MULTIMEDIA: TOOL OR TOY

by

Shelley Wilcox
B.A. University of British Columbia, 1976

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Approval

Name: Shelley Wilcox
Degree: Master of Arts
Title of Thesis: Multimedia: Tool or Toy
Examining Committee:

Chair: Dr. David Zandvliet
Assistant Professor

Dr. Roland Case
Senior Supervisor
Professor

Dr. Cheryl Amundsen
Committee Member
Associate Professor
Committee

Dr. Paul Neufeld
[External] Examiner
Assistant Professor
Curriculum and Instruction
Simon Fraser University

Date Approved: April 15, 2004
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Abstract

This study explored the use of computers as a research and presentation tool and identified the challenges of implementing multimedia programs at the elementary school level. Ninety-four students in four classes in two schools in a suburban area near Vancouver created social studies projects in text and multimedia programs during the eight week study. Research instruments included: self-reports, test exercises (computer and text format), assignments and journals to evaluate student achievement and to survey students’ perceptions. Students were grouped by software program and levels of computer skill.

The data suggest that students are better able to take advantage of the features of multimedia programs if they have a relatively high level of computer skill. Students with average computer skills acquired the most new computer skills and their multimedia projects were generally good at integrating Internet research and creating appealing designs. Students with low levels of computer skills tended to be more successful using the text-based program (CW).

When students analyzed web site content from a text document, most students retained content but scored poorly on analyzing currency and credibility of the information. The study suggests that Internet use focus on critically analyzing the reliability of information rather than reporting content and be embedded throughout the curriculum.

Level of interest when viewing multimedia presentations appears to have less impact on content retention than level of computer skill. Using a variety of media improved content retention minimally.
Student surveys indicated that the computer was a motivating factor but not as much as research suggests since novelty also appears to affect student attitudes; the usefulness of the computer applications in school-related tasks or in future life appears to have influenced student attitudes; and the study indicates that technical problems were an impediment to integration of computers.

Recommendations included teacher training that focused on integrating technology; ongoing technical support for teachers; use of student mentors to assist with using software and trouble shooting; teaching information processing skills prior to research and applying this approach across the curriculum; supporting students with weaker skills; and developing students' time management and organizational skills before research.
Dedication

This thesis is dedicated to my parents who died during this project and to my children who have made so many sacrifices to enable me to complete this project.
Acknowledgements

I would like to thank my committee for their support throughout this project and particularly Roland Case for his patience and support in teaching me how to refine my writing. Special thanks to the two schools that participated in the study and to the teachers who gave their time to make this research possible. Thank you as well to the principals for facilitating the required changes in the timetable to allow this research to occur. My thanks to my school district especially Dr. Cynthia Lewis for supporting this research. Thank you to the Centre for Educational Technology for providing me with SPSS when the data was analyzed.
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Chapter 1 – Introduction

When the computer was introduced into schools, educational journals predicted that this technology would revolutionize teaching practices and change the working environment. The number of computers in schools continues to increase. Bernie Froese-Germain’s report (2002) for the Canadian Teachers’ Federation entitled “Virtual Education Real Educators” indicates computer/student ratios in Canada range from one computer for every nine elementary students to one computer for every seven high school students. However, changes in classroom practices will not occur simply because computers become more available in schools (Ertmer, Addison, Lane, Ross & Woods, 1999, p.55).

Teachers must see computer use as beneficial to their students before they will use computers on an ongoing basis. While many teachers recognize the importance of integrating computer technology into their curricula, researchers and educators alike still report that this is not easily accomplished (Ertmer, Addison, Lane, Ross & Woods, 1999, p.54). Computers continue to have only a marginal impact on classroom instruction: typically, they supplement existing practice rather than replace it. Cuban (2003) says that despite twenty years of computer use in schools, there is little evidence that the computer has altered teaching practices. “When the type of computer use is examined, these powerful technologies end up being used most often for word processing and low-end applications in classrooms that maintain rather than alter existing teaching practices. After all the machines and promises, the results are meager.” (Cuban, 2003) Although many educators and policy makers believe that technology can be a catalyst for educational reform (Collins, 1991; Means, Olson & Singh, 1995, as cited in Tiene and

After reading the literature on how computers are used in schools, this researcher decided to examine methods for integrating computers into academic subjects. Since the researcher performed a variety of roles within her school district including both school based roles as an elementary classroom teacher and computer facilitator and as a staff development facilitator in technology for her school district, she wanted to develop strategies that could be used by classroom teachers during instruction in classrooms and in computer labs. Because the use of the Internet, critical thinking and multimedia were areas of professional specialization, the researcher decided to implement an integrated project in social studies that involved Internet research and the use of multimedia programs. At the time the research was conducted, multimedia programs were being promoted by her school district. The researcher wanted to study these programs as a presentation tool to determine what skills students learned while using them and to assess the difficulties in implementing multimedia programs. The researcher also wanted to examine what skills students learned while using the computer as a tool for research and to present information.

In order to understand the challenges facing effective computer use, it is helpful to consider how technology has traditionally driven the curriculum. Rather than being a support for curriculum in academic areas, the computer itself became the curriculum. Examining why instruction on computers focuses on the technology rather than on its use to support curriculum helps to explain the pedagogical and technical constraints of
computer use in schools. This chapter identifies the two main teacher rationales for student computer use and provides an historical overview of educational uses of computer. The chapter concludes with the research questions and an outline of the organization of the thesis.

Rationale for Use of Computers with Students

Teachers report two educational reasons for computer use: computers motivate students especially those with learning difficulties and they provide students with skills that they will require in the future for work and personal life. The motivational component of computers has three aspects:

1. Generating interest in a topic by presenting materials in a graphic or video format to enhance student understanding.

2. Helping students with learning difficulties to practice required skills and to complete writing tasks in an interesting environment.

3. Acting as a reward for completing assignments or for good behavior.

The second reason for using computers is that teachers believe computers are employed throughout society and that students must inevitably be trained to use them (Atkins, 1992). They believe that students need computer skills to prepare them for the future so they can access library databases, create reports similar to those required in the business world, communicate electronically and access governmental agencies.

Computers can be used as a medium for communicating with others on a regional or global scale and for providing simulations that help students learn to solve problems and make decisions. Internet research enables students to access extensive resources, locate and evaluate information and then present it in a variety of formats. Many teachers
believe these experiences enable students to develop marketable skills required for employment and for personal life.

**Historical Overview of Educational Uses of Computers**

As this historical overview will demonstrate, early instruction on computers focused on the machine itself and the operating languages rather than on student application of computers. The educational uses of computers have evolved from studying the machine and its language to taking advantage of the computer’s usefulness in locating, storing and presenting information in a variety of formats. Teachers have traditionally had three focuses for student instruction on computers:

1. Computer literacy focused on the components of the machine and the languages used to complete commands.
2. Computer Assisted Instruction (CAI), tutorials and Interactive Computer Assisted Instruction (ICAI) were designed to develop skills and master curriculum content.
3. Current trends foster computer use as interactive learning tools, allowing users to create products such as reports, spreadsheets, databases, multimedia presentations and web pages.

Each of these uses of computers and their benefits will be examined.

**Learning About Computer Components and Languages**

When computers were first introduced into schools, they were used as objects of study and storage devices for large amounts of data. The study of computers is reported in the literature as computer literacy which refers to a basic understanding of how a computer operates and how computer programs enable the machine to process commands (Luehrmann, 1982, as cited in Jonassen, 1996). Teachers believed that students must master the input commands to operate computers and learn to use software to create word
processing documents. They believed that knowledge about the workings of the machine and its limitations were necessary to operate computers (White and Hubbard, 1988, p.102). However, Jonassen (1996) found that many students memorized the parts of the computer and learned how to use software applications for word processing rather than learning to use the computer as a tool or developing skills to handle information and solve complex problems (Hunter, 1983, p.9). However, this focus on “computer literacy” was short lived because larger numbers of students began to have home computers and used them without instruction or knowledge of how the components worked.

In the early 1970’s, the computer languages BASIC, FORTRAN and LOGO had a tremendous impact on education. John Kemeny and Thomas Kurtz created BASIC (Beginners All purpose Symbolic Instruction Code) which was written as an introductory computer language. Students then learned FORTRAN (FORmula TRANslator) in order to program the computer to perform calculations and functions. While BASIC was a simple language that ran separate parts of a program independently, FORTRAN was a complicated, compiled language requiring each part of the code to be perfect to enable the program to run. Although BASIC was considered an inadequate language by many computer professionals and college educators, most of the language instruction in teacher preservice and in-service classes was in BASIC (White & Hubbard, 1988, p.103). Consequently, BASIC became the primary language used in education and many educational software programs were written in BASIC. At the elementary level, LOGO was the popular language that enabled young students to create simple programs such as to enable a turtle to perform actions. In the early years of classroom use, computers were used to support mathematics programs by teaching logic as a component of computer
programming and as objects of study by examining their programming languages and components.

**Computer Assisted Instruction**

As advances in software made computers easier to use, computer programming was no longer required to operate the machines and the focus of instruction turned to teaching curriculum subject matter with computers. In the 1960s, two university-sponsored groups at Stanford University and at the University of Illinois developed systems to provide instruction in curriculum areas. Patrick Suppes from Stanford University used the computer to teach subject matter. In 1967, Suppes established a company, Computer Curriculum Corporation that offered computerized instruction to subscribers using telephone connections to local terminals (White & Hubbard, 1988, p.103). Programs were curriculum-based, sequential, provided immediate feedback and tracked student performance. Suppes' efforts at Stanford did not lead to widespread integration of the computer into curriculum areas nor did curriculum-based instruction extend beyond the college level due to prohibitive hardware and software costs. However, Suppes' goal to tie instruction to subject areas remains valid today. At the University of Illinois, a system of instruction called PLATO (Programmed Logic for Automatic Teaching Operation) was created and controlled by a mainframe computer on the university campus that provided 7000 hours of instruction in 150 subject areas. These projects provided the roots for Computer Assisted Instruction in subject areas and by the mid-seventies, with the invention of the microcomputer, Computer Assisted Instruction (CAI) became much more widely used in schools and homes.
CAI is a model in which learners practice a series of tasks to develop specified skills until their achievement reaches a standard that is considered mastery. In CAI, the computer is programmed to lead the student through a series of activities toward the acquisition of specific knowledge or skills and provides performance feedback and rewards (Jonassen, 1996, p.4). A variety of software became available offering drill and practice, enabling users to master skills and to play educational games. CAIs linear design restricted how users operated the software and the content of the programs often failed to meet prescribed learning outcomes. Learners using CAI have no opportunity to choose the type or content of instruction and slower learners must repeat tasks over and over until required mastery is achieved by passing prescribed tests. Although CAI offers repetitive drill of skills, the programs cannot be adapted to individual learning differences and since CAI software is often written by non-teachers, instructional focus is often not on prescribed, curricular goals (Jackson, Fletcher & Messer, 1986, as cited in Jonassen, 1996). Becker (1993, as cited in Berg, Benz, LasleyII & Raisch, 1998) found that students at the elementary level used computers overwhelmingly for drills and educational games that often had marginal links to required curricula. CAI failed to use the computer’s potential to provide a variety of approaches to teach concepts and only developed skills in narrow areas such as spelling or word recognition. Unfortunately, the behaviorist principles underlying drill and practice did not foster the complex thinking required for intellectual tasks such as problem solving, transfer of those skills to novel situations, verbal learning, and originality (Jonassen, 1996, p.5).

Eventually, a more flexible tutorial model was designed that allowed the learner to choose the learning paths and teachers began to create their own programs with new
authoring software. The strength of this model is that it allows curriculum developers to break the teaching, evaluating and remediation tasks into strands offering a variety of ways to master required skills. Tutorials were built on the cycle of presentation – response – feedback. More recent tutorials, adapted to learners’ entry level of learning, allowed learners to select the amount and form of instruction or advised them about how much instruction they needed (Jonassen, 1996, p.6). Like CAI, tutorials helped remedial learners who needed practice but they did not develop independent thinking, problem-solving skills, innovation or creativity nor did they allow for presentation of students’ own knowledge.

The design of CAI and tutorial programs was primarily linear in nature until the advance of hypermedia which allowed learners choices in learning paths and topics to meet their personal needs, interests and learning styles. Hypermedia is a term synonymous with Interactive Computer Assisted Instruction (ICAI) and hypermedia tutorials enable users to link between sections of the program. Although the author had control of the actual content of a program or document, the reader can control the sequence and presentation of information (Ayersman, 1996, p.501). Programs like HyperCard enabled teachers to design customized exercises suited to their particular disciplinary needs and Roberts (1996) reported that research found that students had a more positive attitude toward computers when users controlled learning paths and mastered skills faster when classroom instruction was reinforced with ICAI tutorials and the tutorials were adapted to students’ individual needs.
Computers as a Learning Tool

In the last ten years, computer use for CAI, tutorials and rewards for good behavior (Berg et al, 1998; Fisher & Yocam, 1996, as cited in Ertmer et al, 1999; Hadley & Asheingold, 1993, as cited in Ertmer et al, 1999) has shifted to the integration of technology as a tool in core subject areas. In the latter approach, students use computers to create reports including spreadsheets, graphs and pictures and produce multimedia presentations including sound, pictures, movies and text to demonstrate knowledge in curriculum areas. Critical analysis of information and problem solving are practiced during the research phase and students assess methods of presenting information to determine the most effective medium to report their findings. Jonassen (1996) describes the use of computers as "mindtools" that "require learners to think harder about the subject matter domain being studied while generating thoughts that would be impossible without the tool" (p.30). The worldwide adoption of the Internet for research and communication is encouraging the use of the computer as a tool for research and for presenting information. The least common use of computers is for simulations but as educational budgets decline, virtual tours of museums and other facilities are gaining popularity.

Before teachers offer instruction on technology as a tool embedded in curriculum, they need time to learn how to use software for their own personal use and time to explore resources on the Internet before they feel comfortable working with students. Teachers need opportunities to work with software appropriate to their curriculum, to learn how to operate its features and to plan how to integrate its use into classroom activities before they begin to have their students use computers as a tool.
With experience, teachers can begin to involve students in locating Internet resources, summarizing data in spreadsheets and databases and presenting information in multimedia formats. Teachers must have time to build their confidence in their personal ability to use computers and to problem solve when unexpected situations occur.

Teachers’ technology instruction changes as they gain personal experience with computers (Hadley & Sheingold, 1993, as cited in Ertmer et al, 1999; Sandholtz, Ringstaff & Dwyer, 1997). Teachers need ongoing professional development to support their efforts to integrate technology effectively with the curriculum.

Thesis Questions

To assist in her computer helping roles in her school and school district, the researcher sought to explore the integration of computers as a tool in creating projects in social studies. Although proponents of computer use offer glowing reports of their benefits, the viability and feasibility of computers to support classroom teaching is still a matter of some debate. The object of this study of three teachers’ computer-based projects is to explore the use of computers as a research and presentation tool and identify the challenges of implementing multimedia programs at the elementary school level. The researcher hoped that the findings from this study would inform her own classroom teaching and that of other teachers. The study focused on four broad questions discussed below.

Question 1 – What can we learn about student use of text-based and multimedia computer programs as a presentation medium when creating curriculum projects?

The literature on computer use has suggested that students can benefit from the multimedia features of computer programs in presenting information. It was hoped that
the insights gained from exploring students’ use of the computer as a presentation tool would help to further affirm or contest the purported value of computer-developed curriculum projects and suggest ways in which teachers might use this tool effectively in elementary classes. The researcher identified three factors related to students’ computer use as a presentation tool: (1) the amount and nature of improvements in computer skills during a computer-based project, (2) students’ ability to present visuals and text in an appealing manner using text-based and multimedia programs and (3) student’s ability to effectively integrate information obtained from the Internet into their computer presentations.

Question 2 – What can we learn about students’ ability to assess the credibility of information drawn from the Internet?

Although many researchers and educators extol its virtues as an information source, many others worry about the quality of information available through the Internet. In pursing this second question, the researcher hoped to learn if, after instruction and practice, students could successfully assess the credibility of a website. In answering this question, the researcher studied students’ ability to judge three factors: the currency of information (when the site was posted and updated), the reliability of the content (adequacy of the support and cited sources) and the credibility of the author (relevance of the author’s education, experience, and organizational and educational connections).

Question 3 – What can we learn about students’ interest in and recall of content when viewing text-based and multimedia computer presentations?

Proponents of computer use suggest that students will be motivated to attend to information presented in a computer format. Is it reasonable for educators to expect that
students' interest in computers will enhance their retention of content? In attempting to shed light on this question, the researcher explored connections between content retention and two other factors—student interest in a computer presentation and students’ level of computer skill.

**Question 4 – What can we learn about students’ attitudes and experiences when using text-based or multimedia programs to create a social studies project?**

Student reactions are an important and often under-appreciated consideration in the educational use of computers. As a modest exploratory inquiry into this area, the researcher wanted to learn what students regarded as the most interesting and important aspects of a computer-based project. In addition, she wanted to learn about the difficulties students encountered in completing their projects. It was hoped that this information would shed light on the educational value of the computer and assist teachers in implementing this tool more effectively.

**Outline of the Thesis**

The chapters of this thesis are organized as follows: Chapter two reviews the literature on constructivist theories of learning, and on the benefits and impediments to the classroom use of the Internet and multimedia programs. Chapter three outlines the methodology used in the study, while Chapter four presents the data generated from the research. Chapter five analyzes the data and interprets the findings. Chapter six discusses the limitations of the study, offers suggestions for integrating computers in elementary classrooms, and identifies further areas of needed research.
Chapter 2 – Literature Review

As the educational use of computers has shifted from drill and practice to constructivist learning philosophies, the use of the computer as a research and presentation tool has become more widespread. This literature review deals with three themes:

1. Constructivist learning and the implication for use of technology in the classroom.
2. The impediments to the educational use of the Internet.
3. The strengths and weaknesses of multimedia programs as presentation tools.

The intent of the literature review is to situate the study within a constructivist approach to learning and the support that the Internet can offer this learning approach. The study examines the use of multimedia programs as a presentation tool for students to represent their learning.

Constructivist Learning and Computer Technology

This section describes what is meant by a constructivist approach to learning, outlines the operation of a constructivist classroom and describes how technology, especially the Internet, can support constructivist learning.

A Constructivist Approach to Learning

Constructivist learning is a process of building new knowledge (Novak, 1987, as cited in Mayer-Smith & Mitchell, 1997). It differs from traditional instruction where students repeat information and imitate behavior. Instead, the learner is encouraged to internalize, reshape and make new information their own by connecting their learning to what they already know. According to Schunk (1996), meaningful learning involves
gaining ideas, concepts and principles and then relating new knowledge to existing knowledge. Constructivism considers each learner’s representation of knowledge to be unique as it is influenced by diverse contextual, cultural and personal factors (Schunk, 1996). In a constructivist approach, students are often invited to pose new questions and examine how this new “knowledge” relates to the big ideas and broad concepts or their theories of the world thereby enabling them to build their own knowledge structures (Novak, 1987, as cited in Mayer-Smith & Mitchell, 1997). “In the constructivist approach, we look not for what they can repeat, but for what they can generate, demonstrate and exhibit” (Brooks & Brooks, 1993, p.16).

Students frame their understanding by examining a variety of sources and then presenting their knowledge in a format that best demonstrates their understanding. Students actively engage in learning and are provided with opportunities to process new information, to transform it and “to make it their own” (Berg, Benz, Lasley II, & Raisch, 1998, p.120). Teachers encourage students to use raw data and primary sources, along with manipulative, interactive and physical materials. Despite curriculum pressures, students need time to frame personal understanding of required curriculum by posing and responding to open-ended questions rather than merely covering material from textbooks. Constructivist classrooms are more student centered and research and presentation tools are more individualized than in traditional classrooms.

Organization and Pedagogy of Constructivist Classrooms

Constructivist classrooms are different in design and practice from traditional ones. Constructivist classrooms are not characterized by teacher talk and teachers as the disseminator of knowledge but a learning environment that encourages student initiated
questions and fosters student interactions. The traditional demand for short, simple answers that can be supplied on tests is radically different from facilitating reflection on the complexities of issues. Constructivist classrooms encourage student autonomy and initiative and are learner focused which varies sharply from the rote based instruction required to successfully complete provincial exams.

Cooperative learning and thinking are valued as a means of searching for new insights rather than right answers. Constructivist classrooms foster cooperative learning. Students are constantly revising their views and dialoging with teachers and peers who assist them to reframe their knowledge. Student to student dialog is the foundation upon which cooperative learning is built (Slavin, 1990, as cited in Sandholtz, Ringstaff & Dwyer, 1997; Brooks & Brooks, 1993, p.109).

Since the constructivist approach involves decentralized, student centered learning environments, many teachers have difficulty shifting their instructional practices due to the constraints of large classes, perceived time “away” from curriculum and comfort with traditional methods of discipline and teacher centered instruction. In constructivist classrooms, teachers must reframe their understanding of classroom practice. “Inherent in this model is the need for the teacher to be flexible and responsive in the design of lessons and open to the idea of sharing intellectual control of the agenda with students.” (Mayer-Smith & Mitchell, 1997, p.149) Teachers in this model are responsive to the needs and interests of their students when planning instruction. Constructivist teachers are “sharing intellectual control, encouraging questions that assist students in linking knowledge with their personal lives and implementing flexible and responsive instructional sequences. Teachers promote student problem solving, self-
monitoring and self-direction” (Richardson, 1996, p.132). If teachers are willing to change their approach to learning activities and incorporate the range of resources available on computers, constructivist learning can be facilitated.

**Constructivism in a Networked Classroom**

Technology can play a key role in supporting a constructivist approach by opening the classroom to the wider network of resources. In a networked classroom, computers act as a research, communication and presentation tool to access information and to frame new understandings of course content. The two main advantages of using the Internet relate to its enormous database of resources and its capabilities for communication (Starr & Milheim, 1996). The most significant importance of the World Wide Web to education is its ability to bring a massive set of information resources into the classroom that has never been available before (Provenzo, 2001). Students access a wide array of resources from businesses, to foreign languages, to libraries, to experts in a variety of academic fields and can experience virtual tours of museums, parliament buildings or other tourist sites (Wilson & Utecht, 1995, as cited in Starr & Milheim, 1996). Other uses of the Internet include electronic mail, World Wide Web, listservs, newsgroups, chats, online courses and telnet (remote login used primarily at colleges and universities). Virtual tours of museums and chemical experiments can be viewed on the computer without any safety risks or having to travel long distances. Computers provide extensive resources through the Internet and commercial products available on CDs including videos, encyclopedias and software resources.

The Internet supports individualized learning by accommodating individual differences in learning styles, abilities, needs, interest and prior knowledge (Resource-
based learning, 1994, as cited in Rakes, 1996). Students learn how to gather and organize facts, distinguish between fact and fiction, to recognize bias and to draw implied meaning from sources. By using a combination of primary and secondary sources and performing comparative analysis, students form and defend opinions, identify and develop alternative solutions and solve problems independently (Resource based learning, 1994, as cited in Rakes, 1996). “The computer is a powerful tool for constructivist teachers to facilitate access to resources for students to discover things for themselves and to reach their own conclusions.” (Tiene and Ingram, 1998, p.84)

Computers provide a communication link with others enabling students to dialogue with each other in the classroom and with others from the global community. Since the introduction of web browsers in 1993 and the allowance of Internet access to businesses and individuals, the Internet has become the public forum for communication, discussion and dissemination of information. Students can email an expert or join discussion groups or listservs on topics related to their curriculum studies. By communicating outside the classroom, students gain access to academic institutions as well as opportunities to interact with other students in other schools that are studying similar topics (Heinrich, Molenda, Russell & Smaldino, 1996, as cited in Rakes, 1996). Students access a variety of opinions and sources of information to deepen their understanding and make the global community a part of the learning environment (Takacs, Reed, Wells, & Dombrowski, 1999; Heinich, Molenda, Russell, & Smaldino, 1996, as cited in Rakes, 1996). Learners can also post presentations to the web inviting others to respond to their work and continue the communication with others in the global community. Kaye (1992, as cited in Doherty, 1998) believes that conversation, argument,
debate, and discussion among learners in a collaborative learning environment such as computer mediated conference can lead to significant learning and deep-level understanding. The computer becomes an invaluable tool as it provides the means for both quick retrieval and sharing of information and communication with the global community (Rakes, 1996).

Computers also provide students with the ability to create text documents, graphics, multimedia presentations, videos and web pages to present their knowledge in a variety of formats in a medium that meets their needs. For example, visual learners can produce mind maps and graphics while other learners can use a variety of text and graphics in their presentations. Computers become a tool for research, communication and presentation in constructivist classrooms but their use is dependent on the availability of computers and curriculum requirements.

A networked classroom attempts to integrate technology into core subject areas and make ongoing use of Internet resources. Survey research by Becker and Ravitz (1999) in 153 schools of the National School Network suggests that teachers' sustained use of computers and exploration of Internet resources correlates with increased use of constructivist teaching practices and may even help to influence teachers' pedagogical beliefs that underlie constructivist practices. The organization of a networked classroom involves a shift in both student learning styles as well as pedagogy and classroom management. The role of the teacher in a networked classroom involves accepting that he/she will not have control of everything at all times. As Fischer (1999, as cited in Okamoto, Cristea & Kayama, 2001, p.10) noted, it involves the changing of mindsets: the teacher evolving from the “sage on the stage” to “guide on the side”, the student
switching from a dependent, passive role, to a self-directed, discovery oriented role. Teachers will act more as facilitators by helping students’ access information, process it and communicate their understanding (Collins, 1991; Means, Olsen, & Singh, 1995, as cited in Rakes, 1996; Mehlinger, 1996, as cited in Rakes, 1996; Newman 1992, as cited in Rakes, 1996; Sheingold, 1991, as cited in Berg et al, 1998). In the networked classroom, the teacher remains a central figure in terms of guiding the students and providing the necessary supports and prompting at appropriate times. An important principle of working in a networked classroom is that the teacher circulates constantly throughout the classroom answering questions and monitoring behavior.

**Barriers to Constructivism**

The main barriers to creating constructivist classrooms relate to curriculum pressures, and organizational, instructional and pedagogical practices (Brooks & Brooks, 1993). Although constructivist learning is based on individual choice and framing personal understanding, many teachers feel that curriculum pressures necessitate directing students in their inquiries especially in senior courses where students must write provincial exams. While many teachers acknowledge that students may well develop a deeper understanding of content that they have constructed according to their personal interests and experiences, there is often little time to enable this exploration. One common criticism of constructivism is that it subordinates curriculum to the interest of the child.

Teachers also face pressures from organizational structures and beliefs about classroom management. The realities of timetabling both restrict the amount of time that can be spent on tasks and disrupt the sequence of learning by constantly stopping students
according to a time schedule rather than ending activities when students have completed their exploration or task as they would do in a constructivist classroom. Many teachers who prefer to sustain control over information and thereby control the students' behavior by making it necessary for them to listen to the teacher to understand the required content. Teachers with large classes often find it difficult to enable a variety of activities simultaneously because students must share resources and computers making classroom management difficult especially if access to computers is dependent on prescribed timetables for computer labs. Student-centered classrooms result in a greater diversity of needs, activities and problems including technical problems with computers that require the teacher to make quick decisions and to problem solve on the spot. Thus, pressures to meet curriculum objectives, restrictions from timetables and pressures to manage classes in a centralized manner restrict the potential for constructivist learning.

Teachers must be committed to changing their pedagogical approaches in order to offer a constructivist approach to learning. For many teachers, technology integration may place an initial strain on their time and energy. "There are new skills to learn, new patterns of interaction to get used to and of course, there is some getting used to and defining one's role in a networked classroom." (Murphy & Laferriere, 1997, as cited in Barrell, 2001, p.318) Outside communication with students must be carefully monitored to ensure that students are not communicating with inappropriate individuals or spending excessive amounts of time sending and answering unproductive email. While the concept is commendable, the time involved in managing email and locating and participating in appropriate newsgroups and listservs is often too labor intensive to incorporate in regular research practice. The use of Internet communication can bring
unique information into the classroom through listservs and other communication forums but it may be a time consuming exercise for which teachers need training and time for facilitation. Mayer-Smith & Mitchell (1997) studied how pre-service teachers adapt to constructivist approaches and found that these teachers were more likely to adopt constructivism than classroom teachers who find it more difficult to adjust their teaching styles. Despite the breadth of options available using constructivist learning, “if current instructional practices are perceived to be working, there is little incentive to experiment with new methodologies – even if the pedagogy under-girding the new methodologies is appealing.” (Richardson, 1997, p. 102) Thus, teachers resist adopting a constructivist approach if they feel their instructional approaches enable students to master the prescribed learning outcomes.

**Obstacles to Using the Internet**

As we have seen in the previous section, the Internet can plan a potentially significant role in a constructivist classroom. This potential isn’t easily achieved. The literature suggests at least six kinds of impediments to effective educational use of Internet resources (Starr & Milheim, 1996):

1. Limited access to the Internet and network problems.
2. Difficulties in maintaining hardware and software.
3. Insufficient teacher time and knowledge.
4. Conflicting educational beliefs and teaching styles.
5. Concern about student access to unsuitable materials.
6. Challenges in student-conducted Internet research.

Each of these problems will be discussed individually.
Access to the Internet and Network Problems

While classroom access to computers continues to expand (Cuban, 2003) Internet access continues to be limited especially in elementary schools. In a study conducted in a large metropolitan school district outside Vancouver (Loftus, 2001), 81% of the 523 teachers surveyed indicated they had access to computers but only 41% of these had Internet access. Despite access to computers, 37% of the 131 secondary teachers reported functional computers but only 19% of the 356 elementary teachers had reliable computers. Loftus (2001) also reported that 84% of elementary respondents indicated they had computers in the classroom but only 43% of these were connected to the Internet. All levels of government have made commitments to expand network access to schools but less than half of elementary students have computers with Internet access in their classrooms. To use the Internet effectively requires computers, network connections and sufficient connection speed to allow users to download information quickly.

Users not only need computers but also high speed connections with sufficient bandwidth to access Internet resources such as videos. Inadequate bandwidth reduces the ability of users to view Internet resources. Many districts are forced to block Internet sites, video files and live streaming video because their network infrastructures cannot support the heavy demands made when sound files and video are downloaded. In an effort to block excessive student downloading of games and sound files, port access is often denied. These security and filtering restrictions mean that browsers cannot access sites that have excellent educational resources. Similarly with online courses, the current bandwidth limitations reduce the ability to take advantage of the presentational features
of this medium (Hopper, 2003) so they rely on text, graphics and discussions. In British Columbia, demands on the Provincial Learning Network, which services all educational institutions, have required continual upgrades. Frequent server crashes occurred due to virus attacks making access to the Internet sporadic at best. When networks are unreliable, the teachers cannot access the Internet and the desire to use the Internet declines.

**Maintenance of Hardware and Software**

Although the number of computers in schools continues to increase, funding to maintain the computers is limited so computers often do not function properly and teachers do not have the access to security codes to make adjustments to settings or to load software. While most school districts continue to purchase hardware, minimal training is offered so teachers cannot use the software and do not understand how to operate the computer network to log on, save their work and access programs.

Skilled technicians are required to maintain the computers, load software and to make adjustments to settings in the software but this task often falls to a teacher within the school who may not have the training to perform these tasks. School district technicians offer limited support on a scheduled basis so computers in labs and classrooms often do not function. While one technician is provided for every 50 computers in business (Cuban, 2003), schools usually have one person with limited or no release time to administer and to service networks of as many as 300 computers in some secondary schools. When networks do not perform effectively and Internet access is disrupted, teachers are unwilling to use Internet sources as a regular component of instruction and they avoid the use of programs that are problematic.
The use of the Internet is complicated by the need for ongoing maintenance of computers and continual troubleshooting to keep computer labs operating. When the data flow is disrupted on a network, the computers often have files corrupted so the web browsers are not able to reconnect. Cables fail breaking network connections and sometimes students unplug connections so the next person using the computer is unable to use the Internet until the problem can be located. Since security software is installed, only teachers with special passwords or technicians can maintain the computers placing an ongoing burden on site coordinators. Viruses or Trojans (scripts that enable tracking of activity when on the Internet or send out continual messages to disable a server) that disrupt computer operation are sometimes downloaded when Internet sites are accessed and again computers often require repairs to remove these. Web browsers are often unreliable as they require special subsidiary programs referred to as plug-ins to display components of web pages. These must also be installed or updated by technicians.

Ongoing technical support is required to sustain Internet access (Starr & Milheim, 1996; Maddux, 1994, as cited in Starr & Milheim, 1996). Even teachers with computer access are often restricted by computers that do not function well, lack of Internet access, and lack of adequate technical support.

**Teacher Time and Knowledge**

Effective student use of Internet sources can be a time consuming undertaking. Teachers often question if the time required is warranted especially when the technology is unreliable. Class management in computer labs becomes more difficult when computers are unreliable and teachers must design supplementary activities in case Internet access is unavailable. The time involved in planning instruction, locating
appropriate web sites and troubleshooting computers often restrict Internet projects. Teachers must have time to evaluate Internet resources and to find meaningful ways to integrate this content into curriculum. There is limited time for educators to learn to use the Internet and access time has been limited (Honey & McMillan, 1994, as cited in Starr & Milheim). With continuous pressure to complete learning outcomes in academic subjects, teachers will hesitate to use computers if they feel that the time in computer labs is not productive (Ertmer, Addison, Lane, Ross & Woods, 1999).

As teachers become more familiar with the Internet, their comfort level and knowledge increases but many need professional development on various aspects of Internet use. Many teachers are unfamiliar with advanced searching techniques or features of search engines so they spend a tremendous amount of time looking for appropriate sites. Teachers require training to assist them in embedding Internet activities into the curriculum and in creating instructional strategies and organization tools to enable students to analyze information critically (Maddux, 1994, as cited in Starr & Milheim, 1996). Professional development is needed on behavior management strategies in computer labs but a “Net phobia” continues for some teachers encompassing concern with losing control of the teacher-defined curriculum (Gallo & Horton, 1994, as cited in Starr & Milheim, 1996; Killian, 1995, as cited in Starr & Milheim, 1996).

While most school districts continue to purchase hardware, minimal training is offered to help teachers use the newly acquired software, operate the computer network and access programs. Training on computers is generally done in one-day or after school workshops or as part of professional development days. Most of this training focuses on hardware and software rather than on the connection between computers and curriculum.
(Bork, 1991, as cited in Sandholtz, Rngstaff & Dwyer, 1997). Teachers must spend their own time mastering the software and planning lessons to introduce it to their students but Atkins (1992) found that many teachers are unwilling to make a significant personal commitment until the Ministry of Education and the school district provide clear policy, curriculum development and provision of equipment, time, support and training. Since types of computers and software vary between schools, there may be little incentive to learn to use programs since they may not be available at the next school where teachers are employed. Teachers need more than technical training on software, they need models of how to integrate computers in academic subjects and time to improve their personal, computer skills.

**Educational Beliefs and Teachers' Styles**

Teacher’s beliefs about the educational value and ease of use of computers and their willingness to restructure their teaching practices and classroom management affect successful integration of this technology (Sandholtz, Rinstaff, & Dwyer, 1997; Hannafin & Savenye, 1993, as cited in Ertmer et al, 1999; Hativa & Lesgold, 1996, as cited in Dexter & Becker, 1999). The Apple Classrooms of Tomorrow study emphasized the role of teachers’ predisposition to change as a factor that speeds up or slows down the use of technology (as cited in Dexter, Anderson & Becker, 1999). Two opposing teaching philosophies underlie instruction on computers. One form of instruction is typically teacher-centered with teachers imparting facts and procedural skills to students to complement teacher instruction. These teachers employ computers mainly for drill and practice through educational games, entertainment rewards and assignments building keyboarding skills or word processing classroom assignments. While this approach
improves computer skills, the computer is used in a manner similar to a typewriter to type class notes or paragraphs rather than as a tool for accessing or presenting information (Becker and Ravitz, 1999).

In constructivist or student-centered classrooms, teachers use computers with tool software to allow students to research independently, construct knowledge and to present understanding in a variety of media formats using a variety of software. Becker and Ravitz’s (1999) research on instructional and organizational reforms associated with computer technologies documents a shift in teaching practices in which technology increasingly addresses the goals of social studies, science and occupation-related education. He believes that teachers must move away from the pedagogy of whole-class, textbook-centered, fixed assignment orientation to enable students to construct understanding from Internet research, to create databases and spreadsheets to summarize experiments and research data, and to create multimedia presentations to demonstrate curriculum concepts. This type of instruction is student-centered and involves decentralizing classroom management. Thus the teaching style and classroom management techniques of the teacher often determine the type of activities that students experience on computers.

**Unsuitable Materials**

Many teachers are concerned with the content of materials on the Internet as many web sites are racist, sexually explicit, inaccurate or biased. Filtering software and Acceptable Use Policies can restrict access to inappropriate materials but there is no guarantee that these practices will be successful for all students. Students often encounter popups when using Internet browsers that may lead them to inappropriate sites if they are
selected. Mistakes in Internet addresses can result in linking to mirror sites that may contain pornography such as whitehouse.com instead of whitehouse.gov. Students may share Internet sites with their peers that they have encountered at home. Filtering software in the school may not be updated to block this access resulting in students viewing unsuitable materials. Teachers must be vigilant in supervising students using the Internet and train students to report sites that they encounter with unacceptable materials.

While teachers are often concerned by the amount of inappropriate content, only a few students test the limits and these infractions can be dealt with by having an Acceptable Use Policy. Acceptable Use Policies outline responsibilities for the school district, the teacher and the students and consequences for inappropriate use of the Internet. Parents and students are required to sign contracts thereby reducing concerns about accessing inappropriate materials and making students accountable for their actions (Futoran et al., 1995, as cited in Starr & Milheim, 1996; Maddux, 1994, as cited in Starr & Milheim). A delicate balance must be maintained between filtering inappropriate materials and blocking valuable educational resources. Since filters are generally set up to scan for key words, one mention of a prohibited word will result in blocking sites that may be beneficial. By instituting Acceptable Use Policies, monitoring behavior and using filtering software, schools can offer safer access to the Internet can be offered in schools.

**Challenges of Internet Research**

The primary difficulties of researching on the Internet relate to the volume of data and the reliability of the data sources. With the amount of information on the Internet increasing daily, information overload is greater than at any time in history so the need to
become a "smart consumer" of information, to learn how to exercise discrimination and
to filter information, has also never been greater (Tyner, 1998, as cited in Trilling &
Hood, 1999). The size of the Internet and its disorganized nature necessitate training to
enable students to undertake focused searches that eliminate commercial sites. Since
search engines are not capable of assessing the quality of information, students must
assess the credibility of authors as well as the currency of information. Since the Internet
is not organized according to conventions to categorize and customize information (Clark,
1996, as cited in Rakes, 1996) and is not monitored for bias or inappropriate content,
students must learn to locate credible information quickly that meets the requirements of
their research.

While instructional strategies vary, students need to see a reason for gathering
information, have a clear idea of what kind of information they are expected to collect
(Rakes, 1996) and a defined product that they are creating when they locate it. Effective
Internet use involves providing students with rubrics or checklists to assist them to
analyze Internet sources, clearly defining tasks that focus research, and ensuring that
students have searching and information processing skills to enable them to experience
resource based learning (Brewik & Senn, 1994, as cited in Rakes, 1996). Use of the
Internet must be educationally meaningful and embedded in curriculum.

Students deserve well-constructed lesson plans, engaging them in important tasks
that could benefit from the use of Web resources. When the Web is harnessed to
a powerful teaching strategy, it can have major effect on the teaching and learning
process and on the achievement of students.” (Tiene and Ingram, 2001, p. 60)

When one looks beyond the rhetoric promoting Internet use and examines the
quality of resources available, the critical viewer sees the Internet as but one tool to
access information. The goal of providing straightforward, time effective access to the
right information at the right time remains difficult to achieve. Students must be taught to critically examine what type of information source best suits their needs. To locate simple facts, traditional, print reference tools such as almanacs or atlases enable tasks to be completed quickly and effectively. Although the Internet provides a vast source of information, locating the information is not enough. Students must be taught to determine what type of information they require (current or historical, comparative analysis from a broad base of resources, simple facts, etc.) and then examine where they can locate this information (e.g. print resources from library, textbooks or from the Internet). Students must be able to select search engines for particular tasks in order to locate information faster and more efficiently. For example, databases specifically designed for children such as Ask Jeeves for kids or Kids Click enable students to ask questions and be directed to sources of information. The students assume control for their learning by using an individual approach to locating the appropriate source for their studies and constructing meaning from the information. Students and teachers are often overwhelmed by the volume of material and discouraged by the amount of commercial and inappropriate content.

**Multimedia Applications as a Presentation Tool**

Multimedia offers students a range of mediums to take in and to present information. Multimedia is defined as the use of a variety of mediums including text, graphics, sound and video to present information in an interactive medium (Roberts, 1996). Its multimodal nature enables users to gather information from a variety of mediums that best suits their learning style (Madian, 1996). Multimedia has been complimented for its student-centered, project-oriented approach that provides students
with a variety of means of developing problem-solving skills and presenting information.

This section describes the features of multimedia programs and examines the advantages and disadvantages of using multimedia. The literature review will focus on the following strengths of these programs:

1. learner control of the material.
2. supporting a variety of learning styles using a multimodal delivery.
3. motivational factors generating positive attitudes toward the technology and the content.
4. fostering problem-solving, collaboration and presentation skills.

**Learner Control**

Multimedia is designed so that learning is learner controlled, interactive and motivating. Learner control of the presentation is described as motivating, increasing engagement and reducing anxiety (Yildirim, Ozden, & Aksu, 2001, p.207). A range of software offers students the ability to view information in the order and sometimes in the medium of their choice (Plass, Chun, Mayer & Leutner, 1998, as cited in Mayer, Heiser & Lonn, 2001). Multimedia programs can be linear in format (such as a PowerPoint presentation), or use hypermedia employing hypertext links to connect textual information blocks or engaging graphics. Hypermedia is defined as a means of linking graphics, text, sound and video to enable the user to control the presentation of information while stimulating the learner’s interest. Jonassen (1996) describes hypertext systems as permitting users to determine the sequence in which they access information (browsing), to add information, to make it more personally meaningful, and to build and structure their own knowledge (p.89). In hypermedia presentations, students can choose their own path, proceed with the amount of instruction they think they require and travel anywhere within the data base. The use of branching through hypermedia enables
dynamic display in a variety of mediums and decreases anxiety of learners because they control the learning path (Nelson, 1965, cited in Ayersman, 1996). Hypertext treatments lead to superior knowledge transfer and high order cognitive activity according to Lin and Davidson (1994, cited in Ayersman, 1996).

While hypermedia may enhance meaning for some, others experience "disorientation", which is the tendency to get lost in hypertext databases or become frustrated if links don't work. The choice of links in some software may not be effective since software designers rather than content specialists determine the presentation of information. For some learners, having a variety of methods or paths to study materials enhances understanding and for others the continual linking confuses them and reduces understanding.

**Multimodal Characteristics**

The variety of presentation mediums including text, graphics, sound and video is considered multimedia's strongest and most effective characteristic. Originally it was believed that users could learn by using the modality that suited their learning style (Jonassen & Grabowski, 1996). According to the information delivery hypothesis, students learn more when the same information is delivered by several paths. Madian (1996) believes that multimodal delivery enables users to process information in the format that best suits their learning style. Farmer (1995, as cited in Takacs, Reed, Wells & Drombrowski, 1999) contends that multimedia "hooks" students through the use of sound and response. Research suggests that inclusion of images and sounds can improve comprehension and information recall when multiple modes of information are combined.

Research reports mixed findings relating to student achievement with some offering positive results and others demonstrating that multimedia effects actually reduce processing of information. While some studies report better content retention (Jonassen & Grabingers, 1990), researchers found that in some cases, eliminating printed word from a multimedia presentation produces better learning (Bobis, Sweller, & Cooper, 1993, as cited in Mayer, Heiser & Lonn, 2001; Chandler & Sweller, 1991 and 1996, as cited in Mayer, Heiser & Lonn; Sweller & Chandler, 1994, as cited in Mayer, Heiser & Lonn, 2001). Kalyuga, Chandler and Sweller (2001) studied teaching soldering in a multimedia environment and found that student achievement improved using two media (graphics and speech) rather than three (graphics, speech to read the text as well as text). Providing content simultaneously in too many forms sometimes distracts from content retention. Several studies report that interesting but conceptually irrelevant material added to arouse student interest, results in poorer performance on test of retention and transfer (Garner, Brown, Sander & Menhe, 1992, as cited in Mayer, Heiser & Lonn; Garner, Gillingham & White, 1989, as cited in Mayer, Heiser & Lonn). Although it has been suggested that deeper understanding is achieved in a multimedia environment, tests to determine content retention are often multiple choice or simple questions so this “deeper knowledge” cannot be evaluated or demonstrated (Chadwick, 2002). Contradictory claims are made in the research about improvements in comprehension when multimedia programs are used and one can only definitively state that students generally retain as much content in multimedia as in text environments.
When presentations were viewed in small parts, superior problem-solving performance on tests was documented. In a study of college students that focused on problem-solving transfers, research showed that the same learning principles apply to both paper-based and computer-based environments. This suggests that what constitutes good pedagogy in one environment also applies in other environments (Chandler & Sweller, 1996, p. 196). Research shows that although students take different paths and use different media, tools, and learning aids, they acquire information that allows them to perform at comparable levels (Hsu, Frederick, & Chung, 1994, as cited in Ayersman, 1996; Liu & Reed, 1994, as cited in Ayersman, 1996; Toro, 1995, as cited in Ayersman, 1996). "A review of research shows that the inclusion of images and sounds can improve comprehension and production of text while more fully bringing culture into the classroom (Daiute & Morse, 1994, as cited in Ayersman, 1996). Students are better able to recall information when multiple modes of information are combined (Ottaviani & Black, 1994, as cited in Ayersman, 1996; Boras & Lafayette, 1994, as cited in Ayersman, 1996). By using a multimedia approach in which content is divided into small pieces and presented in a variety of mediums content retention was improved. Users must determine which tool is most effective in achieving the desired goal."

In our current society in which students use computers at home, they are constantly bombarded by the stimulation from computer games, video, music and flash animations. Therefore, it is questionable whether using multimedia programs offers unique experiences to students that would generate high levels of engagement to substantially improve content retention. While these programs are multisensory, these presentations cannot replace tactile, hands-on experiences like examining objects such as fossils or
performing archeological digs (Madian, 1996). While simulations can enable students to view experiments in a safe environment, this can also be done by watching a video rather than adding the extra cost of computer hardware and software. However, while the literature extols the virtues of multisensory learning, there is very little evidence of enhancing learning with multimedia (Toomey & Ketterer, 1995, p16, as cited in Ayersman, 1996). Much of the sparse hypermedia and learning style research has shown no significant differences in performance for learning style groups (Ayersman, 1994, Liu & Reed, 1994, as cited in Ayersman, 1996; Overbaugh, 1995, as cited in Ayersman, 1996). On the other hand, few would disagree that hypermedia is effective for teaching and learning (Ayersman, 1996, p.500). Options must be critically analyzed in order to ensure that scarce educational funds are targeted into areas that will maximize student achievement (Healy, 1998).

**Motivational Factor**

Reviews of the features of multimedia focus on the motivational element inherent in giving students choices in the type of media they use and the path they follow to explore the materials. Multimedia “hooks” students through the use of sight, sound and response (Farmer, 1995, as cited in Takacs, Reed, Wells & Drombrowski, 1999). A multimedia environment can be very motivating because it deviates from the familiar, mundane workbooks and texts. Multimedia programs generate positive attitudes and result in greater recall of information due to increased level of engagement (Reed, Ayersman, & Liu, 1995, as cited in Ayersman, 1996). Brush (1996, as cited in Ayersman, 1996) examined CAI programs in mathematics which were structured for students to work in collaborative groups and observed positive attitudes from the students while
using the materials. Lin & Davidson (1994, as cited in Ayersman, 1996) found that hypertext treatment led to superior knowledge transfer and higher order cognitive activity. Combining text with animation and hypertext captions results in greater recall, inference, and comprehension (Large, Behesti, Breuleux, & Renaud, 1995, as cited in Ayersman, 1996). The increased level of user control provides an intrinsic motivation for learners when hypertext is used as a tool for learning (Becker & Dwyer, 1994, as cited in Ayersman, 1996). The strengths of the multimedia program relate to its unique ability to link graphics, text, sound and video to enable a range of learners to use the medium that best suits their learning style and the ability to control how these elements link together engages users and motivates them to focus on the task/content which improves their content retention.

**Collaboration, Problem Solving and Presentation Skills**

Students often work collaboratively to develop their own software projects that focus on specific disciplinary topics. “Research shows that taking this social constructivist approach offers many benefits.” (Ayersman, 1996, p. 501) Various studies particularly at the college level have found that hypermedia promotes problem-solving skills and understanding of social behavior (Holland, Holyoake, Nisbett, & Thagard, 1986, as cited in Ayersman, 1996; Stevens, 1989, as cited in Ayersman, 1996). Multimedia case studies have been developed for exploring moral dilemmas (Covey, 1990, as cited in Ayersman, 1996), enhancing classroom management skills (Overbaugh, 1994, as cited in Ayersman, 1996, Overbaugh, 1995, as cited in Ayersman, 1996); and teaching complex procedural knowledge through the use of rule statements presented through hypermedia instruction (Kim & Young, 1991, as cited in Ayersman, 1996).
Research reports a variety of types of presentations using multimedia to develop problem-solving skills as well as to deliver content in a manner that is manageable and engaging.

While much has been written about the features of multimedia, little has been said about the skills and learning that results from processing and presenting materials in a multimedia format. Many of the studies on multimedia have focused on specific topics related to learning specific content or problem solving. Speziale and La France (1992) studied students with special needs who used a multimedia program as a study guide to prepare for driver’s exams. Their findings indicated that the hypermedia program fostered cooperative learning; multimodal, multisensory learning; use of bite sized pieces of information to enable user control of paths; improved motivation; increased attendance; and gains in problem-solving skills. Meskill and Swan (1996) studied 14 language arts teachers in a graduate course who evaluated the potential of multimedia programs to support and enhance response-based approaches to the teaching and learning of literature. They found that the programs were a source of diverse information in a range of media. When used as a tool to present developing understandings of texts, multimedia can be an asset and catalyst for discussion for the response-based classroom (Meskill & Swan, 1996, p.239). Students found more creative solutions to problems when explanations accompanied the animation than when they followed the animation (Mayer & Sims, 1994).

Designing multimedia presentations not only develops computer skills, but also requires students to use project management, organizational, decision-making and problem-solving skills. Students can demonstrate their understanding of content but also
develop their critical analysis of information skills and problem-solving skills while designing their presentations. Developing multimedia presentations enables students to create self-directed projects that involve thinking and planning to select the elements to be included. Students are required to critically analyze information from a variety of sources, to determine what information to present, the best format for presentation and the ways to link the information. Students learn how to organize material and coordinate time to design the projects. Designers not only control the content presented but also the manner in which it is linked. Some students can be distracted by creating one component of a presentation such as a video or Flash effect, so teachers must monitor student progress when designing multimedia to ensure that projects are completed. “Multimedia can motivate and facilitate students’ expression if they have something to say, time, access and a rich, constructively critical learning environment.” (Madian, 1996, p. 18)

However, students must be guided in their development of projects toward a sense of quality through discussion, comparison, modeling, a desire to communicate ideas that matter and good feedback from their peers.

Teachers can model good design through the projects they create for student use. Many educators are adopting hypermedia as a construction tool for collaboratively creating their own software suited to their particular disciplinary needs (Ayersman, 1996, p. 501). Teachers are taking advantage of the product’s capability to divide content into small portions and to enable the user to control the sequence and presentation of the information to meet their individual needs. While multimedia programs were considered valuable instructional tools, in each case the teacher had to adapt the software to the
needs of the users. Multimedia programs enable teachers to provide content in a manner that meets the individual needs of the students.

Although multimedia programs provide a broad based learning experience and “while interactive multimedia” may be exciting technically, it does not automatically lead to better educational programs. Good instructional design is good instructional design whatever the medium. It is the responsibility of the teacher to ensure that students are developing their potential to its fullest by focusing on the content of the presentation rather than focusing on flashy effects with little relevance to the content.
Chapter 3 - Methodology

Introduction

This chapter describes the methodology of the study including (1) a profile of the school district, teachers and student groups, (2) a description of the project, (3) an overview of student learning experiences, instruments and data management procedures and (4) an outline of the research. This chapter sets out the nature of the study and the location and context in which the research occurred.

School District

This overview includes a profile of the district, an explanation of how the sites were recruited and a description of the sites used to conduct the research.

Profile of the District

The researcher conducted this research in the school district where she was employed. This is a large school district with 94 elementary schools and 19 secondary schools in a suburb of Vancouver that was, until recently, an agricultural area. The socioeconomic backgrounds of students range widely as reflected by very affluent communities to inner city schools that require lunch programs. Although administration is centralized, each school has a unique technology plan that outlines its procedures for instruction in technology and intended acquisitions of hardware and software. Since technology funding comes from a variety of sources including the Ministry of Education, district-based funding, capital budgets, and parent groups, each site has a unique configuration of computers and software. The types and numbers of computers and software available in schools vary tremendously from school to school in this district.
To assist teacher use of technology in curriculum areas, the school district offered, just before this research was conducted, a series of workshops for teachers both through professional development days and summer institutes. The helping teacher for the district facilitated a group purchase of software to enable schools to purchase multimedia software at a reduced rate, and then offered in-service training using the software. At the same time the use of multimedia was being encouraged in the schools, a district incentive was launched to expand the district-wide network to all schools in order to provide Internet access to all computer labs. The school sites in this research had a site license for the multimedia software, hardware equipment to run the software, and Internet access in the computer lab.

Recruitment of Teachers

The researcher approached the Director of Instruction with a research proposal and was given support on the understanding that teacher and student participation was voluntary. The researcher was given the opportunity to explain the project at a district meeting of computer facilitators. Five teachers expressed interest in the project and were subsequently contacted by the researcher. Two teachers withdrew after the initial contacts due to timetabling problems and a third teacher withdrew soon after that because of time constraints. Consequently, two teachers at one school and the researcher at another school remained as the participating teachers in the project. The researcher agreed to provide instruction on use of the software program and copies of all assessment instruments to be used in the project.
Description of the Sites

The two schools in this study were located in different socioeconomic areas: site one is located in an inner-city neighborhood and site two is in a high socioeconomic neighborhood.

Site One

Site one is located in an older community and is designated as an inner-city school by the school district. The researcher is a teacher at site one. It has a school population of about 400 students and receives funding for a school lunch program. It is known for a traditional approach to instruction that focuses on developing reading and mathematics skills. The school principal supported the integration of computers into subject areas and has funded upgrades to the computer lab to enable multimedia instruction and Internet access. When this research was conducted, the lab included a range of Apple computers from LC 475s and LC 580s with slower processors, to iMac computers with the latest technology and faster processors. Students also had access to a scanner which was connected to a computer with a high speed processor. Thus, site one focused instruction on traditional academic subjects and had a range of technology on which instruction was given by a computer specialist (i.e., the researcher) who integrated the use of computers into curriculum subjects.

At the time of this research, the researcher had thirteen years of teaching experience in a wide range of grade levels and acted as the computer facilitator for the school. The use of the Internet as an information source for curriculum and critical thinking are areas of her professional focus. The researcher maintained the computers, repaired them and loaded software as required to maximize student access to all features.
of the multimedia program. Thus the teacher at site one (i.e. the researcher or teacher one) was experienced in offering training using technology and also had the technical expertise to repair the hardware.

Two grade six computer classes, taught by the researcher participated in this research. One class had 25 students and the other had 27 students. The smaller class had all the ESL students enrolled in grade six and the larger class had all students who received support from the resource room and learning assistance teachers. It was clearly understood that students were to have the option of withdrawing from the research if they chose to (see Appendix I for ethics approval letter). One student in the researcher’s homeroom class decided not to participate in this research, and four dropped out before the conclusion of the research. Transience is very common at this school. Thus the two classes at site one had a range of students and poor attendance affected the ability of several students to complete their projects.

Site Two

Site two is located in an affluent family neighborhood. Three hundred students attend this school that encourages parent involvement. The school’s philosophy focuses on self-motivation to achieve academic success and to complete homework. During this research, the acting principal offered ongoing support in technology to teachers in the school. He had a background in instruction and maintenance of computers and was committed to integrating technology into curriculum areas. This research was completed during his temporary assignment in the school but the regular principal continued to promote integration of technology upon her return.

The two participating teachers from this school both had seven years of teaching experience. Both teachers indicated that they were very comfortable trying new
technology but neither had experience using multimedia. One teacher (hereafter, teacher two) taught a class of 25 grade five and six students, while the other teacher (hereafter teacher three) taught a class of 23 grade six and seven students. The grade six and seven split, as reported by the teachers at site two, was composed of students with average to high academic ability, while the grade five and six split class had the grade six students with average to low academic ability. All students agreed to participate in the study and only one moved during the course of this research. The teachers and students had a personal interest in learning new computer skills and in integrating the use of computers in their academic studies.

The computer lab at site two had Internet access and older Apple computers with slower processors. The teachers described the lab as full of problems and very frustrating since the school was dependent on district support for computer repairs. Due to the age of the computers, the computers' small hard drives did not have enough capacity to load graphics and the sound features of the multimedia program. Therefore, graphics files had to be provided on disks or loaded temporarily by the researcher on each computer workstation. Thus the hardware itself restricted the multimedia features available to students.

The researcher made several visits to site two to assist teachers with setting up the computers, learning how to run the software and troubleshooting computers. Access to the Internet had been installed immediately prior to the project so students had not received instruction on the Internet by the time this research began. All student projects were saved on disks, but many computers broke down over the course of the research making it difficult to complete the research in the required time frame. At the conclusion
of this study when a debriefing was held with the teachers at site two, the researcher was informed that one-third of the computers from the lab had to be sent out for repairs and consequently there were two students working on each computer in the lab. In addition, the sound feature of the program was not installed on the computers so the researcher had to bring in extra computers to the school site to enable students to access this component. In summary, site two was located in a high socioeconomic area but their technology was unreliable and the teachers’ experience limited so they were not able to provide technical support to their students.

**Nature of the Project**

This section outlines the students’ project topics, describes the software programs used and outlines how the students were divided into groups according to their computer ability and experience.

**Project Topics**

The research was conducted in the spring of 1999. After meeting with the teachers prior to the beginning of the project, it was agreed that students in both sites would conduct research using both print and Internet resources on curriculum topics in social studies and then create multimedia projects to present the curriculum content. Individual teachers chose the topics but, at the request of the researcher, only one country was studied by grade six students at each site. That way, comparable numbers of grade six students studied the same country. Table 1 indicates the area of study and topics researched by the students in each class.
Table 1
Topics of Study Reported by Classes and Teachers

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Area of Study</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – grade 6</td>
<td>France</td>
<td>Economy, geography, culture</td>
</tr>
<tr>
<td>1 – grade 6</td>
<td>France</td>
<td>Economy, transportation, culture</td>
</tr>
<tr>
<td>2 – grade 6</td>
<td>Nigeria</td>
<td>Economy, education system, human rights</td>
</tr>
<tr>
<td>2 – grade 5</td>
<td>Natural Resources</td>
<td>Forestry, mining, fishing</td>
</tr>
<tr>
<td>3 – grade 6</td>
<td>Nigeria</td>
<td>Economy, education system, human rights</td>
</tr>
<tr>
<td>3 – grade 7</td>
<td>Ancient Egypt</td>
<td>Hatshepsut, religion, daily life</td>
</tr>
</tbody>
</table>

At site two, grade six students studied identical topics (i.e. Nigeria; economy, education system and human rights) but at site one, the homeroom teacher of the computer class requested that grade six students examine transportation rather than the geography. The researcher felt that this difference would not affect the results of the study. All students’ projects were composed of three paragraphs with a minimum of ten sentences each and were to include pictures that complemented the text. Multimedia projects were to include transitions and sound with all elements complementing the text. The projects created by the students were used for research purposes only and were not graded.

**Software Programs**

The researcher decided to use two software programs available in the school district. The software used to create the multimedia projects was Digital Chisel, a multimedia program that includes databases and allows students to use text, sound, graphics and video. ClarisWorks is an integrated program that includes text, clip art, spreadsheets, databases and communications components. This software was used to create the text-based projects. Both schools owned site licenses for the software, thereby reducing the cost of undertaking this research. Instruction was offered to both teachers at
site two and to all students to enable them to use the programs and to learn required skills such as copying and pasting, scanning and importing graphics from the Internet.

One class at each site used the program Digital Chisel and one used Claris Works so that the number of students using each program was similar. This arrangement allocated 48 students to each software group. Both groups received the same instruction on the Internet and only the software differed. By the end of the research, 94 students remained: 46 were using Digital Chisel and 48 were using ClarisWorks.

**Computer Ability and Experience**

The researcher divided students into groups according to computer ability. Computer skills were determined by a self-report pre-test with four questions and an exercise that required students to demonstrate their skills. The first question on the pre-test asked students to report their computer skills in seven basic areas (opening a file, saving a file, changing font, cutting and pasting files from one file to another, cutting and pasting files from one program to another, drawing pictures and importing graphics) and three advanced skills that students would have if they used the Internet or multimedia programs (downloading pictures and articles from the Internet, performing Internet searches and animating an object). Students were asked to indicate their mastery of a particular skill on a scale of 1 to 3 with “3” indicating they had mastered that skill. There were 10 skills with a maximum score of 30.

To ensure that the self reports were accurate, basic skills were then confirmed by an activity entitled “Exploration of Space” that is included in Appendix V. Students were required to type and edit text and to cut and paste graphics. Results from this exercise
were compared with the skills reported by each student. Thus the self-report was confirmed by testing each student’s ability to perform tasks on a computer.

The second part of the pre-test queried students’ experience with computers: what programs they used; how they spent their time on a computer; and their word-processing speed. To accomplish this, the researcher listed six programs and asked students to indicate if they had used these programs. Students were given a maximum of 5 points if they had used all of the programs, including some multimedia programs. Students were asked to indicate if they used a computer mainly for games, drawing or painting, word processing or for Internet access. This was a means of cross checking the programs students reported using. Finally, students reported their word processing speeds and their teachers were asked to confirm that these were accurate. This information was sought because the researcher believed that weak word-processing speeds would hinder a student’s ability to complete the project within the time allowed. The researcher examined the data on word-processing speeds and determined that 20 – 25 wpm was attained by the top 10% of the students so she established the following rubric to code students’ word processing ability.

<table>
<thead>
<tr>
<th>Words per Minute</th>
<th>Points Awarded</th>
<th>Explanation of Level of Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 wpm</td>
<td>5</td>
<td>Above average level of skill</td>
</tr>
<tr>
<td>20 – 25 wpm</td>
<td>4</td>
<td>Satisfactory level of skill</td>
</tr>
<tr>
<td>15 – 20 wpm</td>
<td>3</td>
<td>Minimum level of skill</td>
</tr>
<tr>
<td>10 – 15 wpm</td>
<td>2</td>
<td>Developing level of skill</td>
</tr>
<tr>
<td>1 – 9 wpm</td>
<td>1</td>
<td>Weak level of skill</td>
</tr>
</tbody>
</table>

Thus the pre-testing was designed to assess the basic skills of the students before they started the project. A composite score from the two parts of the pre-test was
determined and three groups were created. The highest score a student could receive on the pre-testing was 40 points. Group One had the lowest level of skill and any student with a score of less than 20 was considered to be in this group as they did not have grade-level skills. Group Two received marks between 20 - 31 indicating students had a developing level of skill with some skills at grade-level and some below. Group Three was composed of students who attained a score of 32 or above indicating that they not only had grade-level skills but also used the computer for a variety of purposes and could word-process at a minimum of 25 or more words per minute. Kuhs, Johnson, Agruso and Monrad (2001) recommend a variety of rubrics and methods of evaluation to limit the number of points that a student loses for any one type of error. In this case, weak word-processing speeds, for example, could not be the sole determinant of lower computer skills, but rather a variety of elements were considered and a test performed to assess whether students had actually mastered the reported skills. Tables 3 and 4 document the number of students by the two grouping categories: level of computer skill by class and the software program. Table 3 lists the number of students at each level of computer skill for the four participating classes.

Table 3
Levels of Computer Skill by Class Groups – n = 94

<table>
<thead>
<tr>
<th>Teacher</th>
<th>High Ability</th>
<th>Average Ability</th>
<th>Low Ability</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – DC</td>
<td>7 (7%)</td>
<td>10 (10%)</td>
<td>6 (6%)</td>
<td>23 (24%)</td>
</tr>
<tr>
<td>1 – CW</td>
<td>11 (12%)</td>
<td>8 (9%)</td>
<td>6 (6%)</td>
<td>25 (26%)</td>
</tr>
<tr>
<td>2 – DC</td>
<td>11 (12%)</td>
<td>6 (6%)</td>
<td>6 (6%)</td>
<td>23 (27%)</td>
</tr>
<tr>
<td>3 – CW</td>
<td>4 (4%)</td>
<td>8 (9%)</td>
<td>11 (12%)</td>
<td>23 (23%)</td>
</tr>
<tr>
<td>Total</td>
<td>33 (35%)</td>
<td>32 (34%)</td>
<td>29 (31%)</td>
<td>94 (100%)</td>
</tr>
</tbody>
</table>

DC= Digital Chisel   CW= Claris Works

As shown in Table 3, a few more students have higher levels of ability in Teacher 1’s CW class and in Teacher 2’s DC class. A notably higher number of students at the
low ability level were in Teacher 3's class with 11 students reporting low level of skill in comparison to six students in each of the other classes. Similarly a notably lower number of students in Teacher 3's class report high levels of ability with 4 students in comparison to 11 in Teacher 1 (CW) and Teacher 2 (DC) classes.

Table 4 reports the entire sample of students by program and computer ability. As you can see from Table 4, the ability as measured by the pre-testing is fairly even when the entire sample is considered.

### Table 4

<table>
<thead>
<tr>
<th>Program</th>
<th>High Ability</th>
<th>Average Ability</th>
<th>Low Ability</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Chisel</td>
<td>18 (19%)</td>
<td>16 (17%)</td>
<td>12 (13%)</td>
<td>46 (49%)</td>
</tr>
<tr>
<td>ClarisWorks</td>
<td>15 (16%)</td>
<td>16 (17%)</td>
<td>17 (18%)</td>
<td>48 (51%)</td>
</tr>
<tr>
<td>Total</td>
<td>33 (35%)</td>
<td>32 (34%)</td>
<td>29 (31%)</td>
<td>94 (100%)</td>
</tr>
</tbody>
</table>

A slightly higher percentage of students with a high level of computer skill used the Digital Chisel Program: 18 DC students (19%) in comparison with 15 CW students (16%). As reflected in Table 4, a total of 17 CW students (18%) have a lower level of computer skill compared to 12 DC students (13%).

**Student Learning Experiences**

This section outlines the students' online information training and their Internet research and project development.

**Analysis of On-line Information Training**

Although the researcher requested that students be divided into two groups - one that received instruction on critical analysis of information and one that did not - teachers at site two were adamant that all students at both schools receive the same instruction. In the interest of sustaining the teachers' involvement, the researcher agreed that three
weeks prior to the research, all students would receive four lessons (see Appendices- XI-XV) on the use of the Internet and on how to critically analyze the design and content of an Internet site.

In lesson one, students were given a glossary of terms related to the Internet and taught the components of an Internet address. Internet addresses were analyzed to determine who was posting the information and the purpose of the web site. Strategies for determining which addresses would be most likely to provide good research information were outlined and students completed an exercise that required them to match Internet addresses to a variety of tasks. Students then confirmed that the information they required was available on the site.

Lessons two and three focused on the design and content of web pages. In lesson two, students learned the components of a web page and were taught how to determine when a web page was updated and who posted it. Students examined a web page to evaluate its layout, currency, content and reliability of the author (Appendix XIII).

Lesson three focused on effective web page design. Students identified examples of effective and ineffective graphics in order to learn how to bring important information to the reader’s attention, to link to other sites that enhance the content of a web site, to effectively balance text and graphics and to analyze the credibility of the author and the accuracy of the information. Each lesson reinforced the necessity of looking beyond the visual appeal of the page to determine if the content and the authorship of the page satisfied the criteria for sound research (i.e. accurate information, reliable source, credible background of authors).
Lesson four focused on the analysis of information from a web site. Students determined the five most important pieces of information and assessed the currency of the information. The concept of bias was discussed and examples identified in the Internet article that showed that the author favored one side of an argument. Strategies were taught for assessing the accuracy of information such as comparing the content with other web sites, checking facts in an electronic encyclopedia, and going to educational institutions to confirm that specialists in the field agreed with the information. Students were then asked to compare the content of two Internet articles to determine if one was a better source for research than the other. Teachers were asked to repeat the final lesson with other articles. Throughout these lessons, critical analysis of information and strategies for assessing information were reinforced. Students discussed their decisions and were required to explain how they reached their conclusions. The purpose of the training was to teach analysis of information from Internet sites and to demonstrate principles of effective design that students could apply when creating their projects.

**Student Internet Research and Project Development**

At site one, the project took place between the end of March and May 1999 (delays occurred due to the installation of Internet access and commitments away from the school by the researcher) and in site two between the end of April and the end of June 1999. Students started their Internet research from a list of web sites posted in the computer lab. The list included sites of good quality as well as poor quality. Students were expected to decide for themselves whether each source was credible and relevant for their research. Web sites were provided rather than asking students to find them because the teachers at site two felt that students lacked background in locating effective
Internet sites and, without some guidance, would spend their limited research time searching for information rather than analyzing Internet information and completing the required projects. The researcher encouraged the two teachers to allow students time to search the Internet independently for sound, graphic or text files since these elements would enrich students’ final projects and demonstrate information-processing skills. However, time constraints prevented most students from following this approach.

Students had 16 periods of 45 minutes each in the computer lab to complete the project, including conducting their Internet research and word-processing their paragraphs. Additional time was also provided during their two forty-five-minute social studies periods to write draft paragraphs and to consult print materials for research. The students were given instruction on the features of the multimedia program before they created their projects. When needed by students, additional lessons were given to reinforce the use of specific features such as importing sounds and graphics, adding transitions and editing their work by using the screen list. Research, report writing and enhancement of the projects with multimedia effects occurred over an eight-week period during scheduled computer lab periods and social studies periods.

**Instruments and Data Management**

Before the assessment instruments were created, the researcher carefully examined a variety of instruments and conducted readings on assessment. She read general overviews on assessment such as “Assessment Criteria and Standards” (Case, 1999), “Using Rubrics to Promote Thinking and Learning” (Andrade, 2000), *Assessment and Evaluation* (Booth, Booth and Phenix, 1994) and *Put to the Test Tools and Techniques for Classroom Assessment* (Kuhs, Johnson, Agruso and Monrad, 2001) as
well as Ministry of Education and school district curriculum documents. Examples of
online instruments, particularly from the library at Purdue University, were examined to
assist with the rubric design. Kuhs, Johnson, Agruso and Monrad, 2001 outline the
following evaluative criteria as central to the task(s) to be graded:

1. Make sure your expectations match curriculum standards.
2. Imagine what a good student response would look like.
3. Think about parts of the task students would find difficult.
4. Make sure that criteria are consistent with task directions.
5. Decide which task features will not be assessed.
6. Limit the number of criteria.
7. Decide whether the rubric will be specific or generic (p. 63).

Assessment was based on curriculum standards for social studies and technology.
Student projects and various written instruments measured student achievement on
critical analysis of information and computer skills.

A description of each of the seven assessment instruments follows. All
instruments are included in the appendices.

1. **Pre-test of computer skills.** A self-report survey on computer skills (see Appendix
IV), and the test exercise “Exploration in Space” (Appendix V) that confirmed these
skills, formed the pre-test on computer skills that grouped students into skill levels prior
to the project. The pre-test is described in previous sections of this chapter.

2. **Post-test: computer skills (Part A).** Another self-report survey on computer skills at
the end of the project (see Appendix VI) included 18 skills, the first ten skills were
identical to the pre-test survey. The last eight skills related to use of multimedia
programs (using transitional effects between pages, importing sounds into a project,
importing pictures from program or CD/disk, importing video clips into a presentation,
using a screen list to edit a presentation, attaching sounds to graphics, using a template to
create a presentation, and using a scanner to copy a picture into a presentation). This list enabled the researcher to determine if students mastered the original ten basic skills while creating their projects and if they learned multimedia skills. Reported skills were confirmed by analyzing final projects. Thus, students reported what they perceived to be their skills, and then the researcher confirmed whether or not their work demonstrated these skills (as had been done in the pre-test).

3. Post-test: research and presentation skills in final projects (Part B). Final projects were assessed to confirm improvement in computer skills on a scale of 0 to 3 in the following areas: paragraphs, pictures, appeal, and evidence of use of Internet research. (Appendix VII). The maximum score for the project was 12 (see Table 5).

Table 5
Criteria for Grading Final Projects

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description of Criteria for Paragraphs</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>All paragraphs were written in a clear, concise manner with proper grammar and spelling. All paragraphs included the required length and the content was well researched and demonstrated a good understanding of the subject material.</td>
</tr>
<tr>
<td>2</td>
<td>Most paragraphs were written in a clear, concise manner with proper grammar and spelling. Some evidence of research was found but information was not always processed in the students' own words.</td>
</tr>
<tr>
<td>1</td>
<td>One or two paragraphs were written with proper grammar and spelling. There was a little evidence of research but the writing did not indicate a good understanding of the required subject material.</td>
</tr>
<tr>
<td>0</td>
<td>Paragraphs were incomplete and the writing included grammar and spelling mistakes. There was almost no evidence of research or mastery of the required subject material.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description of Criteria for Use of Pictures</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Every paragraph had pictures that complemented the meaning of the text.</td>
</tr>
<tr>
<td>2</td>
<td>Pictures that complemented the meaning of the text were included with some paragraphs, but other pictures did not complement the text.</td>
</tr>
<tr>
<td>1</td>
<td>Pictures were included with each paragraph but they did not complement the meaning of the text or distracted from the meaning of text.</td>
</tr>
<tr>
<td>0</td>
<td>Pictures were not included with the text.</td>
</tr>
<tr>
<td>Coding</td>
<td>Description of Criteria for Appeal of Presentations</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>Projects engaged the viewer and all sounds, graphics and transition effects complemented the text and reinforced meaning. Multimedia effects made the presentation richer and more interesting to view.</td>
</tr>
<tr>
<td>2</td>
<td>Projects were entertaining for the viewer but only some of the multimedia effects complemented the text and added meaning to the presentation.</td>
</tr>
<tr>
<td>1</td>
<td>Projects included multimedia effects but they distracted from the presentation and did not enhance the meaning of the text.</td>
</tr>
<tr>
<td>0</td>
<td>Multimedia effects were not included in the projects.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description of Criteria for Integration of the Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Evidence of research from the Internet sites and processing of the information in the student’s own words.</td>
</tr>
<tr>
<td>2</td>
<td>Evidence of research, but some of the information is copied from the web sites instead of being processed and expressed in the students own words.</td>
</tr>
<tr>
<td>1</td>
<td>Evidence of Internet research in only one or two paragraphs. Most of the information included is copied directly from the web sites rather than processed in the student’s own words.</td>
</tr>
<tr>
<td>0</td>
<td>No evidence of research from Internet sites.</td>
</tr>
</tbody>
</table>

Thus, the self-report and the final projects formed the post-test on computer skills.

4. Assessing a website – Part 1 - France Web (Appendix VIII). When students finished their projects, students’ ability to critically analyze a web page for content, currency and credibility was assessed by analyzing a fictitious author’s web page entitled “France Web” (Appendix VIII). “France Web” was designed by the researcher as an author’s page for a website and contained information about the qualifications and experience of the creators of a fictitious web site on France. Its purpose was to determine whether students could identify reliable content for research and discriminate appropriate credentials for the authors that would make them a credible source of information.

Students were asked to read a page-and-a-half overview and to answer three questions:

1. List the five pieces of information that you considered to be the most important for your research and for assessing the reliability of this page.
2. Determine if the site is current and give three reasons to explain why or why it is not considered current.
3. Give three reasons why we should or should not believe the information posted on this page.

The instrument was scored out of 11, with five marks given for identifying the relevant content and three marks each for assessing the currency and credibility of the page and giving sound reasons for their decisions.

5. Analyzing content – Part 2 - Describing a Multimedia Project (Appendix IX).

Students viewed a multimedia presentation on France in either ClarisWorks or Digital Chisel with the same content. The purpose of the test was to determine the number of the key content elements students remembered when they viewed these computer presentations, analyzed the information and drew conclusions from it. Students at site one were divided into two groups to ensure that an equal number of students from each program group viewed a presentation in each format. The selection of students was random, but an effort was made to include students at all ability levels from each program group. At site two, groups were not randomly created, rather one class viewed the presentation in CW and the other in DC.

The total score was 15 points, and each question was scored for completeness and accuracy. The questions are listed below in Table 6.
Table 6
Content Retention After Viewing Multimedia Project

<table>
<thead>
<tr>
<th>Number</th>
<th>Question</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>List five important pieces of information.</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Describe two types of transportation and explain when you would make use of each type.</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Identify the main product.</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Describe two aspects of culture.</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Indicate how interesting you found the presentation.</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Would you like to visit this area? Why or why not?</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>If you were creating a web page based on this project, what information would you present first, at the bottom, why?</td>
<td>2</td>
</tr>
</tbody>
</table>

6. Journals - My journal of what I did today (Appendix X). Student journals were completed three times during the research study. In them, students described how they spent their time during the class periods and reported any problems they encountered. The journals were only kept at site one during weeks 3, 7 and 8 of the project to determine how much time students spent on a variety of tasks and which skills they were developing. Journal data were divided into four areas: reported activities, evaluation of progress, description of what they enjoyed doing, and nature of any problems including any resulting time lost. In each case, the researcher looked for trends and then counted the number of students offering similar answers. Unfortunately the teachers at site two had not collected journals from their students. Thus, only data from site one were available to assist the researcher in explaining any discrepancies in student achievement.

7. End of unit survey of students’ feelings – Evaluating the Experience of Creating in Multimedia (Appendix XI). This survey queried what students valued about their experiences during the research. Students were asked to indicate what they found most interesting, most difficult and what they considered the most important things they learned while creating their projects. Student interviews were also conducted by a university professor from Simon Fraser University and his observations were compared.
to information provided in student journals. All post-tests were conducted after student projects were completed in the final week of this research. The researcher used a variety of checklists and short answer questions that were time effective to assess student achievement.

All students were assigned numbers according to their registration on class lists and on the basis of their teacher’s number e.g. Teacher 1, Student 27. Data in the study were recorded by site, by teacher, by program, and by level of computer skill. Projects and pre-tests from site one were saved on disks, an external drive and, later, zip disks to minimize the number of disks but at site two, all projects were saved on disks. All data were entered into spreadsheets using Microsoft Excel. A high school student entered data for four of the instruments under the supervision of the researcher, and the researcher completed the data entry on the other three instruments. Every fifth entry made by the data entry person was checked for accuracy. Data was counted both manually and by computer. Statistical analysis was attempted using SPSS but the data sample was not large enough to display meaningful results so this form of analysis was abandoned.
Chapter 4 – Presentation of the Data

Introduction

The presentation of data in this chapter is organized according to the four research questions outlined in Chapter One. In reporting data, the terms “above average,” “satisfactory” and “weak” are used to describe student achievement on tests, projects, self-reports and short answer questions. On testing instruments, students achieving 80% are considered “above average”, achievement of 50 – 79% is considered “satisfactory” and any score less than 50% is considered “weak”. The exception to this scale is computer proficiency and scoring for some components of the student projects. Levels of computer skills were assessed prior to student projects based on self-reports, a test exercise to confirm skills and word processing speeds confirmed by teachers. Students were grouped into three levels of computer ability: “low” (less than 50%), “average” (50 – 80%) and “high” (above 80%). Throughout the analysis, DC refers to Digital Chisel and CW represents Claris Works.

Question 1 – Computer Use

What can we learn about student use of text-based or multimedia computer programs as a presentation medium when creating curriculum projects?

To answer the first research question, the researcher examined student projects created in text and in multimedia programs. The researcher wanted to study the ways that students used the computer as a source of ideas and a medium to present information. Three elements were examined: word processing and graphic skills, ability to create a clear, integrated and engaging presentation (appeal), and inclusion of Internet information.
into the project. The pre- and post-test on computer skills were used to assess if self-reported skills were evident in the projects and to determine how many new skills were learned. Criteria for appeal of the project included integration of a variety of presentation mediums (text, graphics, sound, and transitions) to complement each other and to enhance the project. Content of the project was examined to assess if information from Internet sources was included and comprehension demonstrated by presenting this information in the students' own words rather than merely copying and pasting passages from the Internet into the text.

**Computer Skills Learned**

Table 7 below reports the data on self-reported computer skills after the project.

The researcher sought to verify students' self-report by analyzing students' final projects. While the pre-test of computer skills outlined in Chapter three reported similar numbers at each ability level for each program, the post-test self-report shows a decline in students at the high level of ability. The post-test included the original ten skills from the pre-test considered basic skills (editing and saving documents, performing Internet searches and importing graphics) and eight additional skills that could be mastered while working with multimedia projects (adding transitions, animating objects, and importing sounds and video).

<table>
<thead>
<tr>
<th>Program</th>
<th>High</th>
<th>Average</th>
<th>Low</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Chisel</td>
<td>13 (14%)</td>
<td>14 (15%)</td>
<td>19 (41%)</td>
<td>46 (49%)</td>
</tr>
<tr>
<td>ClarisWorks</td>
<td>7 (7%)</td>
<td>8 (8%)</td>
<td>33 (69%)</td>
<td>48 (51%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20 (21%)</td>
<td>22 (23%)</td>
<td>52 (56%)</td>
<td>94 (100%)</td>
</tr>
</tbody>
</table>
Although students acquired new skills, based on expected levels of growth, student scores declined on the post-test of computer skills particularly in CW where half as many students reported high or average ability levels. On the post-test self-report, 15 CW students (15%) and 27 (29%) of the DC students mastered at least half of the skills and achieved average or high ability levels. Students needed to possess 14 of the 18 skills for high and 10 – 13 to achieve average ability because of increased expectations anticipated as a result of skills that could be mastered because of participation in the project. The researcher anticipated greater improvement in skills but although students gained skills, their rated ability levels declined as they did not demonstrate many of the new, multimedia skills.

Improvement in computer skills is reported in Table 8. The researcher counted the number of new skills reported by students.

<table>
<thead>
<tr>
<th>Number of Skills</th>
<th>Digital Chisel</th>
<th>ClarisWorks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No skills</td>
<td>14 (15%)</td>
<td>10 (11%)</td>
<td>24 (26%)</td>
</tr>
<tr>
<td>1 skill</td>
<td>11 (12%)</td>
<td>10 (11%)</td>
<td>21 (23%)</td>
</tr>
<tr>
<td>2 skills</td>
<td>9 (10%)</td>
<td>17 (18%)</td>
<td>26 (28%)</td>
</tr>
<tr>
<td>3 skills</td>
<td>6 (6%)</td>
<td>6 (6%)</td>
<td>12 (12%)</td>
</tr>
<tr>
<td>4 skills</td>
<td>2 (2%)</td>
<td>3 (3%)</td>
<td>5 (5%)</td>
</tr>
<tr>
<td>5 skills</td>
<td>4 (4%)</td>
<td>2 (3%)</td>
<td>6 (6%)</td>
</tr>
<tr>
<td>Total</td>
<td>46 (49%)</td>
<td>48 (51%)</td>
<td>94 (100%)</td>
</tr>
<tr>
<td>Average</td>
<td>1.63</td>
<td>1.75</td>
<td>1.69</td>
</tr>
</tbody>
</table>

As Table 8 shows, improvements in computer skills were modest and the anticipated benefit of access to multimedia features did not translate into major gains in skills. There was little gain in computer skill with CW students averaging a gain of 1.75 in computer skills while students using DC were marginally lower at 1.63. The multimedia program group did not learn more skills than the CW group. In fact, the
number of students acquiring two or more new skills (above the average number acquired) is 22% for DC compared to 29% for CW. The data revealed that the most common skill learned by CW students was copying and pasting especially graphics which were deemed by the researcher to be a basic and not an advanced skill.

Presentation Appeal

Table 9 reports the rating for overall appeal by program groups on final projects. Appeal is defined as the inclusion of graphics, sounds, and transitions to enhance the meaning of the text and to make the projects interesting to the viewer.

<table>
<thead>
<tr>
<th>Program</th>
<th>Very Appealing</th>
<th>Appealing</th>
<th>Unappealing</th>
<th>Incomplete</th>
<th>Total - n= 94</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Chisel</td>
<td>3 (3%)</td>
<td>27 (29%)</td>
<td>5 (5%)</td>
<td>11 (12%)</td>
<td>46 (49%)</td>
</tr>
<tr>
<td>ClarisWorks</td>
<td>9 (11%)</td>
<td>16 (16%)</td>
<td>8 (8%)</td>
<td>15 (16%)</td>
<td>48 (51%)</td>
</tr>
<tr>
<td>Total</td>
<td>12 (13%)</td>
<td>43 (46%)</td>
<td>13 (13%)</td>
<td>26 (28%)</td>
<td>94 (100%)</td>
</tr>
</tbody>
</table>

Table 9 reveals that there were only a few very appealing projects (3 DC and 9 CW) and the anticipated benefits afforded the DC group did not translate into enhanced appeal. Also surprising is the large number of incomplete projects (28%) indicating that many students did not complete the work. Thirty students created appealing and very appealing projects with DC (32%) compared to 25 students using CW (27%). The opportunity to use transitions, screen effects and sounds that might have added appeal to presentations did not translate into more appealing projects. In many cases, students scored poorly for appeal because their use of these elements did not complement the text, but actually distracted from the presentation. The reduced opportunity to use multimedia features in CW meant that few of these multimedia distractions impacted the appeal of student projects.
Integration of Internet Information

Final projects were also examined for evidence of integration of information from the Internet (Table 10).

<table>
<thead>
<tr>
<th>Table 10</th>
<th>Evidence of Integration of Internet Research – n = 94</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program</td>
<td>Above Average</td>
</tr>
<tr>
<td>Digital Chisel</td>
<td>4 (4%)</td>
</tr>
<tr>
<td>ClarisWorks</td>
<td>14 (15%)</td>
</tr>
<tr>
<td>Total</td>
<td>18 (19%)</td>
</tr>
</tbody>
</table>

Less than half of the students were able to integrate information from the Internet into their projects and express their research in their own words. It appears that DC users were slightly more successful than CW users in integrating Internet research: 26 DC (27%) were satisfactory or above average in comparison to 20 CW (21%). However, more CW students had above average achievement: 14 CW students (15%) in comparison to 4 DC students (4%). Almost half of DC students (22 DC students 23%) were rated as satisfactory indicating they used more than one Internet source and reported the data in their own words. A variety of factors will have impacted this achievement and these are discussed in Chapter five. It appears that the curriculum projects reflect more copying and pasting of Internet information than presentation of ideas in the students’ own words.

Question 2 – Credibility Analysis

What can we learn about students’ ability to assess the credibility of information drawn from the Internet?

Data analysis for this question involved assessing students’ ability to analyze the credibility of an Internet site when the information was presented in a paper rather than a
computer format. A fictitious author’s web page entitled “France Web” (Appendix VIII) was created by the researcher to measure three factors: (1) students’ ability to identify and recall key components of information; (2) to assess currency of information and (3) to assess author credibility based on information from an author’s page from a web site. Table 11 summarizes student achievement on all three factors.

Table 11

<table>
<thead>
<tr>
<th>Component</th>
<th>Above Average</th>
<th>Satisfactory</th>
<th>Weak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td>51 (55%)</td>
<td>21 (22%)</td>
<td>22 (23%)</td>
</tr>
<tr>
<td>Currency</td>
<td>21 (22%)</td>
<td>16 (17%)</td>
<td>57 (61%)</td>
</tr>
<tr>
<td>Credibility</td>
<td>16 (17%)</td>
<td>14 (15%)</td>
<td>64 (68%)</td>
</tr>
</tbody>
</table>

Table 11 clearly shows that students are good at comprehension but poor at assessing currency and credibility. Students successfully identified key elements of the information with 51 students (55%) scoring above average and 21 students (22%) receiving satisfactory achievement. However, less than half of the students 37 students (39%) could satisfactorily evaluate whether the information was current and 64 students (68%) were weak at assessing the credibility of the author. During the instruction prior to the creation of the projects, students were taught to use three criteria to assess the credibility and currency of a web site. It appears that students can identify basic facts (e.g. data on geography of country) but when they are asked to assess the reliability of these facts (e.g. how we know the site is current) they have difficulty deciding what is relevant and providing reasons for their conclusions. As we will see in Chapter five, this raises concerns about using the Internet as an information source. If students have difficulty assessing whether a site is reliable and credible, they may be vulnerable to the many suspicious sources of web based information.
Question 3 – Multimedia as a Presentation Source

What can we learn about students’ interest in and recall of content when viewing text-based and multimedia computer presentations?

Students were shown one of two presentations: either an unedited, ClarisWorks project produced by a student or a multimedia presentation in Digital Chisel that the researcher created to include identical content to the CW project but enhanced by additional graphics, sounds and transitions between sections of the presentation. The researcher wanted to assess whether students could: (1) identify the main ideas and details from the content and (2) draw conclusions about the most effective order in which to present the information. At site one, students were randomly divided into two groups that matched computer and academic ability levels but at site two, each class viewed a different presentation. After viewing a multimedia presentation, students completed the instrument “Describing a Multimedia Presentation” (Appendix IX).

Content Recall and Level of Interest

The researcher wanted to determine if there was a connection between the reported interest in the presentation and students’ ability to identify key facts. Common educational philosophy would suggest that the more students are interested in a presentation, the more they will remember from it. Since the literature suggests that computers engage student interest, the researcher wanted to examine whether level of interest in a computer presentation would affect content recall. Achievement levels on the content recall are reported by level of interest in Table 12.
Table 12
Content Recall and Level of Interest – n = 94

<table>
<thead>
<tr>
<th>Level of Interest</th>
<th>Above Average</th>
<th>Satisfactory</th>
<th>Weak</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Interesting</td>
<td>6 (6%)</td>
<td>4 (4%)</td>
<td>1 (1%)</td>
<td>11 (12%)</td>
</tr>
<tr>
<td>Interesting</td>
<td>34 (37%)</td>
<td>17 (19%)</td>
<td>4 (4%)</td>
<td>55 (59%)</td>
</tr>
<tr>
<td>Boring</td>
<td>14 (15%)</td>
<td>6 (6%)</td>
<td>8 (8%)</td>
<td>28 (29%)</td>
</tr>
<tr>
<td>Total</td>
<td>54 (58%)</td>
<td>27 (29%)</td>
<td>13 (13%)</td>
<td>94 (100%)</td>
</tr>
</tbody>
</table>

Very few students indicated that they found the presentation very interesting (11 out of 94 students) and level of interest does not seem to affect recall greatly. The largest number of students indicated that they were interested and most of them (34/55 students 68%) received above average levels of content recall. Overall 51 of the 55 students (93%) who indicated they were interested recalled the content but 71% of students who indicated they were bored retained the content (20/28) receiving above average or satisfactory achievement. Level of interest appears to have some but perhaps not a major impact on content recall as most students could recall the content regardless of their interest level.

**Content Recall and Computer Skill**

The researcher explored a possible connection between content recall and levels of computer skill. This analysis was intended to determine if students with higher levels of computer skill navigated computer presentations more successfully and were more attentive to the details and content of the presentation due to their training in project design and layout. Table 13 reports content recall by computer skill after viewing a multimedia presentation.
Students at all levels of computer skill were good at recalling information but above average content recall was greater for students with higher levels of computer skill. Content recall appears to correlate with computer skill. Two-thirds of the students with high computer skill scored above average on recall (20 out of 31). Similar ratios occurred for students with average computer skill (24 out of 38). Less than one-half of low computer skill students scored above average on recall (10 out of 25). Computer ability correlated with content recall more than with students’ reported level of interest in the presentation.

**Question 4 – Student Attitudes and Experiences**

**What do we learn about student attitudes and experiences when using text-based or multimedia programs to create a social studies project?**

Two sets of student journals were used to collect data on students’ attitudes and experiences when using multimedia programs. The “Journal on Evaluating the Experience in Creating in Multimedia” (Appendix XI) surveyed students’ interests, difficulties and what they learned from creating their multimedia projects. In addition, students at site one kept journals during three of the weeks identifying problems they had and time lost due to problems. When informal interviews were conducted with students at the end of the research, students expressed frustration with technical problems. These
journals helped to determine the severity of technical problems described in student interviews.

**Most Interesting Components**

The focus in this section summarized in Table 14 is on student reports of what they found interesting during their work with multimedia programs. Students were asked open-ended questions and no attempt was made to guide their responses.

<table>
<thead>
<tr>
<th>Interesting Element</th>
<th>Number of Students</th>
<th>Percentage of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>26</td>
<td>28%</td>
</tr>
<tr>
<td>Internet</td>
<td>21</td>
<td>22%</td>
</tr>
<tr>
<td>Software Program</td>
<td>13</td>
<td>14%</td>
</tr>
<tr>
<td>Importing Pictures</td>
<td>11</td>
<td>12%</td>
</tr>
<tr>
<td>Computer</td>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td>Nothing</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>No Response</td>
<td>16</td>
<td>17%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>94</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 14 indicates that 50 students (52%) found elements relating to the computer (i.e., the Internet, software program, using the computer or importing pictures) to be the most interesting part of their experience. It is significant to note in light of much computer hype that content remained the most frequently identified single item with 26 students (28%) indicating content as the most interesting element.

**Most Important Aspect of Project**

Table 15 reports what students considered to be the most important aspect of their experience of creating multimedia projects.
Table 15
Important Aspects of Final Projects n = 94

<table>
<thead>
<tr>
<th>Important Aspect</th>
<th>Number of Students</th>
<th>Percentage of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content of Country Study</td>
<td>26</td>
<td>28%</td>
</tr>
<tr>
<td>Learning to Use the Software</td>
<td>20</td>
<td>21%</td>
</tr>
<tr>
<td>Internet Research</td>
<td>16</td>
<td>17%</td>
</tr>
<tr>
<td>Using the Computer</td>
<td>9</td>
<td>10%</td>
</tr>
<tr>
<td>No Response</td>
<td>23</td>
<td>24%</td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
<td>100%</td>
</tr>
</tbody>
</table>

The single element most valued by students was learning the content of the study which was identified by 26 students (28%). Students also valued using the computer: the data indicate that 48% of students (45/94) identified a computer-based aspect (software, internet or the hardware). Twenty-nine students (31%) valued learning about the computer and the multimedia software while 16 students (17%) identified using the Internet as the most important aspect.

Difficulties Encountered

Table 16 reports what students found most difficult about creating their projects and problems they experienced.

Table 16
Difficulties Experienced During Project - n = 94

<table>
<thead>
<tr>
<th>Problems</th>
<th>Number of Students</th>
<th>Percentage of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software</td>
<td>21</td>
<td>22%</td>
</tr>
<tr>
<td>Research</td>
<td>18</td>
<td>19%</td>
</tr>
<tr>
<td>Hardware</td>
<td>17</td>
<td>18%</td>
</tr>
<tr>
<td>Internet</td>
<td>16</td>
<td>17%</td>
</tr>
<tr>
<td>No Problems Reported</td>
<td>22</td>
<td>24%</td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
<td>100%</td>
</tr>
</tbody>
</table>

Technology presented the biggest obstacle to completing the projects. The data indicate that 38 students (40%) identified problems with computer hardware or software. Thirty-four students (36%) had difficulty with research (the process of locating, processing and presenting the information) and using the Internet (using a web browser...
and searching for the sites) and 22 students (24%) did not indicate any difficulties. When students use computers, they face challenges from both the technology and the content that they are researching.

Table 17 reports information from the journals kept at site one on problems students experienced during their lab time. These journals were completed in weeks 3, 7 and 8 of the project to determine how students spent their time during lab periods.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Students</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware - computer crash</td>
<td>19</td>
<td>41%</td>
</tr>
<tr>
<td>Organizational - lost disk or research notes</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>Software - couldn't use</td>
<td>3</td>
<td>7%</td>
</tr>
<tr>
<td>No Problem Reported</td>
<td>17</td>
<td>37%</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>100%</td>
</tr>
</tbody>
</table>

Technical problems were the biggest reported problem. Table 17 indicates that during the three weeks period in which the journals were kept at site one, 22 students (48%) had problems with the computer but 17 students (37%) did not indicate a problem. Only 5 (11%) of the 46 students lost 45 minutes (1 full block of computer time) and 14 (30%) lost 15 – 30 minutes. Twenty-two of the 46 students who completed this journal (48%) lost computer time due to technical problems but the amounts of time do not appear to be significant for more than 11% of the students. However, the students were very frustrated with the computers by the end of the project.

**Analysis of Tasks Performed in Computer Lab**

Table 18 summarizes student journals from weeks 3, 7 and 8 of the project which indicate the nature of the activities students were undertaking in the computer lab. These journals were collected only at site one so the size of the sample is 46 students.
Table 18
Tasks Performed in Computer Lab n = 46

<table>
<thead>
<tr>
<th>Nature of Task</th>
<th>Week 3 – Number and Percentage of Students</th>
<th>Week 7 – Number and Percentage of Students</th>
<th>Week 8 – Number and Percentage of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text Only</td>
<td>44 (96%)</td>
<td>17 (37%)</td>
<td>11 (24%)</td>
</tr>
<tr>
<td>Text and Multimedia</td>
<td>0 (0%)</td>
<td>10 (22%)</td>
<td>14 (30%)</td>
</tr>
<tr>
<td>Multimedia Only</td>
<td>0 (0%)</td>
<td>10 (22%)</td>
<td>12 (26%)</td>
</tr>
<tr>
<td>No Response</td>
<td>2 (4%)</td>
<td>9 (20%)</td>
<td>9 (20%)</td>
</tr>
<tr>
<td>Total</td>
<td>46 (100%)</td>
<td>46 (100%)</td>
<td>46 (100%)</td>
</tr>
</tbody>
</table>

The journals indicate that in week 3 in the lab almost all of the students were processing text. In the last two weeks, the percentage of students using multimedia increased to 56%. In week seven, 37% of students were adding text and over half of the students (56%) were adding multimedia elements such as graphics, transitions, and sounds. The number of students who had no response also increases in weeks 7 and 8. This was due to technical problems for four students, four students were absent and one student had completed the project. The journals suggest that more than half of the students were using the multimedia components but self-reports of skills after the project do not indicate that they felt that they had mastered them. Chapter five will explore possible explanations for these results.
Chapter 5 - Data Analysis

The data analysis is presented according to the four research questions. Conclusions from the data are related to the literature review. Explanations of anomalies in the data are also suggested.

Question 1

What can we learn about student use of a text-based or multimedia computer programs as a presentation medium when creating curriculum projects?

In relation to the first research question, three conclusions are suggested by the data:

- Students with higher levels of computer skills are able to take better advantage of the multimedia programs.
- Multimedia opportunities presented by the computer programs may have detracted from the appeal and content of student presentations.
- Various non-technology related weaknesses may have affected students’ ability to make use of the multimedia programs.

The data suggest that students are better able to take advantage of the features of multimedia programs if they have a relatively high level of computer skill. In the findings, students with average or higher levels of computer skills created more effective projects than did students with low computer skills. Students with average computer skills acquired the most new computer skills and their multimedia projects were generally good at integrated Internet research and creating appealing designs. Students with average and high computer ability were able to locate information, move through web sites and utilize more presentation features while creating their projects. On the other
hand, students with low levels of computer skills tended to be more successful using the text-based program (CW) than they were using the multimedia program (DC).

When designing multimedia projects, students must make decisions about information to include (integration of Internet research), the format to use, and how to link the various aspects of the presentation (Jonassen, 1996). While many DC students incorporated multimedia elements, these elements did not always complement the text and often did not improve the project’s presentation appeal. The use of sounds and transitions that were added just for “effect” often detracted from the content. Students with weaker skills appeared to be distracted by multimedia features such as sound effects and they spend considerable time simply trying to decide what element to include in their projects. Many weaker students had less time to use multimedia effects because of their slow word processing speeds. Consequently, the multimedia program was not very beneficial to them. This finding is in keeping with findings in the research literature which suggests that including many multimedia effects may distract from the meaning of the presentation (Mayer & Chandler, 2001; Lehrer, Erickson, & Connell, 1994, cited in Ayersman, 1996). Perhaps because of the fewer distractions, students with the lowest level of computer skills integrated more Internet research using the text-based program.

Three factors may explain why students with low levels of computer skill are not as successful when creating multimedia presentations: weaknesses in searching, in information processing and in word processing. Students with weaker skills need more time to locate information, to understand it and to make decisions about what to do with the information. A familiar text environment avoids sound, graphics and transitions that often lead to browsing and experimentation. Students may therefore be more likely to
focus on content rather than enhancing their presentation with extra elements. When students have weak searching skills, they often employ single word searches that generate too many hits leading to time loss trying to locate usable information. Many students had difficulty organizing and locating information indicating that the computer itself is not sufficient to assist students with research but rather they must have developed the necessary information processing skills to enable them to perform successful research on the Internet. As Rakes (1996) indicates, students must have a clear idea of what kind of information they are to collect and a means of assessing these sources. Similarly, Chadwick (2002) believes it is more important to know the meaning and value of the information and how to use it for appropriate means. Yeager and Morris (1995, as cited in Gibson, 1997) recommend using “productive” software designed to encourage effective research skills by helping children to organize and analyze the information collected.

The researcher had initially speculated that word processing speeds would have a significant impact. However, less than half of the incomplete projects came from students with weak word processing skills. Other factors that might impact the creation of the projects include lack of organizational skills to manage the writing and the research, limited attention span, frequent absences from school and weak research skills. It may be that students who have weaker computer skills benefit from using a familiar program to present research information as this allows them to focus their energies on the content rather than on learning how to operate a new program.

Restricted access to the Internet due to the late installation of the network in the computer lab at site one and differences in composition of the classes in the study may
account for some variation in integration of Internet sources at the two sites. Late installation of Internet connections to the lab reduced access and since students had done a lot of their research from print materials, it was hard to engage them in further research on the Internet. The composition of the classes also varied: the two classes using Digital Chisel having more ESL students and fewer students with high academic abilities than the CW classes but fewer learning assistance students. These language and academic deficiencies likely made it more difficult for ESL students to master the required content and skills. Teacher three’s class was a group of capable students with high academic ability but lower computer skills and they received the highest achievement on integrating the Internet. Reading and academic ability likely impacted student’s ability to complete the project. The ability to read instructions and overall academic ability may well affect a student’s ability to master new programs and present information. Even when Internet sites are supplied by the teacher, weaker students tended to surf the sites and copy and paste information rather than rewrite content in their own words. Thus, it appears that for a variety of reasons the content of a presentation is not necessarily enhanced by using sophisticated multimedia programs even though a variety of features and mediums can be utilized. Reed and Rosenbluth (1995, as cited in Ayersman, 1996) contend that the skills gained by students using multimedia went beyond content-area knowledge to include abilities of finding and interpreting information, articulating and communicating knowledge, and using computers as cognitive tools. However, when using technology, students still require the traditional classroom skills of organizing materials, listening to instructions, solving problems (software in the lab) and processing information.
Question 2

What can we learn about students' ability to assess the credibility of information drawn from the Internet?

Examination of the data related to the second research question suggests two conclusions:

- Students were relatively poor at critical analysis of currency and credibility when compared with comprehension of content.
- Developing critical analysis requires more than passing instruction.

Students were much more successful on comprehension and information recall than on drawing inferences and assessing the currency and credibility of web sites. More specifically, the data from Table 11 on the “France Web” exercise indicate that 77% of students correctly identified key concepts in the text but only 39% demonstrated the ability to assess currency and 32% could identify reasons to support the author’s credibility. If students do not possess these critical thinking skills, serious questions are raised about the advisability of basing research on Internet resources. If students are unable to discriminate the credentials of an author, determine how recent the information is (currency) and whether the information includes evidence of bias, they may be misguided and cite sources that are unsuitable for research. As Tyner (1998 as cited in Trilling & Hood, 1999) indicates, the need to become a “smart consumer of information, to learn how to exercise discrimination and to filter information has never been greater”.

The study suggests that students did not develop the important skill of critical analysis in the few lessons they were provided on this topic. Obviously students need further practice in critical analysis, and instruction must focus on these skills rather than
having students merely report content from Internet sites (Collins, 1994; Means, Olsen & Singh, 1995, as cited in Tiene and Ingram, 2001; Mehlinger, 1996, as cited in Rakes, 1996; Sheingold, 1991, as cited in Berg et al, 1998). An isolated project is insufficient to master these skills. Greater success may likely require embedding this kind of instruction into many areas of the curriculum.

**Question 3**

What can we learn about students' interest in and recall of content when viewing text-based and multimedia computer presentations?

In relation to question three, the data suggest two conclusions:

- Student levels of interest in the computer presentations did not have as much an effect on the students’ ability to recall information as the research literature might suggest.

- Computer skill correlates with the ability to recall content.

The research literature is full of reports of the motivational value of the computer in enhancing student learning. Yet in this study the data did not find a close match between levels of interest and content recall. Table 12 reports that 54% of those students who were very interested in the sample presentation recalled the content very effectively. Surprisingly, 50% of students who indicated that they were bored with the presentation were equally successful in identifying the key elements of the content. This would seem to indicate that level of interest had a minimal impact on students’ recall of content.

Level of computer skill appeared more closely associated with content retention when students viewed the multimedia presentations. As reported in Table 13, 94% of students with a high level of computer skill recalled the content successfully and 89% of
students with average computer skills remembering the key elements of the content. This compares with only 72% of the students with a low level of computer skill successfully recalling the content. One explanation for the success of students with a higher level of computer skill is that their skills enabled them to navigate the presentations and use the features of the tool to assist them to understanding the content. Despite the claims in the literature of the advantages of a multimodal presentation (Ottaviani & Black, 1994, as cited in Ayersman, 1996; Boras & Lafayette, 1994, as cited in Ayersman, 1996), this study demonstrates that only a small improvement is noted in content recall in a multimedia environment. As several researchers have stated (Hsu, Frederick & Chug, 1994, as cited in Ayersman, 1996; Liu & Reed, 1994, as cited in Ayersman, 1996) students acquire information in a multimedia environment at comparable levels to other methods of presentation.

**Question 4**

**What can we learn about student attitudes and experiences when using text-based or multimedia programs to create social studies projects?**

Four conclusions may be drawn from the student surveys regarding the students' attitudes and experiences when using the computer programs:

- The computer was a motivating factor, but perhaps not as much as the research literature might suggest.
- Novelty with the computer appears to have been a factor in student attitudes.
- The usefulness of the computer applications in school-related tasks or in future life appears to have influenced student attitudes.
- Technical problems are an impediment to integration of computers.
When students were asked for the most interesting component of the project, most students valued learning the curriculum content and developing computer skills. One-half of the students identified computer-related tasks and approximately one-quarter of the students valued using the computer to create their projects. The two key elements identified by students as the most interesting were the content of the project (28% indicated country study) and using the Internet (20%). On the question of the most important aspect of the project, 30% of the students indicated that the content of the project was most important followed by learning the program (21%) and the Internet (16%). Using the computer as a tool to present their social studies projects appears to be important to the students but so too is the content of what they are studying.

The data suggest that learning to perform a computer task is seen as more important if it is a new experience rather than building on skills that students have already been exposed to. The use of the Internet was cited more frequently at site two where they had just received Internet access, indicating that students may have valued the novelty of this experience. More site two students also identified importing pictures as the most important aspect of the project. Significantly, students at site one had already been taught how to import pictures prior to the project and had some experience with Internet sites. These students tended to place greater value on learning the program and the content of the project. While students at site one had access to all components of the multimedia program, students at site two had access to sound files only during the last two days. Although the novelty of learning new programs appealed to a small number of students, working on computer tasks relating to their coursework seemed to increase the meaning and value for students.
In their comments, students often referred to valuing a skill such as locating information on the Internet because they would need it to complete assignments or later in life for employment and advanced education. This suggests that integration of technology may be most welcomed by students when they see themselves learning computer skills that will assist them in completing their curriculum requirements and will be valued in the work force. This conclusion is supported by Budin (1991, as cited in Gibson, 1997) who recommends that teachers first consider the curriculum and then see ways to integrate technology that meets these curricular needs.

The student journals do not offer an adequate picture of the extent to which technological difficulties influenced the outcome of the study. However, it is telling that the most frequently cited student difficulty was hardware problems. Of the 29 students who indicated that they had problems during the project, two-thirds identified hardware problems. The computers experienced frequent crashes during the use of the software and this frustrated students. Although not represented in the data collected from students, technological difficulties are a significant obstacle to effective computer use.
Chapter 6 - Conclusions and Future Research

This chapter outlines the limitations of the study and what was learned from the experience. Suggestions are made about classroom instructional strategies and about the technical assistance and training required to integrate technology. Areas of future research are also identified.

Limitations of the Study

The findings of the study must be tempered by the many obstacles and shortfalls in the research. The following limitations were identified after the completion of the study:

1. Small sample size and composition of population sample;
2. Time constraints and delays due to technical problems;
3. Lack of consistency between sites in terms of teacher training, instruction and support on multimedia programs;
4. Incomplete and poor data;
5. Weaknesses in the design of assessment instruments.

Sample Size and Composition of the Classes

The study examined the use of multimedia and text-based programs with four classes of grade six students in two schools. Because of split classes, there were only 82 grade six students participating out of a total sample of 98 students. Sixty-eight participating students completed the assigned project further reducing the size of the sample. Students were divided into groups by the software program and then subdivided by level of computer skill. Small numbers of students in groups reduced variations and the small sample size makes it impossible to generalize to other school populations.
Furthermore, with such small groups variations in the data on a couple of students significantly impacted the results especially in the school where attendance was problematic. Any variations between the classes are based on very small numbers of students, therefore it is hard to decide what to attribute the results to. The study does provide insight into trends that might be apparent in other populations. To accurately document the impact of multimedia on a range of students, a much larger study is needed and sample groups of students would need to be selected on the basis of specific criteria such as similar levels of academic ability. Despite the small sample size, the study provides a glimpse of what happens in a computer lab setting for grade six students using multimedia programs.

The composition of the three classes may also have skewed the results. After the study, the researcher had a meeting with the teachers from site two where they revealed that the composition of their classes might be problematic. The split classes in the school had been set up to group students according to academic ability so the grade 6/7 class had the average to high academic students while the grade 5/6 class had the students with average and lower ability students in grade 6 and grade five students with average ability. At site one, the classes had been established to group all ESL students in one class and all the students who needed learning assistance support in the other. Therefore, these two classes also have approximately one third of the students who needed language or academic support (8/25 students). Since the Digital Chisel students at site two were the ones with lower academic ability and at site one the students had language difficulties, these groupings may have impacted the results. In the Claris Works group, site two had the higher academic students while site one had the students receiving learning assistance
so there was more of a balance of academic abilities in this group. This discrepancy would affect areas such as Internet research where a lot of reading is required.

**Time Constraints and Technical Problems**

Three kinds of time and technical constraints significantly impacted student achievement during the research:

1. Limited access to computers and computer labs;
2. Restricted Internet research;
3. Delays due to technical problems.

Timetabling access to computer labs is a difficult task and is dependent on the good will and cooperation of the teaching staff. Scheduling becomes a key element in long-term projects and the availability of open booking blocks becomes critical. In this study, one school had to withdraw because they were unable to sustain the required access to the computer lab. At site two, the late start up of the project (May) did not allow computer times to be changed if they were affected by school events and ongoing field trips. Ongoing school programs such as assemblies often result in the cancellation of computer lab times necessitating continuing projects for longer periods of time than the teacher can sustain interest in the project. Eventually, the researcher had to bring computers to the site to be placed in the classroom for students to access the sound component of the program which limited student access to computers. At site one, the delays in Internet access made the project extend for too long and student motivation began to decline. Another difficulty is that when features of software programs are taught one week and not practiced until the next, students often forget how to complete tasks so the process of learning new programs was slow and laborious especially for
students with weaker skills. Scheduling in computer labs can be adjusted to enable most consistent access for a brief period of time if teachers are open-minded and willing to share resources or if lab times are made available when colleagues cannot use them. An effective system of communication must be in place to facilitate this so that teachers know when the lab is available. Flexible scheduling to allow consistent access to computers in labs, pods, libraries and computers in classrooms is critical for integration of technology into academic areas to enable ongoing access to Internet resources and projects that allow students to demonstrate their mastery of required content in a variety of mediums to meet the needs of a range of learning styles.

Students needed ongoing access to the Internet to enable effective research. Forty-five minute lab periods, held twice a week over an eight week period, did not provide sufficient time for students to develop critical analysis skills while exploring the Internet for resources and processing and presenting the required content in the projects. An arbitrary decision was made by the three teachers to limit Internet access to assigned sites including both excellent resources and biased sites containing poor content. Students identified additional Internet sites for curriculum content that were added to the list of sites. However, Internet sites with sound, video and a variety of desktop publishing features such as backgrounds were not included in the list so students involved in the multimedia research did not have resources specifically focused on improving the quality of their presentations. During discussions at the conclusion of the study, all teachers agreed that greater unstructured access to the Internet would have been valuable.

Technical problems also reduced access to computers making it difficult to complete the research projects by the required deadline. The multimedia program was
not compatible with the security software on district computers so the security software had to be turned off during research. Without this security, students could save files directly onto the computer and were often unable to locate their work. Some program files were damaged when students moved program components resulting in an inability to start some programs. Many computers were not operating by the end of the research, necessitating that students share computers further reducing their work time. The teacher’s ability to problem solve during class times varied from rapid resolution at site one to a loss of computer access at site two until a district technician fixed the computers. The teachers at site two delayed the research until May and June due to other ongoing school activities leaving no time to extend the project deadline when problems arose. At the end of the research, extensive repairs were required to the computers and the software had to be reloaded before the computers could function effectively.

The scanner was broken by the time the study began so only those students at site one could be taught how to use a scanner. At site one, time spent scanning reduced time for research and writing resulting in less time to process and present the content of the final project. Students at site two merely copied and pasted graphics from disks or the Internet into their projects so they were able to include more pictures and improve their achievement.

At site one, more computers were available for student use and all available computers had fully operating multimedia software. This lack of sound effects reduced site two students’ ability to enhance their projects. Unexpected circumstances caused access to computer hardware and software to vary between the two sites and this likely affected the overall achievement on projects particularly for students using the
multimedia program. It was difficult for teachers to sustain motivation and commitment to improving the quality of student work in a climate in which technology is unreliable.

Unexpected delays in the installation of Internet access lines disrupted instructional opportunities for students. Internet access was not available at site one until the beginning of April due to the need to remove asbestos in the floor. The introductory lessons were taught using offline Internet sites and Internet research for the projects occurred a month later. Instruction at site two was done on a consecutive basis with the introduction immediately followed by the research so students were able to apply their skills to their project research. Thus, students at site two had greater access to the Internet. The delay in Internet access at site one made it more difficult to engage students in Internet research as most of the research had already been completed using text materials that students had accessed while waiting for the Internet connection. Thus, technical problems slowed student progress with respect to open access to the Internet, to time to complete their projects and to access to computers and software features.

Lack of Consistency Between Sites

Despite efforts to provide consistent instruction to all students in the study, the background training of the teachers and differences in instruction and support for students using the multimedia program may have impacted student achievement. This study did not include any assessment of the impact of teacher’s training and prior experience with multimedia on student instruction. However, the teachers had different backgrounds ranging from a computer specialist who serviced the lab for her school to a teacher with very basic knowledge of program operation. The computer specialist at site one was more knowledgeable about the operation of the multimedia program and had trained
student mentors. Formal instruction was provided to all students by the teacher so more equitable access was achieved and more students used the multimedia features because they received ongoing support from the teacher and student mentors. When problems arose at site two, students had to wait to complete tasks until their teacher contacted the researcher for advice or for the district technician to come to repair the computers. The greater a teacher’s knowledge of computer operations and software features, the easier it is to help the students use the computer more effectively to solve problems that occur.

Another variation was on instruction offered on multimedia programs and the support from peer mentors. While the researcher carefully designed lessons for consistent instruction to all students in critical analysis of information, instruction on the features of the multimedia program varied. More specifically, students at site one received formal instruction on the scanner and on features of the multimedia program, such as the use of video and sound, while informal instruction was given at site two in response to questions. Furthermore, students at site one who completed their work early mentored other students. This cooperative mentoring enabled more students at site one to make use of the multimedia features as peers offered instruction on the features of the program and assisted with problem solving the software. Students at site two did not have much time to either experiment with the sound and video components of the program or to ask for assistance if they could not use these features themselves. Consequently fewer students would have added the multimedia effects that would have improved the appeal of the projects. Thus, in reality for most students at site two, they were using the multimedia program in a manner similar to the text program and that provides one reason for the lack of variation in the data. Limited access to computers
with the multimedia sound and video features, combined with lack of knowledge of how to use them, caused student frustration and may account for the lower than expected achievement for students using the multimedia program. To avoid these problems, it would have been advisable to provide lesson outlines for all aspects of instruction and offer better technical set up to ensure consistent performance of hardware and software and uniform instruction on software use.

Incomplete and Lost Data

Despite the efforts of all three teachers to collect data efficiently, some data were lost due to hardware failures, improper saving of projects, student absences and the extended period between the actual research and the writing of the report. The time lag between conducting the research and reporting its findings has limited the data in some areas, as teachers were unable to provide the researcher with complete sets of data analysis instruments. The researcher did not realize that some materials were missing and when contacted, the teachers were unable to produce the material. One teacher moved to a new classroom at the end of the year and inadvertently threw out one envelope containing assessments done on web pages so the data on the pretest in critical analysis were removed from the analysis. Conducting the research in June made it impossible for site two students to keep journals as they only had enough time to complete major assessment instruments. Ongoing time pressures in schools and limited access to computer labs made it impossible to reschedule assessment. Data from site one was incomplete due to the high level of absenteeism in this transient community which made completion of required assessment instruments difficult. Since the project extended over such a long period of time, the students began to lose research materials and their
interest in the topic perhaps accounting for some of the incomplete projects. The challenges faced during this research are common when classroom teachers offer instruction in computer labs where their time is cancelled due to special events or network failures, student projects are lost due to hardware and software problems and students are absent during scheduled classes and cannot complete their work.

**Imperfections in the Assessment Instruments**

Assessment instruments were designed to be completed quickly without disrupting classroom activities but these instruments did not always provide sufficient data to draw conclusions. Assessment of computer skills was by self-report surveys and confirmation of skills from assessments of the final projects. However, some skills could not be confirmed without direct observation of students working on their project (for example, use of a template to create a presentation or use of a screen list to edit a presentation). Another example is that some students at site two indicated that they could use a scanner and they may have done this at home but since the school scanner was not operational, this could not be confirmed. The pre/post-test on information processing were difficult to correlate since the form of questions on the pre and post-tests was not identical. Thus the surveys did not provide an entirely reliable picture of each student’s ability to use the computer.

The researcher felt that qualitative observation, interviews and short answer questions would have offered more insight into the issues. This form of assessment would connect students’ ability to critically analyze information directly to their experiences with the computer rather than providing general information about groupings based on levels of computer skill. However, many teachers consider in-class assessment
by neutral parties disruptive to classroom routines and the teachers' teaching and technical support duties also makes this form of evaluation difficult for them to personally perform. Information about students' academic ability would also have clarified levels of achievement on critical analysis of information questions and helped to understand whether it was reading skills or computer skills that impacted the results.

Although the assessment instruments had flaws, the data provide some answers to the research questions. Clearly more detailed instruments would have enabled more accurate analysis of students' performance. It is often difficult to convince teachers in already pressured circumstances to have their students complete more assessment instruments when they cannot be included in report card marks. It was hoped that the researcher could supplement the written instruments by the researcher's observations to place the instrument in context. However, teacher observations became impossible since the teacher was spending all her time troubleshooting the technology. Thus the needs of researchers, classroom teachers and students resulted in compromises that reduced the integrity of data collection instruments in order to limit disruption to student learning in the classroom.

**Lessons Learned from the Study**

The recommendations to support integration of information technologies are organized around three themes: instructional strategies, teacher professional development, and technical and hardware support. The chapter closes with suggestions for further research on the educational use of multimedia programs and with concluding remarks on the researcher’s learning from this study.
Instructional Strategies

Emerging from the study are five recommendations for instructional strategies that would enhance student use of computer technologies:

1. Using student mentors.
2. Pre-teaching computer skills to students.
3. Selecting appropriate research topics and projects.
4. Developing students’ time management and organizational skills.
5. Supporting learners who have difficulty using technology.

Using Student Mentors

Because of the many challenges associated with integrating information technologies and the increased demands on teachers, use of student mentors can benefit both students and teachers. At site one, a small group of students had been trained to offer peer mentoring in using the scanner, for accessing the Internet, and for troubleshooting the software. These mentors were very effective in helping other students in the lab and in reducing class time lost while waiting for teacher assistance. Student mentors reduce pressure on the teacher in the lab and assist teachers in becoming comfortable with a more decentralized approach to instruction. The student mentors themselves also seemed to value their role. When students who had assumed this mentoring role were redirected to add more detail to their completed projects or examine more Internet sites, their response was “No thanks, I’d rather help.” While mentoring, students learned leadership and management skills and these skills should be included in assessment instruments.

Although training peer mentors is time consuming and often involves out-of-school time during lunch hours or after school, stress is reduced in the computer lab by
having peers assist with program components and basic trouble shooting. Thus, the use of student mentors develops the mentors' computer and leadership skills while reducing pressure on teachers and enabling other students to complete their work.

**Pre-teaching Computer Skills**

The study confirms that students require practice and instruction in computers if they are to successfully complete computer-based projects. In addition to the demands of researching and mastering the content of the social studies curriculum, students needed considerable technical and information processing skills to complete the two computer-based aspects of the project: developing Internet research skills and learning to use a multimedia program. Because of these demands, as the data suggest, students had very little time to develop new computer or design skills since much of their time was spent researching and processing information for their project. As well, the double load likely contributed to students' low completion rate of their final projects. If key information processing skills were already mastered, students would likely have been better able to use the multimedia program. Students will likely draw greater benefit from multimedia if use occurs after information processing skills have been developed and practiced. This conclusion is supported by the results of a subsequent project at site one. Because they had already been introduced to the program, students exhibited more information processing skills and a much higher level of achievement than was demonstrated in the study. Rather than introducing all new computer skills during a project, it may be advisable to develop some skills prior to using them in a project and to allow students time to explore new programs before using them for curriculum-based instruction. The pre-teaching of strategies for information processing and effective presentation of information would likely have improved the quality of student projects.
Selecting Appropriate Topics and Resources

In their efforts to introduce computer technologies into the classroom, teachers must not overlook the need to select appropriate topics supported by usable resources. At the conclusion of the project, the teachers at site two indicated that there had been a lack of Internet sites at an appropriate reading level and limited student interest in the topic. It appears that the grade five students using Digital Chisel had difficulty reading the prescribed Internet sources on natural resources. In addition, the resources on the topic of human rights were also drawn from a limited and excessively challenging group of Internet sites. The high reading level made it difficult for students with weaker skills to use the materials. This led to frustration and encouraged those students who could not process the information to copy directly from the site. If students are unable to read recommended resources or locate information, they often give up. Teachers must ensure that necessary resources at an appropriate reading level are available to students. This may require the provision of both text and Internet resources for weaker students who can use textbooks or other print materials or supplementary graphics in digital form to enable them to enhance their presentations.

Allowing students to choose their own topics and to decide how to research them may increase student motivation to produce quality projects. Although the researcher intended to allow student choice during the study, she was constricted by the requests of the other teachers to specify topics and restrict Internet sites. Lack of student interest in the selected topics may also have impacted the one-quarter of the sample who did not complete their projects. If choice of topic is not considered an option, offering software choices or choice of media to present information to more competent students with average to high computer skills is often a great motivator and results in better projects.
with more content. Offering students some choices in topics, freedom to access Internet resources and format of the presentation (multimedia or web page or text program) may increase ownership of their own learning.

**Developing Time Management and Organizational Skills**

In this study it was clear that students with organizational or time management problems brought these problems to the computer lab. Teachers can assist students by providing organizers and tools to manage their lab time and resources. The following are a sampling of strategies:

1. Use graphic organizers for note taking and for organizing information, especially with students who have weak reading and writing skills.
2. Store reference books and other student support materials in the computer lab to reduce inefficient use of time.
3. Set daily and/or weekly goals to remind students of their purposes and the time frames in which the work is to be completed. Specifying deadlines for research reduces the likelihood that students will endlessly “surf” for resources rather than process the information they have found.
4. Develop rubrics listing all required components both academic and those related to the computer program (e.g. transitions between slides in multimedia presentations) for use as student checklists to complete their projects.
5. Clearly articulate guidelines for required content, elements to be presented in the projects and standards for evaluation to help students improve their organizational skills and achievement.
6. Offer extra assistance from peer tutors, aides or learning assistance teachers to those students with learning or behavior difficulties.
Supporting Learners Using Technology

For students with learning or physical difficulties, technology can be both an asset and a source of frustration and failure. Teachers need to design assignments that allow students to demonstrate learning in a variety of formats. Information could be presented as graphics, text or video as long as it demonstrates understanding of curriculum content. Some students need extra time to complete assignments but often a peer tutor, an aide or the teacher can assist with part of the word processing and Internet research. The text to speech feature on computers can also be used to narrate assignments and record them on the computer. Teachers need to examine the features available within programs or schools can provide peripheral devices such as wireless mice, special keyboards or drawing tablets to enable students with physical challenges to use technology. Whenever possible, it should be arranged for learning assistance teachers to work in the lab with the students who have weak reading skills or to help these students prepare paragraphs to be typed in the lab. By providing tools and extra time if needed, teachers can facilitate the integration of technology into curriculum areas for students with a wide range of abilities and learning styles.

Professional Development

Research on classroom integration of technology has found that teachers progress through a series of stages while learning to use technology for their personal use and with their students (Dexter, Anderson & Becker 1999; Tiene & Ingram, 2001; and Sandholz, Ringstaff & Dwyer, 1997). This progression generally begins with teachers using software applications for administrative tasks such as creating documents, report cards and evaluation materials. Once confident in their ability to use a computer, teachers
begin to involve their students in computer-related tasks (e.g., search the Internet, create databases and spreadsheets, use programs to present information). Three levels of professional development may help support teachers in moving along this continuum: personal exploration of computers, training of others, and instruction in computer applications and pedagogy.

Teachers can benefit from personal experiences with multimedia programs by creating their own products (e.g. present course content to their students or to create projects of personal interest to themselves). By personally using the programs, teachers will better understand program features so that they can offer instruction to their students. Practicing with the program also develops confidence in teachers' ability to solve difficulties with the software and to demonstrate program features. While some teachers are satisfied teaching basic skills such as cutting and pasting graphics, others want to offer their students a fuller array of features available through the multimedia program.

Training student mentors or mentoring other teachers also enables teachers to practice their computer skills offering an opportunity to practice instruction in a small group situation building confidence and trouble shooting strategies. Once teachers have had a successful experience with a technology project, they are more willing to integrate computers into core subject areas and to assist colleagues and help them use technology. Teachers and school-based computer specialists can assist their fellow teachers with integration projects.

Teachers need instruction on various aspects of the computer, including software features, advanced Internet searching techniques, and troubleshooting computers. In addition, teachers need professional development on methods of embedding technology
into core subject areas and teaching on critical thinking, as it relates to computer use. Since most professional development workshops focus on software program features rather than instructional strategies or troubleshooting techniques, it is difficult for teachers to acquire this knowledge except through hands-on experiences with their classes. Since workshops are so brief, there is rarely enough time for presenters to outline problems that might arise as these will be unique to each school site’s hardware and software. Teachers often experience a steep learning curve when using software programs with their classes. Loftus (2001, p.23) states that teachers on average spent a mere two hours in technology-related professional or in-service activities during the 1999-2000 school year. Offering instruction on computers is a time intensive undertaking as new skills must be learned (use of software and troubleshooting) and when these demands are added to technical problems in the computer labs and the pressures of covering curriculum, many teachers are unwilling to undertake multimedia projects. To integrate technology into curriculum on an ongoing basis, teachers will need training on how to embed the use of computers into curriculum activities and how to manage instruction effectively in computer labs.

Technical Support

The major technical challenges in this study were the difficulties encountered with the computers including hardware problems, software problems (e.g. at site two, the sound files were not operating properly) and the need to continually adjust the settings on the computers. Computers fail for a variety of reasons including corruption in files, missing components of programs, viruses and disruption in data transmission resulting in corruption to preferences in Internet settings making the Internet browser unable to open.
Monitor failures, network failures or faulty computer components or connections necessitate ongoing troubleshooting. It is very difficult to offer instruction on content or features of programs if lab periods are spent trying to keep the hardware and software operating. When teaching is overtaken by technical demands, student achievement suffers and students and teachers become frustrated and less willing to use technology. If teachers are placed in a position where they must maintain hardware and software independently, many teachers will simply avoid the technology, as they have neither the training nor the time to sustain computers and teach a full range of courses (Atkins, 1992).

In this study, the importance of technical support was evident in the difference in student access to computers and software between the two sites. Without a computer specialist on site two, more of the computers failed to operate and student access declined. Discipline issues arose when students did not have a task to complete and the additional workload would not be something most teachers would wish to do for more than a few periods in length. On the other hand, at site one the researcher's time was consumed by maintaining and upgrading computers and offering technical support to site two. The consequence of this was that regular teaching duties were difficult to sustain and the researcher was unable to journal observations of student learning in the lab. One of the greatest instructional challenges faced by teachers is keeping the hardware and software in a computer lab functioning properly. Many of the problems encountered in this study may no longer apply as newer computers are more powerful, with more memory (RAM), hard drive space and many are run on a network. All teachers do not have the luxury of this level of computer or software support for their classroom and continue to use outdated equipment so many teachers may still experience the problems outlined in this
Without qualified, technical support, teachers often find it too difficult or too frustrating to use multimedia programs or Internet applications. Thus the technical background of teachers using multimedia programs often determines their successful implementation and the use of these programs also necessitates an ongoing commitment to technical support (Akins, 1991; Cuban 2003).

Until school sites have trained computer facilitators to maintain computer labs and assist colleagues to learn how to operate computers and software (especially at the elementary level), technical problems will continue to limit the meaningful integration of technology into the curriculum that will quantitatively demonstrate improvement in student achievement while using technology. It is recommended that school districts provide release time for computer specialists to ensure that mentoring and technical support is available at school sites. Technology specialists in schools could also train student mentors to assist in classrooms. These practices encourage teachers to broaden their knowledge of computer applications and to increase their integration of computers into classroom practice (Dexter, Anderson & Becker, 1999; Tiene & Ingram, 1995; Sandholtz, Ringstaff & Dwyer, 1997).

**Future Research**

A number of the issues raised in this study about effective instructional strategies for integrating multimedia and the Internet into core subject areas call out for further research. The following are the kinds of studies that are needed:

- Conduct a large scale study in which students create research reports in either a text, paper medium and or using multimedia programs. If all writing was done on the computer, researchers could better understand how computers
support or hinder student writing. Another approach would require one set of
students to use only paper research materials (e.g., books, maps, textbooks)
and another set only the Internet. It would also be of interest to study whether
or not academic ability correlates with computer skills (using technology to
create presentations).

- Examine the impact of teacher background knowledge of computer software
and problem solving technical problems. Data over a prolonged period of time
would reveal the "teacher effect" on student achievement. This might enable
school districts to plan more efficiently for teacher professional development
and assess the impact of teacher use of multimedia on student learning. Data
on student achievement would also enable school districts to assess if
expenditures on hardware and software result in measurable improvement in
student achievement.

- Examine how students construct meaning during Internet research and
determine whether unrestricted access to Internet sites affects the quality of
student projects. To avoid problems with students accessing inappropriate
web sites, teachers often spend a lot of time locating superior web sites and
then have students examine the content from these sites. In this approach,
students do learn how to discriminate credibility of authors and comparative
analysis is rarely done. By examining how students select web sites, what
content they draw from them and whether they can synthesize content as
effectively from pre-selected sites or find the appropriate content without
teacher guidance, teachers would have a means of planning effective
instruction. Instruction would focus on reducing copying and pasting from Internet sites and improving students’ ability to assess credibility of information and authors and to perform comparative analysis. They could assess searching skills, information processing skills and content mastery.

- Determine whether instruction in identifying and assessing relevant information is generalized to all academic areas. Students need a variety of instructional experiences to develop skills and the mind set to think more critically.

Concluding Remarks

This thesis examined the benefits and drawbacks of using multimedia programs and studied the use of the Internet in curriculum-based projects. The research literature suggests that multimedia programs provide opportunities for a broad range of students to develop computer skills and to increase retention of content through the use of multimedia presentations. This study suggests that teachers continue to face challenges relating to both technology and training so that effective integration of technology remains a goal rather than a reality.

In concluding this chapter, the researcher would like to include her personal reflection on the lessons learned during the course of this research. Tremendous amounts of time and effort were required to deal with the technical aspects of installing multimedia software and peripherals especially on older computers. Unless a teacher was deeply committed to the use of technology, this project would have been cancelled due to the frustration and barriers encountered. Understanding the magnitude of the learning curve for teachers unfamiliar with technology has had a tremendous impact on the
researcher's instructional strategies with students and on her training of other teachers to use technology. She now offers a wider variety of approaches to learning features of new programs and ensures that information processing skills are taught and practiced for an extended period of time before undertaking instruction on multimedia projects.

Beyond the technical aspects are the challenges of structuring experiences that develop critical analysis of information. In a society where students are bombarded with enticing multimedia effects, it is more difficult to engage students using traditional methods. The short attention span of many students hinders their desire to read the printed word and, as a result, many students simply copy information without internalizing it. In inner city schools like the one used in the study where the focus is on literacy, the use of the Internet is hindered by the students' reading abilities. Although students received instruction on critical analysis of information skills, the final projects demonstrated little more than cutting and pasting of information and graphics. The study supports the need to encourage information processing skills on an ongoing basis in the classroom so that students develop the inclination to think more critically in all aspects of their learning.

During the research, it became obvious that timetabling and curriculum restrictions make it very difficult for a teacher to employ a constructivist approach. These projects were not constructivist in nature because students had few options with respect to accessing and presenting content. Experiences with this type of knowledge construction are valuable and should be incorporated into curriculum planning. In the subsequent year, the researcher built a project into the program that offered students choice of topics and modes of presentation. While the use of multimedia programs is
challenging, it is also appealing to students and teachers must ensure that student are using these programs to use the computer as a tool not a toy.

The researcher hoped to institute a more constructivist approach to the social studies program, however this goal was hindered by the restrictions from the curriculum and the students' lack of experience with the Internet and multimedia programs. To institute a constructivist approach to learning using technology, a teacher would require open access to Internet resources and to computers rather than simply using computers with students during scheduled lab times. While the original goals of the researcher may not have been reached, a greater understanding of required instructional strategies to teach information processing and critical thinking were learned as well as more appreciation for the complexity of integrating technology into the curriculum.

The challenges of integrating technology into curriculum remain due to declining financial resources and the need for ongoing teacher training and support. However, teachers are willing to integrate technology if they have the technical support and computers with Internet access available to them in their classrooms and accessible through labs or pods. The use of multimedia programs especially ones like PowerPoint that are considered industry standard is important so that students can develop the skills they need to help them in the workforce. The goal is to have students use technology as a tool rather than a toy and to teach students to be smart consumers of information and critical thinkers.
Reference List


Murphy, Elizabeth, & Laferriere, Therese. Classroom management in the networked classroom – new problems and possibilities. In Barrie Barrell, *Technology*


Appendix I
Ethics Letter

SIMON FRASER UNIVERSITY

January 14, 1999

Ms. Shelley Wilcox
Graduate Student
Faculty of Education
Simon Fraser University

Dear Ms. Wilcox:

Re: Multimedia - Tool or Toy?

I am pleased to inform you on behalf of the University Research Ethics Review Committee that the above referenced Request for Ethical Approval of Research has been approved contingent upon this office receiving a letter of acknowledgment and approval from administrator from each of the schools involved in your study authorizing your research to be conducted. Once these letters have been received by this office, you may proceed with your research.

This approval is in effect for twenty-four months from the above date. Any changes in the procedures affecting interaction with human subjects should be reported to the University Research Ethics Review Committee. Significant changes will require the submission of a revised Request for Ethical Approval of Research. This approval is in effect only while you are a registered SFU student.

Best wishes for success in this research.

Sincerely,

Dr. Adam O. Horvath, Chair
University Research Ethics Review Committee

cc: R. Case, Supervisor

/bjr
Appendix II
Letter from Teachers

I, ______________________ (participating teacher) agree to participate in the research project being conducted by Shelley Wilcox for Simon Fraser University. I understand that my students will be doing a series of lessons on the critical analysis of web pages and preparing a project in either the software program Digital Chisel or ClarisWorks. All students will be assigned a group and a number according to their level of skill on computers and their number on the class list. Anonymity will be guaranteed to all students.

Shelley Wilcox will provide all lessons related to the critical analysis of information as well as assignment sheets for students. She will offer training on the software programs and will provide technical assistance when needed. Shelley will also provide letters to parents explaining the project. All work will be completed by June, 1999.

It is understood that the principal at each site will write a letter of support for this research to Simon Fraser University. Any questions or concerns relating to this project can be addressed to Shelley Wilcox (588-5468), Dr. Robin Barrow, Dean of the Faculty of Education (291-3148) or Dr. Roland Case (291-3745).
Appendix III
Letter to Parents

January 20, 1999

Dear Parent or Guardian of

I am conducting research on the use of multimedia programs to develop critical analysis of information skills in students. This project is towards the partial completion of requirements for a Masters degree at Simon Fraser University. Its purpose is to determine if the use of multimedia programs is an effective means of teaching students computer skills and critical analysis of information skills.

Projects created by students will be based on topics from the grade six Social Studies curriculum. All project work will occur in scheduled periods for computers and social studies.

I would like permission to use samples of your child’s work in analyzing whether your child uses critical thinking skills while using a multimedia program to present information about a country. During class periods students will fill in brief surveys, keep short journals and answer a few short answer questions after viewing two projects. All these instruments will be used for data for the research project. Student anonymity would be guaranteed as reporting will be based on a grouping of students according to their level of skill on a computer and a number on a class list rather than on an individual basis. At no time would your child’s name be used in the findings.

If, at any time, your child or you did not want to participate in the project, none of the child’s work would be used. Students not participating in the research project will be given another computer assignment for them to work on during the research project. These assignments will involve writing and drawing in ClarisWorks. There will be no effect on grades or course evaluation if a student does not wish to participate in the project. You would be welcome to see a summary of the project’s results upon completion.

If you have any questions, concerns, or complaints about the project, please feel free to contact Dr. Robin Barrow, Dean of the Faculty of Education at 291-3148, Mr. Peter Munro, Principal of Old Yale Road Elementary, Ms S. Wilcox or Dr. Roland Case in the Faculty of Education at Simon Fraser University at 291-3745.

Sincerely,

Ms S. Wilcox
Appendix IV

Teacher’s Name ____________________________ Student Number ____

**MY COMPUTER SKILLS**
Place a check mark in the column that best describes how you can perform these tasks on a computer:

<table>
<thead>
<tr>
<th>Task</th>
<th>Very Easily</th>
<th>Sometimes</th>
<th>Not Able to do at this time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open a file</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Save a file</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change the size of the text and font</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut and paste files from one file to another</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Draw a picture using the tools in Claris</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import graphics into a document</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Download articles from the internet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform an internet search to locate articles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animate an object</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create a button</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Place a check mark beside the name of any program that you have used for projects:
- ____ ClarisWorks
- ____ Hyperstudio
- ____ Digital Chisel
- ____ Writing Centre
- ____ Netscape Navigator
- ____ Adobe Photoshop

Place a check mark beside the word describing how you spend most of your time on the computer:
- ____ games
- ____ drawing or painting
- ____ word processing
- ____ internet access

My word processing speed in words per minute usually is ______ wpm.
Appendix V

Exploration of Space

Follow the directions exactly as outline to complete a story on the exploration of space.

1. Open the file “Exploration of Space”. Copy and paste the graphics from the folder below the appropriate sentence.

2. Open your picture of a rocket. Copy and paste this picture into the “Exploration of Space” story under the sentence that talks about rockets.

3. Open the file “Telescope” and copy this under the appropriate sentence.

4. Select all the text and change the size to 14 with Palatino font.

5. Save your file as Space Story. Return the disk to the teachers.
Appendix VI
My Computer Skills After the Project

Teacher's Name ___________________________ Student's Number ________

Place a check mark in the column that best describes how you can perform these tasks on a computer:

<table>
<thead>
<tr>
<th>Task</th>
<th>Very Easily</th>
<th>With Some Difficulty</th>
<th>Not Able to do at this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open a file</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Save a file</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change the size of the text and font</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut and paste files from one file to another</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut and paste from one program to another</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Draw a picture using tools in ClarisWorks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import graphics into a document</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Download articles or pictures from the internet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform an internet search to locate articles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animate an object</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use transition effects such as sounds and visual effects between pages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import sounds into a project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import pictures from program or CD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import videos clips into a presentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use a screen list to edit a presentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attach sounds to a graphic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use a template to create a presentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use a scanner to copy a picture into a computer presentation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix VII
Post-Test Marking Sheet for Completed Projects

Paragraphs
3 – well researched and written in a clear, concise manner
2 – some research which is written in a clear, concise manner
1 – some research but not written in a clear, concise manner
0 – very little research and not written in a clear, concise manner

Pictures
3 – effective use of all graphics to enhance meaning of text
2 – graphics included but only some enhance meaning of text
1 – graphics included but detract from meaning of text
0 – graphics not included in report

Appeal of presentation
3 – sounds and graphics reinforce meaning of the text and make presentation richer and interesting to view
2 – project is entertaining but sounds and graphics do not enhance meaning of text or make presentation richer more interesting to view
1 – sound and graphics distract from meaning of text and make the project difficult to understand and to enjoy
0 – boring, distracting and not informative

Integrating research from the internet
3 – Evidence of Internet research throughout paragraphs. Research is written in the student’s words.
2 - Evidence of Internet research throughout paragraphs. Most of the research is written in the student’s words but some research copied directly from web sites.
1 – Evidence of Internet research but most information copied directly from web sites.
0 – No evidence of Internet research.
Appendix VIII
About France Web

France Web was created by Voyage de France in cooperation with the City of Paris as a web site to promote travel to France and to provide a forum for discussion of French culture. Its creators include Paul St. Jacques and Michelle Dubois who have been involved in creating Web Pages for a variety of French companies including Chanel Fashions and Medoc Wines. Although we are software engineers, we have spent a year researching French culture and working with government agencies in order to create appropriate links to organizations promoting French culture. We wish to thank Dr. Andre Cyre of the University of Paris for his assistance on the historical links to sites in Paris, the Louvre for their information on French art, and the Mistral (Ministry) of Culture for their assistance. Clearly the dominance in Europe and France painters and writers necessitates an avenue to promote these talented artists. Michelle Dubois is herself a sculptor who is anxious to ensure the world wide exposure of French artist.

Our Core Beliefs Reaffirmed

In the last six months, Voyage de France has participated I expanding the World Wide Web to include a great many business and advertising sites on-line. France Web considers itself to be a “publishing company” that will serve as consultants to people wanting to place valuable French sites on the Web. Since it is obvious to the authors that content based sites are becoming the most popular on the web, every effort has been made to link the site to cultural organizations such as the Louvre. As president of the Parisian Artists Organization, Ms Dubois believes that visitors to Paris and France should be aware of the many cultural venues available for the, to visit.

Layout of the Site

The site is divided into three sections: travel and cultural exhibits, history and France chat which allows individuals to communicate about their travels in France and to discuss any component of French culture including music, drama, the arts and literature. Individuals can post articles on subjects relating to French culture to any section of the site but must first submit their information to the authors of the site and include information about their company or organization in their request. Any organization which sponsors the site receives an automatic posting in the appropriate area. The site is constantly evolving as more organizations in the Paris region post to the site and more cultural facilities are showcased. The site was posted in July of 1998 and is revised on a monthly basis. All links are reviewed every three months and all web pages (except historical links) must have been posted in the last two years to be included on the site.

The kid’ section of the chat area of the site is supervised by volunteers from the Ministry of Education in Paris. Individuals who do not follow the rules laid out on the website will be denied access to the discussions.

Posting to the Site

Requests for advertising should be directed to http://www.franceweb.org/advertising/. Since the site depends on both commercial and organizational sponsors, priority will be given to applicants who include information about their company or organization and which post an information based web page. All pages should be written in French and include translation capability. Sites written in English only will not be considered since one of the principal goals of
this site is to promote French culture in the French language. Assistance is available to foreign companies who cannot meet these standards but since French products and superior in quality, it would be expected that advertised products would be produced in France. Furthermore, since the City of Paris is one of the primary sponsors of this site, companies need to include information about where their products can be purchased in Paris.

Notes, Disclaimer, etc.

The creators of the sites are not historians but rather software design engineers who want to promote French culture around the world. Historical articles are read by Dr. Cyre but inaccuracies might still appear on the site. Literary review is conducted by Dr. Francois Gillenue of the Parisian Writers Society. The web site is sponsored by the City of Paris and travel agencies promoting travel to France. It should be noted that opinions expressed in articles on the site do not reflect the views of the organizations included on the site appear as they have stated them because we believe in freedom of expression. Debate is encouraged and criticism will be considered but not necessarily followed.

READ THE AUTHOR’S PAGE FROM THE FRANCE WEB INTERNET SITE AND ANSWER THE FOLLOWING QUESTIONS.

1. List the five pieces of information which you would consider to be the most important for your research and for assessing the reliability of this page.
   a) 
   b) 
   c) 
   d) 
   e) 

2. Is this site current enough to use for research? List three reasons why the site should or should not be considered current.
   a) 
   b) 
   c) 

3. List three reasons why we should or should not believe the information posted on this page.

___
___
___
Appendix IX
Describing a Multimedia Project

1. List the three most important pieces of information in the presentation.
   A) ___________________________________________________________________
   B) ___________________________________________________________________
   C) ___________________________________________________________________

2. Describe two types of transportation in France and explain where you would use each type.
   _____________________________________________________________________
   _____________________________________________________________________

3. What is the main product which is produced in this area?
   _____________________________________________________________________

4. What aspect of French culture is described? Describe two examples of French culture is shown in the project.
   _____________________________________________________________________
   _____________________________________________________________________

5. How interesting did you find this project
   _____ Very interesting  _____ Somewhat interesting  _____ Boring

6. After watching this presentation, would you like to visit this area? Why or why not?
   _____________________________________________________________________

7. If you were creating a web page based on this project, what information would you present first, at the top of the page?
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
Appendix X
My Journal of What I Did Today

Teacher's Name _______________ Student Number _______________

Week number _____ Period ______

Place a check mark on the line of each task that you accomplished today in class:

_____ Typed a few sentences but did not complete one paragraph
_____ Typed one or more paragraphs
_____ Added graphics
_____ Added sounds
_____ Added screen effects
_____ Added transition effects
_____ Added to my screen list

My progress today was:

Productive ______ Somewhat productive ______ Not productive ______

Please explain your answer.

__________________________________________________________________________

I felt that I enjoyed what I was doing today: very much _____ a little ____ not at all

What part did you enjoy?

__________________________________________________________________________

Please note if you had any problems with the computer freezing or the software crashing and the amount of time you were unable to work.

PROBLEM - ________________ TIME LOST - ________________
Appendix XI
Evaluating the Experience of Creating in Multimedia

1. What did you find the most interesting about this project?
   ____________________________________________________________

2. What did you find most difficult to do in this project?
   A) __________________________________________________________
   B) __________________________________________________________
   C) __________________________________________________________

3. What were the most important things you learned by doing this project? Why do you think these are important?
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________