is imperative that schools provide as many opportunities as possible for students to experience success. The learner-centered school that delivers curriculum in this manner will use a variety of teaching strategies that will meet the needs of individual students.

Computers, with their library of knowledge at students' fingertips, can make it possible for students to enjoy learning by making them explorers, active participants in

educational adventures. This can be done by building computers into the core curriculum. No longer is computer literacy an option–it is a new basic. New technologies make it possible to relieve the teacher of much of the burden of imparting information to students, thereby freeing them to diagnose learning difficulties, coach, develop students' creative and problem-solving capacities, and participate in school management. The substantial productivity advances that can be expected from integrating computer use will result not from replacing teachers with machines, but through greatly improved achievement by students when good teachers are augmented by appropriately used technology.

The use of the Web site aided in reducing teacher administrative time for repetitive instructions and on management tasks. Students reported that they liked using the Web site, noting advantages such as being able to progress at their own pace; and a colleague suggested that the Web site not only made her job easier, but that it also transferred some of the responsibility for learning to the students. For all of these reasons, and numerous others mentioned throughout this study, it is clear that the use of Web-Based Instruction to supplement everyday teaching is another strategy that teachers can integrate into their repertoires of teaching practices. The Web site motivated students, the students were observed to be more on task more often, and the role of the teacher shifted from purveyor of information to guide for student learning. In summary, no negative effects on student learning emerged from the use of the Web site in this study, and for that reason, it should continue to be employed for teaching students.

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APPENDIX A

CONSENT FORM

Dear Parents/Guardians of Grade 7 Information Processing students:

Please allow me to introduce myself to you. I am Norman Mathew and I will be your child's Information Processing (Computer Studies) teacher for this year. This is my fourth year of teaching at Ottewell, and my twenty-third year with Edmonton Public Schools. I have always had an interest in using computers in the classroom, and especially in using computers to help students learn.

I am embarking on my Doctoral Degree within the Faculty of Education at the University of Alberta, and am working on a special project for this degree while I am at Ottewell School. The project involves using Web Based Instruction to help students learn about computers. During the 1997-1998 school year, students at Ottewell School will be using the Internet to receive their lessons, assignments and instructions while in the computer lab. I will also be in full time attendance during the class and will be able to spend time working with small groups or individual students. The instructional materials that students will see will take them step by step through concepts and procedures they need to know to use a computer. In addition to direct instruction, students will also be able to see computer animations of the procedures, or choose step-by-step instructions, or any combination of these. You can visit this web site, if you have an Internet connection at home, at:

http://www.epsb.edmonton.ab.ca/schools/ottewell/CTS/ctindex.htm

There will be an information session for parents regarding the web site and this study on Monday, September 15, 1997 at 7:00 p.m. in the Room 16 computer lab at Ottewell School. You are invited to attend this session.

The point of my study is to determine if teaching is more effective, and if students learn more and understand more when Web Based Instruction is used. The students will be requested to respond to survey questions asking them about their Web Based Instruction experiences. This letter is to seek your permission to allow your child to participate in this study. Since participation in the study is voluntary, your child may withdraw from the study at any time and/or your child may choose not to respond to some questions. I personally guarantee that neither your child's name or photograph will appear in any part of the study, nor will the school be named in the study. I would ask that you check the appropriate box below, sign and return this form to me prior to September 12, 1997.

Thank you.

Sincerely,

Norman Mathew, M.Ed.

❑ I give permission for my child _____ to participate in the Web Based Instruction study described in this letter.

❑ I DO NOT give permission for my child _____ to participate in the Web Based Instruction study described in this letter.

Parent/Guardian Signature _____ Phone_____ Date _____

APPENDIX B

STATEMENTS AND QUESTION PRESENTED FOR STUDENT RESPONSES

1. Describe the three things that you liked the most about the Information Processing Web Site.
2. Describe three things that you liked the least about the Information Processing Web site.
3. Describe and give three examples of how you used the Information Processing Web Site (please do not confuse this with the Internet in general).
4. Give one example of how using the Information Processing Web Site helped you become a more independent learner.
5. Given the choice, would you prefer to use the Web site or to have your teacher give class lectures for your Information Processing course?
6. Describe why you liked or did not like using electronic mail to hand in your assignments.

APPENDIX C

COMPANION CD-ROM