DISSERTATION

STUDENT EXPERIENCES OF COMPUTER ASSISTED INSTRUCTION: A CASE STUDY

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY RICHARD B. DONNELLY ENTITLED STUDENT EXPERIENCES OF COMPUTER ASSISTED INSTRUCTION: A CASE STUDY BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

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An evaluation of the acceptance of this delivery system by the students will benefit the academic community in its endeavor to prepare and deliver courses with the use of technology. The information gathered from this study will benefit the instructor, who is challenged to plan ahead, prepare beyond the immediate future and be available to the student, whose satisfaction with learning is imperative. Participant responses focused on the student experiences of Computer Assisted Instruction (CAI) are discussed and both the positive and the negative aspects of CAI are presented.

Recent literature has noted the variety of methods to teach distance education courses with the use of technology. Technology is causing tremendous changes in the way people communicate with each other and how they gain access to various types of information. All these changes are important for faculty to understand both in terms of how technology applies to particular disciplines and how courses can be taught. This information is intended to provide educators insight into technology, including applications that can affect their educational efforts. Computer Assisted Instruction (CAI), teaching and learning inherently give pedagogical and technology challenges to teachers, students, and administrators.

Three themes, in particular, emerged from the course under investigation—Course Design Flexibility, Instructor Interaction, and the Variety of Technology Tools. Some participants in this study reported that the flexibility of the Computer Assisted

Instruction (CAI) enabled them to learn during periods of their daily/weekly schedule when they were fresh, and thereby, better prepared to make instructional gains. Findings of the present case study indicate that the time and convenience dimension of course flexibility to be of substantial benefit, especially students engaged in professional employment and/or parenting.

Some students in this research were distressed that the orientation session offered by the instructor during the first week of class was not adequate. The results strongly suggest that participants relied heavily upon the instructor's familiarity with computer-based technologies. Some students in this research study continued to have problems with the technological dimension of the course. Typically, they relied upon the course instructor for assistance in these cases. Based upon the data received from the students in this case study, the researcher has concluded that instructors utilizing CAI must be prepared to perform dual roles as experts in their field and as teachers of computer usage.

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DEDICATION

To Susie

CHAPTER I – INTRODUCTION

At the 21st century Teachers Initiative convention May 1996, President Clinton announced a proposal for the purpose of helping teachers and educators become proficient in using the latest computer technologies in schools. President Clinton stated that teachers should be, "as comfortable with computers as they are with chalkboards." Additionally, in his 1997 State of the Union Address, President Clinton proposed that furnishing computer access to all students should be a major objective for the advancement and improvement of America's educational system.

Present literature suggests that there has been a marked increase for the use of Computer Assisted Instruction (CAI) in higher education. There are a large amount of courses available, which are delivered entirely over the Internet, or in mixed mode using the Internet to supplement traditional teaching. Increased use of technology and Web-based instruction has provided universities with a means to accommodate more students' needs by providing them with a mechanism for meeting course criteria (Littleton, 1999).

The research presented here will explore the educational use of personal computers (PCs) using CAI. This trend should continue to evolve in the 21st century as one viable solution to mass education, especially for those students who have to work and uphold family responsibilities while studying. The potential of CAI, with the Personal Computer (PC) as a medium, is only beginning to be explored and researched (Kulik & Kulik, 1986; Niemiec & Wallery, 1987; Roblyer, 1988).

Research has also attempted to assess the acquisition of the technological knowledge and skills of students as well as how best to promote standardized computer usage in a variety of settings, e.g., community, clinical, and food service management

(Shah, 1999). CAI may facilitate the implementation of these goals and standards. Due to family and job responsibilities many unfortunately find it difficult to reach their educational goals. This is of particular concern in the hospitality industry, which is characterized by long hours and physically taxing work. If retraining or retooling is to be successful, higher education must be readily available to a more diverse population (Collins, 1994).

In contrast to CAI, Computer-Assisted Learning (CAL) is defined as the student-driven use of computers and appropriate software to facilitate their learning, so that information is received and assimilated at a pace set by the user. Conversely, in CAI, the instructor sets the pace (Kinnaman, 1990). It is clear that educational technology, in the form of telecommunication courses, interactive video, CAI, CAL, CD-ROM, and other new advances, has greatly enhanced opportunities for learners.

In one related study, Jaffe (1989) compared the effects of CAI with print instruction in a food-purchasing course at Purdue University. Results indicated the group receiving CAI showed a learning gain equal to that of students instructed by more traditional methods. Other schools are testing the waters by developing non-traditional, delivery modes in hospitality management courses. In the Chicago area, a consortium of community colleges and universities has been formed to offer courses via CAI. Included in the offerings will be a range of hospitality courses in great demand, such as food sanitation and safety, or those that are unique, such as bed and breakfast management (Jaffe, 1989).

Purpose Statement

The purpose of this study is to use archival data to explore "students' experiences" of CAI when teaching a Web-based food purchasing course. The focus of the research is to ascertain the students' perceptions relating to strengths and weaknesses of computer-assisted instruction, and their suggestions, if any, as to what improvements may be possible.

Research Questions

The focus of this qualitative case study is to examine the Grand Tour question:

What is the students' experience of Computer Assisted Instruction?

The following Sub Questions were; a) what do the students' perceive as the strengths of CAI? b) What do the students' perceive as the weaknesses of CAI? and c) What ideas for improvement to CAI do they have?

Definition of Terms

Asynchronous Communication - when individuals are not on-line at the same time to receive information.

Computer Assisted Instruction (CAI) - Computer-Assisted Instruction (CAI)
The use of a computer to provide course content instruction in the form of drill and practice, tutorials, and simulations. The instructor sets the pace.
The term is used synonymously with CBL (Computer-Based Learning), and CBI (Computer-Based Instruction) (Chambers & Sprecher, 1983).

Drill and Practice - A type of CAI design that provides practice and reinforcement of previously introduced concepts. Representative of a repetitive, or "flash card" approach to learning in which rote memory is emphasized (Chambers & Sprecher, 1983).

Computer Assisted Learning (CAL) - Student-driven use of computers and appropriate software to facilitate learning so that information is received and assimilated at a pace set by the user.

Distance Education (D. Ed) - All arrangements for providing instruction or electronic communications media to individuals engaged in planned learning in a place or time different than that of the instructor.

Meta-Analysis- Cooper and Hedges (1994) defined meta-analysis as the statistical analysis of a collection of analysis results from individual studies for the purpose of integrating the findings. In comparing meta-analysis to the narrative literature review, Whitley (1997) added that the former is a quantitative synthesis of a set of studies that integrates the results of their statistical analyses, while the latter uses qualitative techniques to integrate a body of research.

Personal Computers (PC) - An individual computer with enough speed, memory, hardware and software to allow student and teacher interaction.

Simulation - A type of CAI lesson design where the computer models a real world or fictional situation in which the student plays a role and interacts with the computer (Chambers & Sprecher, 1983).

Synchronous Communication - Individuals interact with one another in “real time”. Usually used with audio-conferencing.

Traditional Teaching - when students and instructors meet face-to-face in the same classroom environment.

Tutorial - A type of CAI lesson design in which question and answer, dialog type learning in the traditional tutor mode is emphasized (Chambers & Sprecher, 1983).

Delimitations

There are hundreds of hospitality management programs operating successfully throughout the world. The focus of this study was limited to a group of students willing to participate in a research project regarding a food service purchasing course-using Computer Assisted Instruction (CAI) at a University in the Rocky Mountains.

Limitations and Assumptions

As mentioned above, by limiting this study to only one case study, the generalizability of the study is restricted. The purpose of this case study is not one of generalizability, but more of documenting what occurred during a course offered using CAI.

Significance of the Study

This research gives an opportunity to capture the "students' experience" of CAI. Results from what the students perceive as the strengths, weaknesses and their ideas for improvements to be made using CAI should be helpful as the "lessons learned" for administrators and instructors when planning to teach future CAI courses.

Researcher's Perspective

Currently, I am a forty-seven year old, Caucasian male who is a first generation, degree-seeking student. My profession for approximately the last 30 years has always been an extension of hospitality management and food service. Working as a chef, I have been involved in training both employees and peers within the food service industry. I have taught hospitality management education at various four-year universities as well as two-year community colleges.

Although I have served in the capacity of chef departee for 20 plus years, beyond the excitement of the food preparation, I personally have most enjoyed training new employees. One of the senior mentors I acquired during my profession urged me to seek more education and pursue a teaching career in the hospitality management industry. Consequently, I began to take courses toward several degrees, and am currently in pursuit of my doctorate.

In education, I have been a tenured Associate Professor, Assistant Professor, Instructor and Adjunct faculty member. During my career as a working student and educator, I felt the need for a change in the current system. It seemed that education was a well-kept secret from those who held industry positions most of our lives. For me, the best of both worlds happened when I was teaching during the day and attending classes nightly. My instructors taught me several lessons. Several cautioned me that the system was inflexible and change was very slow. As a student, by the time I might initiate change in the system, I might have finished with my degree. I challenged myself to become an agent of change whenever possible. Thus, I hoped that when I finally was in a position to initiate some changes that would be more student-friendly, I would have the knowledge I needed through my past experiences as a learner. Hence, my interest in CAI, education anywhere at anytime, and a virtual classroom with no walls except those in the comfort of a home.

CHAPTER II: REVIEW OF THE LITERATURE

This chapter begins with a historical look at the use of computer-based technology in education. Educators, administrators, and students should recognize the significance of technology in American schools and universities. This chapter looks at the literature concerned with the evolution of computer-assisted instruction, computer-assisted instruction today, educational applications, computer-assisted instruction studies, three forms of reviewing studies and current directions in evaluation and assessment of computer-assisted instruction.

The Evolution of Computer-Assisted Instruction

In an application to the Federal Radio Commission by the State University of Iowa seeking additional power for its radio station in 1927, the following quote was included, "This is no place to indulge in idle fantasies…it is no dream to picture the school of tomorrow as an entirely different institution than today because of the use of radio in teaching" (Pittman, 1986, p. 38). The U.S. government granted radio broadcast licenses to 202 schools of various levels during the end of World War I and the start of World War II. According to historian Von V. Pittman, Jr., "the educational stations would permanently dominate open-broadcast radio,". Even though there were at least 13 colleges and universities offering for-credit courses on the air during the first two decades of radio, by 1940 nationwide enrollment for courses by radio was zero (Pittman, 1986). During 1936, the U.S. Commissioner of Education and Chairman of the Federal Radio

Education Committee, John W. Studebaker, stated at the first National Conference on Educational Broadcasting:

> Educators on their part have discovered that producing successful programs is a far more complicated process than it first originally appeared to be. There is not the slightest doubt in my mind that radio will become one of the most powerful constructive forces for the education of our people if we devote adequate attention to the development of truly educational programs. (Marsh, 1937)

Television director Nathan M. Rudich stated to educational broadcasters in 1948, "start preparing for television as a medium of education." If properly used, television can be one of the most significant aids that has ever come within reach of the educator (Carson, 1948). Educational institutions tried to develop the television medium; however, once it matured they were quickly left behind. Will the history of educational radio and television repeat itself or will educators find success with the new technologies and the World Wide Web?

The First Generation Of Computers

Given the complexity of the origins of computer technology, it is by no means surprising to find disagreement among historians concerning the proper criteria for identifying the first manifestation of an authentic, fully-fledged computer. As Merrill, Hammons, Vincent, Reynolds, Christensen, and Tolman (1996) have observed, manifold, diverse, and interpenetrating lines of technological advances unfolding over the course of centuries cumulated with the invention of what generically is referred to as the computer.

The first computer was the Electronic Numerical Integrator and Calculator or ENIAC, developed by Dr. John Vincent Atanasoff and his fellows at Iowa State College in 1939 (Merrill, et al, 1996; Digby-Junger, 2000). A huge, room-sized device powered by vacuum tubes, the ENIAC was created for the specific purpose of assisting in the calculation of solutions to problems at the cutting edge of physics (Merrill, et al., 1996). The ENIAC was the immediate forerunner of the stand-alone, mainframe computers developed by International Business Machines (IBM) after World War II, which dominated this nascent patch of educational technology until the "microcomputer revolution" of the late 1970s brought desktop PCs into American schools and universities.

Educational Technology Emerges

The popular belief has been that educational technology (ET) is the result of an evolution of the audio-visual (AV) technology movement and is primarily a post-World War II idea. According to M.D. Roblyer (1992), the first instructional use of computers took place in 1950, when scientists at the Massachusetts Institute of Technology (MIT) constructed a computer-driven flight simulator to train Air Force pilots. At that time, the field of ET had cohered around AV media, notably films and fixed-frame film slides. The widespread use of training films during World War II affirmed the perceived value of AV technology for instructional ends and created a pool of professionals committed to AV as an educational adjunct. Television provided the AV and the ET movement with a powerful impetus. As early as 1950, the first educational television station was in operation at Iowa State (Pittman 1986).

As an outgrowth of ET, the first use of computers with public school students occurred in the late 1950s. In 1958-1959, John Kemeny of Dartmouth University composed a new computer language called BASIC, and its relative simplicity facilitated the development of the first computer assisted instruction (CAI) programs (Chambers & Specher, 1983). In 1959, IBM used CAI programs written in BASIC to teach binary arithmetic to New York City elementary school students who worked at a "typewriter inquiry station" connected to an IBM 1500 mainframe computer (Roblyer, 1992).

Aside from Kemeny's work, Stanford University professor and subsequent founder of the Computer Curriculum Corporation (CCC), Patrick Suppes, is acknowledged widely as the so-called "Grandfather of CAI" (Roblyer, 1992, p. 334). In the early 1960s, in an effort to integrate computers into education, Suppes and his Stanford colleagues initiated a systematic effort to develop a full range of drill-and-practice and tutorial CAI applications programs, first in mathematics and then in other curricular areas. Drill-and-practice is common to CAI and stresses memorization via a flashcard technique. In concert with IBM, Suppes and the Stanford team engaged in two parallel efforts to develop and implement CAI. Using an IBM 1500-mainframe system, Suppes et al. implemented a CAI system to teach reading and math to students at Brentwood Elementary Schools in East Palo Alto, California (Roblyer, 1992).

Concurrently, the Stanford researchers utilized a Digital Equipment Corporation (DEC) PDP-1 mainframe (with a simpler hardware configuration than its IBM rival) for drill-and-practice activities in math and reading. In time, this system would become the core of a CAI product line marketed by CCC. By 1978, CCC had installed thousands of computer terminals programmed with its courseware in public schools and colleges around the United States (Roblyer, 1992; Chambers & Specher, 1983).

Programmed Logic of Automatic Teaching Operations (PLATO)

During the same time frame, researchers at the University of Illinois, with financial support from the National Science Foundation (NSF) and the Control Data Corporation (CDC), developed a potential technical language, TUTOR, under the heading of Programmed Logic of Automatic Teaching Operations (PLATO). The

PLATO system utilized a different technology for screen display and focused on full-scale tutorial courses (Chambers & Specher, 1983; Merrill, et al., 1996). According to Chambers & Sprecher (1983), despite the somewhat earlier appearance of BASIC,

> when the PLATO system was developed, computers were still relatively unknown in education. If available, they were programmed in complex computer languages and were almost exclusively batch processing machines. For such equipment, it took many hours to write a simple program. (p.8)

In short, PLATO facilitated the development of hundreds of software packages in a host of subjects. These were used at the University of Illinois for instructional purposes and ultimately supported over 4,000 terminals at hundreds of locations, including select public schools, colleges, and universities (Merrill, et al., 1996).Between 1960 and 1980, CAI was shaped by time-sharing activities offered by universities, all of which were developed on and driven by large-scale mainframe or moderately smaller minicomputer systems. By the start of the 1980s, some 22 large universities around the United States had established computer centers with time-sharing systems that public schools in the area would access through terminals (Roblyer, 1992). Nevertheless, in terms of the educational landscape as a whole, CAI did not make substantial inroads.

As Chambers and Sprecher (1983) would recall shortly thereafter, by the mid- to late-1970s, "disenchantment with CAI had begun to settle over many educators as well as key funding agencies" (p. 17). In 1977, the educational efficacy of PLATO was appraised in an evaluation study conducted by the Educational Testing Service (ETS). The ETS assessment team noted that, since its introduction into select classrooms, both students and faculty generally had become involved in CAI. Consequently, as students utilized the systems, their attitudes toward PLATO and CAI improved. Moreover, the ETS researchers found that PLATO exerted a significant positive influence (as measured by standardized achievement tests) on student learning outcomes in mathematics as compared to traditional methods of teaching. Somewhat disappointingly, the report went on to conclude that, no further significant achievement effects were found in any other subjects, either in favor of PLATO or in favor of the regular classroom (Chambers & Specher, 1983). By the late 1970s, interest in and enthusiasm for the educational use of computers had begun to wane.

Microcomputers Arrive

Just when it seemed that CAI would be relegated to the sidelines of educational enterprise, a parallel line of technological breakthroughs recorded in the early 1970s reached fruition. Having described the near demise of CAI in the late 1970s, Chambers & Sprecher (1983) then stated, "the introduction of microcomputers literally revolutionized the use of CAI in education in the United States" (p. 18). Microcomputers were small enough to fit on a desktop, did not have to be connected to a large computer, did not require special air conditioning or humidity controls, and were easy to operate. The microprocessor or chip contained in the system could perform arithmetic and logic functions and could be programmed just like the more expensive wired circuits of the mainframes (Digby-Junger, 2000). In essence, the microprocessor was the key component of the microcomputer or Personal Computer (PC), and eliminated the need for large mainframe machines or mini-computers to conduct CAI. Attendant costs of CAI hardware, software, and courseware began a downward trajectory that has proceeded to this day.

In 1976, Steven Wozniak and Steven Jobs designed the first microcomputers using chips, founding the Apple Computer company three years later. Between 1977 and 1980, the first wave of microcomputers, including Commodore Pets, Tandy/Radio Shack

TRS-80s, and Apples began to appear in classrooms and on campuses across the country. In 1981, the mainframe manufacturer IBM marketed its own "micro" computer and the entrance of a well-established and respected firm. This contributed to the rise of a market for PCs and a PC industry (Digby-Junger, 2000). Within the next few years, the "focus of instructional computing shifted from large, centralized systems to small, stand-alone ones" (Roblyer, 1992, p. 335). As costs declined, even small public school districts were able to digitalize their respective curricula (Merrill et al., 1996). Apart from cost accessibility, the PC revolution in CAI differed from the "mainframe era" in several significant ways. As Roblyer (1992) has elaborated:

> First, microcomputers were brought into the schools by teachers and students rather than by computer companies and universities; it was a 'grass-roots' movement. Second, software for microcomputers came not from professors and programmers at university R&D centers but from small companies and development centers, from teachers themselves, and later from book publishers. Educators now had more individual control over computers and the software to run them. Previously they (educators) were dependent on whoever was in charge of running the mainframe computer to allow them access. Now they could buy software and use it at their convenience. But the most significant difference was in the nature and scope of the role computer technology would play in education (p. 335).

The first microcomputer courseware programs were the essence of tutorials, drills, and simulations created for use on mainframes. Nevertheless, as Roblyer's account suggests, with the advent of the PC and CAI, the nature and scope of the latter would undergo a dramatic transformation.

Educational Software

A key force behind this transformation can be traced back to the late 1960s prior to the invention of the microprocessor at Intel. In 1968, MIT professor Seymour Papert, heavily influenced by the learning theories of Swiss developmental psychologist Jean Piaget, began work on the creation of the computer language LOGO (Chambers &

Specher, 1983). Papert first used LOGO to write programs for mainframes and then adapted it to the creation of educational software for PCs. In time, LOGO became the basis of a vast array of powerful computer applications or tools, including word processing, electronic spreadsheets, and database managers operating on PCs.

As PC-based CAI became increasingly widespread in the 1980s, LOGO and its derivatives became the focal point of new digital curricula that went beyond drill-and-practice, tutorial, and simulation to materials aimed at the development of learner problem-solving skills and higher-order cognitive functions (e.g., exploration and brain-storming) (Roblyer, 1992). In addition, microcomputers with flexible disk drives added to the standard PLATO terminal provided courseware via the computer while bypassing telephone communications.

Parallel developments in educationally oriented computer software (and hardware) took place through the Time-Shared Interactive Computer Controlled Information Television (TICCIT) system developed at Brigham Young University in 1971 and marketed by the Mitre Corporation, which added color television CAI mix (Roblyer, 1992; Merrill, et al., 1996). The researchers in the TICCIT project subsequently developed complete courses in math and English for use at the college freshman level (Merrill, et al., 1996). TICCIT was implemented first at two community colleges, Phoenix College in Arizona and Northern Virginia Community College in Alexandria (Chambers & Specher, 1983). In 1978, TICCIT was evaluated by ETS, which reported that it had significantly positive achievement effects for both math and English over the baseline of conventional (lecture/discussion) college-level teaching (Chambers & Specher, 1983).

Thereafter, in the mid-1980s, the Minnesota Educational Computing Consortium (MECC) produced a wide array of CAI courseware to become the single largest software provider in the educational field (Roblyer, 1992; Chambers & Specher, 1983). Concurrently, in 1985, the Apple Computer Corporation initiated its Apple Classrooms of Tomorrow (ACOT) project in elementary and secondary schools across the United States, moving toward what would soon be called "integrated learning systems" (ILSs) (Merrill, et al., 1996).

Integrated Learning Systems, Multimedia And The Internet

Integrated learning systems (ILS), namely microcomputers, are not only the dominant form of computer technology utilized in schools but also are utilized in multimedia learning stations (Roblyer, 1992). The development of multimedia CAI and, in turn, ILSs, has been propelled forward of late by the emergence of "the most powerful electronic communications network (i.e., the Internet) in the world's history" (Digby-Junger, 2000, p. 495). With respect to the Internet, Digby-Junger (2000) noted that, while the term "Internet" did not appear in a major U.S. newspaper until 1988, the origins of the "Net" extend back to the mid-1960s. In 1964, scientists at the RAND Corporation developed a configuration of mainframe computers connected by pathways reminiscent of telephone lines that would have military applications. Five years later, the Advanced Research Projects Agency Network (ARPANET) implemented a system featuring 20 individual computer stations or nodes, located at various distances from each other, using a common language, and able to communicate with each other. In 1972, 46 university and research organization networks were added to the ARPANET system, and the epicenter of what would become the Internet began to grow as UNIX was developed as a common operating language. By 1984, more than 500 host computers were on-line on the Internet (Digby-Junger, 2000).

Until the late 1980s and the establishment of the World Wide Web (WWW), the growth of the Internet was controlled tightly by the Pentagon. In 1991, hypertext mark-up languages (HTML) led to the creation of hypertext, so that "clicking with a mouse on a hyperlink, a highlighted passage in a Web text, could speed a reader to related information instantaneously" (Digby-Junger, 2000). Aside from the fact that the military officials objected to the spread of information technology (IT), starting in the early 1990s, the federal government subsidized the wiring of public schools, colleges, and university classrooms into the Net and associated telecommunications costs. Most notable in this regard was the passage of the High Performance Computing Act of 1991 (sponsored by Senator Al Gore, Jr.) (Digby-Junger, 2000).

Between the onset of the PC revolution in CAI/ET and the present, the penetration of digital technology into American public education has advanced at an extraordinary pace. In fact, Digby-Junger (2000) estimates that the number of host computers on the Internet rose exponentially from 80,000 in 1989 to 10 million in 1996 and is expected to climb to 50 million by the end of the century . Despite this significant increase in computer technology, specifically the Internet use, recent estimates indicate that there is an inadequate number of computers to serve public school students.

Alspaugh (1999) investigated whether there was a relationship between the number of students allocated to one computer and their educational outcome. After students were exposed to computer learning situations, they were put into groups and given achievement tests. The student groups ranges from 4 to more than 10 individuals per computer. Alspaugh found that there were no statistically different levels of achievement among the four groups considered in the study. Therefore, the author concluded that the allotment of computer technology in educational curriculum does not displace the traditional outcome measures while students acquire computer experience and skills (Alspaugh, 1999).

While the computer has gone from being a novelty within American education during the 1980s to being a standard feature of schools across the nation in an impressively short time span, the growth of digital telecommunication information networks accessible through PCs has been even more astounding. Schools use computers not only for administrative purposes but also as instructional or learning aides (Roblyer, 1992). Since the advent of the hypertext Web or Internet in the early 1990s, the adoption/diffusion rate(s) within public schools has been unprecedented (Digby-Junger, 2000). Libraries are offering Web versions of books, newspapers, and magazines for students and the general public.

A parallel phenomenon is evident within higher educational institutions. As Judith Johnson (1999) has recently observed, "in the past several years, there has been a dramatic increase in the use of technology at the college level for instructional purposes in many higher education institutions" (p. 165). With this increase in college-level, Internet instruction, the number of students engaging in distance learning (DL) is on the rise. DL enables students to complete courses and degree programs without actually stepping foot on their university campus. In fact, some DL providers are "virtual universities" that do not have a campus in a traditional sense (Johnson, 1999, p. 165).

Thus far we have concentrated on the technology dimension of CAI as a form of ET, yet an adequate grasp of computer technology's potential educational dimension also requires consideration as a leaning media. Through CAI, active engagement in a shared learning environment and, hence, the generation of learning, are potentially super-charged.

CAI Today

Computer Supported Cooperative Learning (CSCL)

When set alongside conventional, "teacher-centered," pedagogical and classroom organization approaches, CSCL may be categorized as "student-centered" in orientation. Placing its emphasis upon inductive reasoning, CSCL is a substantial departure from the conventional instructional format of teachers pouring a body of knowledge into their students through primary reliance upon instructor lectures.

> Researchers who work in a Computer Supported Cooperative Learning framework have developed several successful collaborative techniques that enhance student achievement. CSCL contexts typically involve multiple methods of computer-based communication with the capacity for students to look at and manipulate digital texts and objects collectively. (Schacter & Fagnano, 1999, p. 334)

CSCL applications ask questions, search for students' answers to inquiries, comment on and review others' work, and reformulate answers to the original questions. This process becomes knowledge-building and offers a mechanism by which a student can recognize his/her own learning needs and pursue individualized learning goals. The basic assumption is that more active student involvement in the educational process and increasing salience of the process dimension of developing student reasoning skills will generate superior learning outcomes when compared with students' passive reception and retention of principles, concepts, and facts from textbooks and teacher presentation. In fact, numerous studies have found a positive correlation between the implementation of a cooperative instructional approach, with marginal increases in student academic achievement, competencies, and group work skills (e.g., problem solving) (Schacter & Fagnano, 1999).

Today, Scardamalia and Bereiter's (1996) Computer Supported Intentional Learning Environment (CSILE) is the most widely used form of CSCL, and, according to Schacter and Fagnano (1999), "eight years of research on CSILE has demonstrated that CSILE maximizes student reflection and encourages progressive thought, taking multiple perspectives and independent thinking" (p.335). CSCL and CAI have had an important impact on students' learning capabilities and methods by which they gather information and make decisions.

Similarly, Niemiec, Sikorski, and Walberg (1996) proposed that CAI allows learners to take control of the instructional and learning processes. Learner control refers to concepts including the student's own selection of goals and course content, time allotment for mastering information, and the sequence or pace of instruction. In Niemiec et al.'s review of the literature it was found that learner control had no effect on achievement. Niemiec, et al., argue that, of the nine reviews analyzed, seven reported biased evidence (Niemiec, 1996).

Technology Adoption And Utilization

Computer utilization for learning in society at large is dependent on internal and external factors such as sociocultural (e.g., race, economics) and personological (e.g., teacher attitudes), as well as exposure to cutting-edge technologies (Rogers, 2000):

> Barriers to successful technology adoption appear to have internal and external sources. Internal barriers may be summarized as 'teacher attitude' or 'perceptions' about a technology, in addition to a person's actual

> competency level with any technology. External sources include the availability and accessibility of necessary hardware and software, the presence of technical personnel and institutional support, and a program for staff development and skill building. Barriers that cross internal and external sources are a lack of time and funding and the unique culture of the institution (p. 459).

In particular, external variables, such as the provision of adequate training, may affect the acquisition or the utilization of technology. Similarly, internal factors (e.g., teachers' attitudes) may affect the beginning stages of adopting technology. Rogers (2000) reported that, among the 1000-plus art teachers surveyed, 27.84 percent were in the "familiarization" stage, 66.25 percent were in the "utilization" stage, but only 5.23 percent had fully integrated CAI into their course, while less than one percent (0.68 percent) had moved into a "reorientation" phase. All other things being equal (e.g., external factors/funds), this gap can be remedied as people become more comfortable utilizing the computer technology.

As the beginning stages of computer utilization are minimized, barriers concerning access, availability, and technical support become pronounced (Rogers, 2000). Of the post-secondary schools surveyed, 19 percent stated that funds for technology-related needs were inadequate. In addition to endorsing a sharing of best practices to establish continuity in the system, 17 percent thought that technical support staff was scarce. Moreover, 14 percent called for adequate time to train faculty and staff on new computer technologies (Rogers, 2000). The fact that computers are underutilized at the higher educational level may be due to the fact that faculty are not trained adequately, the funds are insufficient, and multimedia officials are not motivated to reconcile it. Consequently, if teachers are adequately trained and funds are available to acquire new computer technologies, perhaps computer technology would play a significant role in designing curricula and influencing teaching practices.

According to proponents of CAI, the process of exploiting digital technology for educational purposes tends to unfold in stages. Rogers (2000) has articulated a five-step model of technology adoption consisting of (1) familiarization, (2) utilization, (3) integration, (4) reorientation, and (5) evolution (pp. 457-458). Familiarization refers to the initial exposure, whether it be brief or extensive, to a technology. Utilization refers to the process of actually trying the technology. A technology is integrated when it becomes part of the curriculum in delivering or developing instruction. While many public schools and universities currently are familiar with digital technology and have acquired and utilized the requisite hardware and software, they vary greatly in terms of the third stage, integration (and beyond into reorientation and evolution). Reorientation allows the teachers and educational leaders to consider computerized technology as a tool to facilitate enrichment in the learning process. Finally, as organizations adopt computerized technology, they evolve into schools that are able to grow and change as the needs of the students and the learning context change (Rogers, 2000).

Computer Integration Concerns

Although the number of computers in the classroom has increased significantly, the level of technology use expected of educators and the actual use and integration of computers in the classroom is disparate (Fabry & Higgs, 1997). With respect to computer availability, by 1985, over 90 percent of public schools owned at least one microcomputer. From 1995 to 1996, more than 18.1 million computers were installed in U.S. public and private K-12 schools and 4,200 colleges and universities (Fabry & Higgs, 1997). Unfortunately, this computer technology provided to schools quickly became outdated. As Fabry and Higgs (1997) noted:

> While the United States leads the world in the sheer number of instructional computers, half of these computers are 8-bit machines, incapable of supporting CD-Rom sized databases, running complex software, or being networked. The computers in use are predominantly used for lower-order thinking skill activities such as drill or practice (p. 391).

Consistent with the brief account of hardware obsolescence in American public education, Rogers (2000) states that "many schools purchased a computer for every classroom in the late 1980s, but did not provide technical support or staff development opportunities" (p. 467). Many public school districts invested heavily in PC hardware/software in the late 1980s and early 1990s and are now exceedingly reluctant to undertake a second wave of hardware/infrastructure expenditures despite the fact that these outlays are needed to run higher-order CAI software/ courseware, especially in multimedia telecommunications configurations.

The teacher's computer skills, whether they are disproportionate or inadequate, and attitude are central to the utilization and implementation of computers in the learning process (Fabry & Higgs, 1997). Teachers' attitudes may range from being innovators, whereby they remain at the forefront of technology, to laggards who are the last to adopt computerization. Unfortunately, Fabry and Higgs report that only 16 percent of educators have a positive attitude toward computer technology and are innovators or early adopters.

Technology Training, Maintenance And Hidden Costs

While teachers' attitudes toward computerization may be positive, insufficient investment in technology training for both pre- and in-service educators may serve as an external barrier to the full utilization of CAI and its "higher-order" outgrowths. Their ability and willingness to tackle this challenge are variable and biased toward the negative in the absence of adequate technical staff support. As Fabry and Higgs (1997) confirm, in their day-to-day activities, classroom teachers are characteristically on their own in dealing with digital technology: only 6 percent of elementary schools and only 3 percent of secondary schools have full-time, on-site technology coordinators. These authors conclude that, it is impossible to expect teachers to utilize technology efficiently and effectively unless they are given adequate training and resources to learn the intricacies of the technology.

When considering the costs of infusing technology into school curricula, one often underestimates or fails to take into account the costs of maintenance, repair, training, technical staffing, and upgrading or replacing the system. According to Fabry & Higgs (1997), schools spend an estimated $2.7 billion dollars annually on technology. This estimation is grossly insufficient, as the estimated annual cost to maintain computers is $11.8 to $30 billion annually. Therefore, it is inconceivable that funds for computer use in public schools are sufficient to promote effective learning. As a result, in addition to teachers' skills and attitudes towards computerization, the lack of the availability of funds and computer costs limit to technology integration.

The extent to which teachers receive support (e.g., training, administrative) for adopting and implementing computer use into their curricula directly affects their attitudes toward technology. In instances in which teachers do not receive support, they may experience anxiety. Anxiety may stem also from a lack of familiarity with the programs. In this way, the computer literacy of educators represents a part of the challenge that teachers confront when they face the programmatic need to employ computer technology with their students. Whatever its cause, anxiety may cause teachers to resist technological change (Fabry & Higgs,1997).

In order to deal with the potential anxiety caused by the introduction of computers into the curriculum, many believe that a change must take place with respect to the philosophy of teaching. For example, Fabry and Higgs (1997) have asserted:

> To integrate technology into classroom practice in the manner envisioned by ardent proponents, teachers must make two radical changes–not only must they learn how to use the technology, but they must also fundamentally change how they teach. Teachers are being asked to move away from relying on a teacher-centered classroom to a more student-centered classroom. This represents a more difficult transition for teachers than simply using technology (p. 388).

This shift from teacher-centered classroom to a more student-centered classroom may be challenging for some teachers. Under these conditions, some classroom educators are resistant to the inroads of technology into practices with which they have become accustomed.

In addition to their own skill and attitudinal deficits, college-level educators using CAI and, even more pointedly, CAI/multi-media/Internet technology are faced with highly variable and, in some cases, surprisingly low levels of incoming student experience with digital technology, and its modes, tools, and potentialities.

Classifying CAI Applications

Currently, types of CAI modes/applications are varied. Merrill, et al., (1996b) identify seven educational applications of computers in schools: (1) tutor, (2) drill-and-practice, (3) simulations, (4) problem-solving applications, (5) learning games, (6) tool applications, and (7) "tutee" applications (pp. 11-13). Tutorial applications primarily teach new information. Drill-and-practice programs resemble a series of flashcards, which encourage the student to develop memorization skills. Simulators model genuine systems or phenomena. Problem-solving applications allow students to improve their logical reasoning skills by giving them problem situations. Game programs offer interest and motivation to learning by providing a medium for competitive play between a student and opponent(s). The computer becomes an instructional tool, much like a pencil or slide rule, which students utilize in the learning process. Tutee programs allow the computer to become the student, while the student becomes the teacher. In this way, the student must be familiar with ways in which to communicate effectively with the computer (Merrill[2], 1996b). Consequently, the software and educational courseware broadens CAI's scope and range to extend from lower- to higher-order functions.

Just as the modes or methods of CAI have expanded, tools have become varied, numerous, and specialized. Tools are now designed to assume part of the cognitive burden involved in a task. These tools take over many computational and other tedious operations, allowing the student to engage in higher order operation. Tools range from those that entail no knowledge of their own (e.g., word processors) to those that provide an enormous body of knowledge (e.g., databases), from those limited to one field of study to those that have wide applicability (Salomon, 1996).

In an effort to delineate computer/CAI mode responsibilities, in 1980 Robert Taylor presented three-part taxonomy of CAI uses under the rubrics of "tutor," "tool," and "tutee" modes. Within the tutor mode, Taylor placed "any application in which the computer had been programmed to present information to students as an authoritative source–much like the teacher" (Roblyer, 1992, p. 337). The tool mode was comprised of applications having some practical or time-saving value; prime examples are word processing or statistical programs. In the "tutee" modes, the student essentially "taught" the computer by programming it. Robert Taylor's framework attempted to clarify the roles, not only for the computer, but also for the users in an attempt to simplify this dynamic process (Roblyer, 1992).

As computer tools become capable of performing higher-order functions, new educational opportunities become possible. In this way, students are more independent in becoming responsible for their own learning. In addition, most of the learning is exploratory rather than instructive. Team collaboration is encouraged and teachers, once considered the sole sources of knowledge, become conductors and guides of such learning activities (Solomon, 1996).

Change in the Learning Environment

As students become responsible for their own learning, their self-image is affected positively. Levine and Donista-Schmidt (1997) propose a model which suggests that computer experiences affect the learner's self confidence, as well as their computer-related attitudes. Data from Levine & Donista-Schmidt's survey of 309 students, 7^{th} to 12^{th}-grade, report that computer confidence had a negative effect on commitment to learning. The authors caution that these results are the opposite of what they expected (Levine & Donista-Schmidt, 1997, p. 83). The authors reconcile their results with their hypotheses by stating that, "the negative effect that computer confidence has on commitment to learning suggest that the less computer-related self-confidence there is, the more commitment students possess to learning computers" (p. 97). Christensen and Tolman (1996) add that attitude extremes of computer users are not as prevalent today as they were in the earlier stages of computer learning (p. 7).

Rocheleau (1995) identified another pattern of computer use based on student profile. The author found that heavier computer use and grade superiority occur in students with high socioeconomic status (SES). Moreover, the author cautions that the heavier computer use trend declines as the students move from 7th grade to high school. In addition, until 1992, males were more likely to be heavier users; however, the gap narrowed post-1992. Rocheleau concludes that computer ownership and parental interest in their children utilizing computers has the biggest impact on the tendency of a particular student to become a heavy user (Rocheleau, 1995, p. 1).

CAI Studies

Although researchers have analyzed the effects of CAI on a wide range of outcome variables, the lion's share of the empirical literature on CAI has focused either upon or included correlations between the use of computers as an instructional medium and various measures of student academic achievement. Within this body of research, several studies have sought to compare the performance of students using computer technology to learn specific bodies of content and/or academically-relevant skills, with the performance of control groups relying upon conventional instructional media to absorb similar or identical lessons.

Methodologies Used in CAI Research

As Roblyer, Castine and King (1988) apprise us, reviews of CAI efficacy studies have taken one of three forms; traditional, "box vote" and meta-analyses. The first of these is that of the "traditional" informal assessment consisting of narrative summaries devoid of hard quantitative results. The second approach is designated by Roblyer, et al., as the "box vote" method. The procedure for composing reviews through the "box vote" format basically entails gathering original studies on the subject of CAI efficacy, subjecting them to exclusionary criteria of varying stringency, and then simply counting the number of articles reporting differences in academic achievement (and/or other educational outcome variables) between experimental (CAI) and control (non-CAI) groups for comparison with the number of articles finding no statistically significant differences, yielding an arithmetical "vote." The "box vote" method stood as the principal alternative to narrative reviews prior to the mid-1970s and is still in widespread usage, although most often as a supplement to meta-analyses.

Since the late 1970s, the technique of meta-analysis has come into vogue as a means of synthesizing original data and results from multiple CAI efficacy studies. As described by Roblyer, Castine and King:

> The rationale behind meta-analysis is a simple one: to subtract the impact of the control of traditional method from that of the experimental method or the one under study and thus estimate the impact the new method would have over and above the old one. This estimate, known as the 'effect size,' is usually calculated by subtracting the mean score achieved by the non-treatment group from that achieved by the group of the treatment under study. (p. 18)

In application to CAI efficacy, the treatment group would be comprised of students using computers to learn lesson content or academically relevant skills, with the "non-treatment" group consisting of students taught the same content/skills via traditional instructional media (e.g., teacher lecture). Roblyer, et al., (1988) continue on to tell us that the "effect size" is reported in terms of standard deviations such that a .25 standard deviation, for instance, "can be interpreted to mean that using the computer method results in average performance at about the 60th percentile, while students in the non-computer group achieve on the average at about the 50th percentile" (p. 18).

Research methodologies vary according to the circumstances under which they are employed and are vulnerable to critique. The "box count/vote" approach is simplistic and fails to overcome differences in the designs and methodologies of the studies counted. Meta-analytical techniques are more sophisticated, but their very complexity calls into question the validity of adjustments made to data reported in primary studies. In addition, the assumptions governing the criteria used to determine whether a particular study will be included in the analysis or discarded from the final synthesis is questioned. In light of the amount of potentially relevant original research studies now in print, scholars virtually are compelled to rely upon review articles, but each of the three generic formats for these analytical surveys compounds the ambiguities existing within the primary data bases of primary field investigations, (Roblyer, 1988).

Meta Analytical Studies

CAI efficacy research upon which such reviews have been based represent study design or methodological defects that undermine the validity and reliability of their results, findings, and conclusions. In this context, we turn to a challenging and controversial essay on confounding in educational computing research put forth by Richard Clark in 1985 (pp.137-148). Here Clark argued that most of the (generally positive) CAI efficacy research conducted to date had failed to control for the confounding influence of extraneous variables and was, as a consequence, defective in construct validity. Clark (1985) articulated the core of this critical judgment in a passage that reads:

> It appears that the vast majority of published educational computing studies show sizeable learning and performance gains from CBI (computer-base instruction) and computer attribute theory variables. These gains averaged approximately .5 standard deviations on final examinations over more conventional instructional alternatives. However, this learning

> gain cannot be unambiguously attributed to "computers," CBI or computer attributes. There is compelling evidence that much of the educational computing literature lacks construct validity. Studies are often vulnerable to rival hypotheses that learning gains resulted from different instructional methods, content, or from student enthusiasm for a novel medium, not from the computer *per se* (p. 146).

In some cases, Clark (1985) observed, CAI efficacy experimental (computer) and control (non-computer) study groups were actually taught by different teachers. In others, the content of computer-assisted course materials was so radically different from that of lessons delivered to control groups that seemingly significant gains from CAI usage might be attributable to variations in curricular content as opposed to the supposed superiority of computers as educational media.

In addition, Clark (1985) wrote, since there is an established relationship between the introduction of experimental interventions and subject interest, the superior performance of CAI student groups relative to controls might be a mere artifact of novelty, i.e., a variation on the Hawthorne Effect. In individual (e.g., Grabe, 1984) and evaluation review (Niemiec & Walberg, 1996) studies, one or more of these limitations upon the validity of study results are explicitly acknowledged. Moreover, we note that when Roblyer, Castine and King (1988) conducted an exhaustive search of published CAI efficacy studies in 1988, they located several hundred investigations published between 1980 and 1987.

> Nevertheless, their meta-analysis encompassed data from only thirty-eight journal studies and forty-four graduate dissertations, the remainder having been excluded due to study flaws and lack of data," so that "only a fraction of the total number of research reports could be used (p. 119).

In an effort to analyze the learning effect of CAI, Fletcher-Flinn and Gravatt (1995) conducted a meta-analysis of relevant literature published between 1987 and 1992 (p. 219). Of the 120 studies reviewed, the authors categorized the features (e.g., course content, educational level, and publication year, duration of treatment, teacher effects, CAI type, subject assignment, comparison group instruction, and retention) from each study in order to assess the effects of computer technology on the overall effectiveness of learning . Fletcher-Flinn and Gravatt found that CAI students outperformed those from conventional classes 60% of the time. In fact, their meta-analysis revealed consistently that CAI students had a distinct advantage over those who received traditional instruction in adult training, higher education, and secondary school settings. In elementary school, the effect was somewhat larger. In addition, CAI materials were found to be flexible and suitable over a broad spectrum of subjects, educational levels, and situations. Fletcher-Flinn and Gravatt (1995) concluded that, "this study is similar to past reviews in showing a learning advantage for CAI, but we contend like Clark that this gain in proficiency is an artifact of poor research design and comes about because of the superior quality of CAI materials, rather than as some intrinsic aspect of computers per se as vehicles of instruction" (Fletcher-Flinn, 1995, p. 231).

In recognition that the educational effects vary by student background characteristics, Christmann, Lucking, and Badgett (1997) performed a meta-analytical review of research studies on the influence of CAI upon the academic achievement of high school students. They divided their research base among studies that utilized samples drawn respectively from urban, suburban, and rural school systems. It is noteworthy that, in contrast to many past meta-analytical evaluations of CAI, the studies included in Christmann, et al.'s, review were carried out with PCs and PC-based software, rather than with mainframes using older software. From the total of 28 studies included in Christmann, et al., (1997) sample, they reported that the overall effect size was such that "a student exposed to CAI attains academic achievement that is greater than that achieved by 56.7 percent of those students exclusively exposed to traditional instruction" (p. 33). In other words, CAI appears to move the students in the meta-review's studies from the 50th percentile to the 56.7th percentile. This was a relatively modest global result when compared to greater gains suggested in earlier meta-analytical reviews. As for their particular point of interest, Christmann, et al., found some variation, as urban students benefited the most from exposure to CAI followed by suburban and rural students. The differences among the groups were comparatively small and barely reached statistical significance (Christmann, 1997).

Many CAI investigations have sought to compare the efficacy of computer-based instruction in one disciplinary area, such as mathematics, with its efficacy in another subject area, such as reading. Fletcher-Flinn and Gravatt (1995) reported that, on the whole, CAI was more effective in teaching mathematics and science than in teaching reading and writing. In their estimation:

> It may be that either the teaching of reading and writing is more dependent on direct teacher interaction or, alternatively, the experience of reading and writing is equivalent across contexts (i.e., books and paper-and-pencil versus computer materials), with both providing sufficient practice or skill enhancement exercises (p. 231).

More recently, Gail Ryser, James E. Beeler and Carol McKenzie (1995) investigated the effects of student immersion in a Computer-Supported Intentional Learning Environment (CSILE), described as a "constructivist learning environment" that featured a cooperative learning approach. According to Ryser, et al., after one year the study's CSLIE group "had a higher level of self-regard, improved ability to regulate their behavior, and an increased ability to make credible judgments about someone else's assertions than did the control group" (p. 375). Ryser, et al., reported that the CSILE had attained its protocol objective by enhancing the development of students' critical thinking skills.

Current Directions In Evaluation And Assessment Of CAI

In light of the ambiguous results obtained from quantitatively oriented studies of CAI over the past three decades, many "strong media effect" proponents are now advocating a fundamental revision in both the interpretation of past findings and the research approach for evaluating the impact of digital technology on learner and learner related variables. In terms of the former, the last five years have witnessed a turnabout in CAI efficacy study criticism. Over fifteen years ago, Richard Clark (1985) led the charge against poorly designed CAI research that reported positive advantages for computer-based media that, in many instances, may have reflected the influence of confounding factors. Currently, however, CAI supporters are asserting that the "modest" achievement gains reported in the CAI literature actually *understate* the potential value of using computers as an educational technology. John Schachter and Cheryl Fagnano (1999), however, note that CAI efficacy research generally shows only a modest improvement in learning. When courses and teaching approaches are designed and used according to "sound learning theory and pedagogy," that is a student-centered, constructivist approach (possibly including a cooperative learning dimension) these positive effects are much greater. Consequently, in order to increase the potential value of CAI digital technology, advocates contend that pre-service educators be prepared for their classroom roles through exposure to "constructivist" teaching principles.

Similarly, Marra and Carr-Chelman (1999) worked with a group of 28, pre-service, secondary school teachers and guided them toward "constructivist" uses of CAI (e.g., higher-order functions beyond drill/tutorial/simulation). Marra and Carr-Chellman designed the study such that students, after completing certain tasks which modeled the constructive uses of technology, expressed their views on how to use technology in their own career based upon their current experience with technology in essays. At the conclusion of this endeavor, virtually all of the subjects in the study held much more positive opinions about the value of computers in the classroom. Therefore, Marra and Carr-Chelman's conclusions are congruous with those reported by Schachter and Fagnano (1999).

Researchers who are proponents of the "strong effect" maintain that, in many classrooms, computer technology is constrained to the original "Big Three" modes of CAI, with a very heavy (if not exclusive) emphasis on drill-and-practice. According to a survey of computer use in 4th and 8th grade public school classes, learning games and drill-and-practice predominate over computer simulations and the introduction of new topics. This is inconsistent with Fletcher-Flinn and Gravatt's (1995) meta-analysis, which found CAI may well be an effective instrument for drill-and-practice functions. With the advent of the PC, multimedia technology, and the Internet, CAI may be even more effective and valuable as a means of introducing new topics and enhancing both student cognitive and social skills.

In examining the research on the educational effect of student exposure to hypertext environments such as the World Wide Web (WWW), Sigmar-Olaf Tergan (1997) reported that, due to shortcomings in the design and methodology of these studies, "the potential of hypertext/hypermedia for enhancing learning may have been underestimated" (p. 209). He elaborated on this point:

> In most research approaches hypertext/hypermedia systems have been studied as stand-alone systems. As research has revealed, computer-based systems for learning are most effective when they are embedded in a larger educational background. Hence possible potentials for enhancing learning may not have been fully used (p. 226).

Following a "re-analysis" of research data on the educational effects of hypertext/hypermedia, Tergan stated "that a significant improvement in the effectiveness of the course has already been attained by introducing a new instructional concept putting emphasis on active and cooperative involvement of the student in the process of goal attainment" (p. 227). In the future, perhaps the modest gains for CAI reported in the research literature will be interpreted within a framework that acknowledges constraints on these effects.

A second direction in CAI research pivots upon criticism of the quantitative criteria used to evaluate "achievement" among students in experimental study groups. On this front, Salomon (1996) has asserted:

> The method of pretest and posttest studies, which is based on a standard mode of usage and is limited to a narrow range of outcomes, may not be the most appropriate (approach to the study of computer-afford communications in teaching). For one thing, embedding learning in a communicative-intensive social context may affect cognitions, motivations, self-concepts, attitudes, and the qualitative nature of interactions, which far transcend the traditional measures of achievement. For another, the conception and measurement of achievement itself may need revision in light of the shift from students as scientific knowledge receptors to students as science makers (p. 899).

Salomon is but one of several strong media effect scholars who have criticized the manner in which CAI research has been carried out to date. Criticism of CAI studies that measure learning outcomes solely by standardized tests, and thereby fails to measure what the computers have actually taught are becoming increasingly prevalent. (See Kirkpatrick and Cuban, 1998).

As Russell and Haney (2000) have recently argued,

> Nearly all instruments used in standardized testing situations to compare students having various levels and types of computer experience are composed of paper-and-pencil tasks that exclude the very same computer resources and tools by which students with computing expertise might be able to demonstrate their greater competencies to do academic work (p. 4).

A similar point has been made by James Pellegrino, Gail Baxter and Robert Glaser (1999) who maintain that in past investigations of CAI's impact on student achievement "important aspects of cognition and learning such as conceptual understanding, reasoning and complex problem solving were often [somewhat] ignored" (p. 320), because they were more difficult to implement in the context of standardized assessments of achievement. CAI evaluations have concentrated on measuring academic achievement in terms of standardized test scores that reflect learner retention of curricular content. The tendency is for teachers to confine CAI to instructional modes that further content recall, e.g., drill and practice, over deeper learning through computer-assisted means, e.g., problem-solving, brain-storming and the like.

As Charles Crook (1994) explained, "we must go beyond input-output designs that characterize much research in the area (of CAI learning effects). The reason this is inadequate is because any such computer experience is more or less situated in some broader framework of teaching activity" (p. 9). According to Crook (1994), "the real impact of learning through this technology may need to be measured with attention toward how it is assimilated into the surrounding frame of educational activity" (p. 9). Similarly, Doug Johnson (2001) has recently written:

> The product of such instruction is not a neatly quantifiable score on an objective, nationally normed scored test. Conducting and assessing such projects requires the ability to develop and apply standards, delay for long periods of time the satisfaction of task completion, and acknowledgement and acceptance that conclusions, evaluations, and meanings which result from the efforts are often ambiguous (p. 175).

At present, then, there is widespread dissatisfaction among strong media effect scholars with a CAI efficacy data-base that is comprised primarily of quantitative findings derived from standardized test scores that measure only one, relatively narrow, dimension of CAI's true value as an educational technology. It seems that there is a call for the assessment of CAI according to multiple criteria. Thus, toward the conclusion of their 1995 meta-analysis, Fletcher-Flinn and Gravatt wrote: "It is concluded that educational approaches should be judged by a number of criteria including achievement gains and when this is done, CAI may far surpass other forms of instruction" (1995, p. 219). In additional to academic achievement gains measured through comparisons on standardized tests and/or via a pre-test/post-test experimental design, Fletcher-Flinn and Gravatt (1995) tell us:

> Other advantages, such as time savings for students as well as teachers, cost effectiveness, the presentation of realistic problems requiring interactive hypothetical-deductive reasoning, immediate feedback and self-evaluation, opportunities for collaborative learning in small groups, and ease of teacher monitoring and control are equally valid measures of any instructional program (p. 232).

Beyond this, CAI may well have important indirect effects on student learning through its influence on psychological variables. In this context, the authors note that longitudinal studies of Integrated Learning Systems (ILS) have found positive effects for student self-concept, attitudes toward computers, attitudes toward learning and school climate/culture as a consequence of the introduction and extended use of advanced computer technology. In his investigation of the Apple Classrooms of Tomorrow project (ACOT), Tierney (1996) found that immersion in a digital classroom has a profound and positive impact upon how students see themselves as learners and as community members. Tierney (1996) commented that the ACOT project students have integrated technology into their everyday lives. Technology is essentially what these students are about, individually, and in an educational and cultural sense. Pellegrino, Baxter, and Glaser (1999) noted that cognition and achievement were often absent in the traditional classroom setting, since such aspects of these components; i.e., conceptual understanding, reasoning and complex problem solving, were too difficult to implement in standardized assessments of achievements.

Because CAI evaluations have concentrated on measuring academic achievement in terms of standardized test scores that reflect learner retention of curricular content, the tendency is for teachers to confine CAI to instructional modes that further content recall (e.g., drill-and- practice over deeper learning through computer-assisted means, problem-solving, brain-storming, and the like). CAI has been assessed according to multiple criteria. In this way, Fletcher-Flinn and Gravatt (1995) wrote: "It is concluded that educational approaches should be judged by a number of criteria including achievement gains and when this is done, CAI may far surpass other forms of instruction" (p. 219). In addition to academic achievement gains measured through comparisons on standardized tests and/or via a pre-test/post-test experimental design, Fletcher-Flinn and Gravatt (1995) tell us:

> Other advantages, such as time savings for students as well as teachers, cost effectiveness, the presentation of realistic problems requiring interactive hypothetical-deductive reasoning, immediate feedback and self-evaluation, opportunities for collaborative learning in small groups, and ease of teacher monitoring and control are equally valid measures of any instructional program (p.232).

In addition to being evaluated according to multiple criteria, CAI may well have important indirect effects on student learning through its influence on psychological variables. Longitudinal studies of (ILS)s have found positive effects for student self-concept, attitudes toward computers, and attitudes toward learning and school climate/culture as a consequence of the introduction and extended use of advanced computer technology. Fletcher-Flinn and Gravatt (1995) conclude that, when considering multiple criteria for evaluating student learning, CAI may surpass traditional methods of instruction.

Conclusion

Since the "PC revolution" of the 1980s, the use of computer-based technology as an educational medium has increased at a phenomenal rate. If anything, the advent of the World Wide Web and the Internet in the 1990s has accelerated the penetration of digital technology into American classrooms and college campuses. Given the investment that educational institutions have placed in what has traditionally been referred to as computer-assisted instruction or CAI, it is by no means surprising to find that a substantial amount of evaluation studies have been conducted for the purpose of determining the effects of computers on student learning. The vast majority of these CAI efficacy studies have sought to assess the effects of computer educational technology by comparing standardized test scores of "experimental" (i.e., CAI) and "control" (non-CAI) groups (Roblyer, Castine & King, 1988).

In 1988, M.D. Roblyer and his colleagues (Roblyer, et al., 1988) noted that despite the accumulation of a massive body of research data on CAI, the impact of computer applications on student achievement "remains largely an unknown quantity" (p. 12). Most of the studies included in Roblyer, et al.'s, (1988) review were conducted with students connected to mainframe, as opposed to micro- or personal computers. Nevertheless, even as the results of studies on PCs have come to dominate the research literature, we still do not have a conclusive assessment of how well CAI works in comparison with conventional instruction (Roblyer et al., 1988). As Heather Kirkpatrick and Larry Cuban (1998) have stated: "Over the past 30 years, studies of classroom use of computers have found evidence of moderate effectiveness when it comes to the academic performance of the students who use them. They also have found evidence of minimum effectiveness, and of no effectiveness at all." As Dan Carnevale (2000) has recently put it, "cyberspace...is still a vacuum when it comes to reliable information with which to evaluate online courses" (p.9)

As the survey of the literature encompassed in this chapter reveals, the possible value of CAI has been exaggerated by the evolution of the technology, and yet significant obstructions remain hindering its full utilization (Blanchard, 1999). Quantitative studies based on standardized test scores are now the subject of criticism from scholars who maintain that these evaluations cannot capture qualitative aspects of CAI's effects upon students. For computer-assisted instruction to reach its potential, supporters argue, both educational practices and educational evaluation must undergo an enormous transformation.

It appears that there is an unfulfilled and urgent need to assess the effects of instruction through computer-based media in a manner that captures the qualitative dimension of student learning experience. Such research necessarily must solicit the opinions of end users (e.g., students) about the perceived absolute and relative advantages and disadvantages of digital technology use in the courses to which they have been exposed. Qualitatively, numerous scholars have solicited feedback from students about their "online" course experience. It is as an addition to this growing body of qualitative research that the present study has been designed.

CHAPTER III: METHODOLOGY

Research Approach and Rationale

This chapter describes the case study research design methodology and procedures used in this study. The first section identifies the purpose of this research; this is followed by an explanation of the research design methodology to be used for this case study, a description of participants, procedures for data gathering, procedures for data analysis and strategies used to establish trustworthiness.

Qualitative data provides the investigator with ways to interpret intricate interrelationships within the specific case under study. Emerging from the investigator's personal involvement and interpretations, the research strives to understand the specifics of the phenomenon (Stake, 1995). Understanding of the students' experiences during the food-purchasing course comes from examining the unique nature of the students, teacher, and course within a real-life context (Yin, 1994).

The Purpose Of This Study

The purpose of this case study is to explore the students' experiences utilizing Computer Assisted Instruction (CAI), in a food purchasing course. The purpose of this study is to use archival data to explore "students' experiences" of CAI when teaching a Web-based food purchasing course. The focus of the research is to ascertain the students' perceptions relating to strengths and weaknesses of computer-assisted instruction, and their suggestions, if any, as to what improvements may be possible.

Research Questions

The focus of this qualitative case study is to examine the Grand Tour question:

What is the students' experience of Computer Assisted Instruction?

The following Sub Questions were; a) What do the students' perceive as the strengths of CAI? b) What do the students' perceive as the weaknesses of CAI? and c) What ideas for improvement to CAI do they have?

Explanation Of The Research Design Methodology

This case study is designed to be consistent with the assumptions of the qualitative paradigm, a paradigm that is known for its inductive and emergent analysis process (Creswell, 1998). A qualitative case study design was selected for this research. The case study methodology includes the process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting (Creswell, 1994). The case study methodology will be used because the researcher is exploring a phenomenon (the case) bounded by time and activities and has collected detailed information using a variety of data collection procedures during a sustained period of time (Merriam, 1988; Yin, 1989).

Participants

The participants were graduate and undergraduate students from a quantity food-purchasing course, at a western U.S. university. The researcher had just finished placing the course on-line and asked students to participate in this research. The researcher selected this case so as to maximize what can be learned in the period of time available for the study. There were 40 students in the course, 18 males and 22 females; ages ranged from 20 to 36 years old.

Data Collection Instruments And Procedures

This section presents a brief description of the procedures used to collect information for this case study using the following qualitative data collection instruments: open-ended pre-questionnaire, mid-term peer evaluation, open-ended post questionnaire, and post personal student interviews. (For a detailed account of the description of the case, data collection procedures, and informed consent for participation in this research project, please see Appendix A).

During the semester, participants were asked for their course feedback, regarding their experiences in the food-purchasing course. A goal of qualitative research is to ensure that researcher and participant concur on the description of the events of the study. In this case, all on-line data collected was automatically downloaded from the course emails or tape-recorded, verbatim accounts. This information was then archived, for later analysis.

Student Pre-questionnaire

When administering the Pre-questionnaire, the participants were completing an on-line questionnaire of questions, and there was no direct participation with the researcher. Appendix B is a copy of the questionnaire that contained six open-ended questions that were emailed to all participants in the study. Students were instructed to send their responses to the password protected email account and handled as described in Appendix A. This is considered Archival Data Source One.

Mid-term Peer Evaluation

Research exposure during the mid-term peer evaluation was limited, as questions were submitted by a third party for discussion, and the subsequent exchange of comments was not discussed with the researcher. Appendix C is a copy of the questionnaire, which the facilitator created choosing six questions for participants to answer and return during the session. The written student responses were recorded on a "Student Course Survey" form used for this evaluation. Then the hard copies were collected by the facilitator to protect the documents for subsequent data analysis. Appendix C also contains the Step-By-Step procedure for the mid-term peer evaluation. This is considered Archival Data Source Two.

Student Post - questionnaire

When administering the post-questionnaire, the participants were completing an on-line questionnaire of questions, and there was no direct participation with the researcher. Appendix D is a copy of the questionnaire that was six open-ended questions that were emailed to all participants in the study. As in the pre-questionnaire, students were instructed to send their responses to the password protected email account and handled as described in Appendix A. This is considered Archival Data Source Three.

Post- Personal Student Interviews

Personal student interviews in the final phase involved direct interaction with third party interviewers; this approach was necessary to ensure the topics raised in the previous information gathering sessions were complete and fully addressed. Appendix D is a copy of the interviewers form asking nine open-ended questions; however, some participants answered more when probed by the interviewer. This is considered Archival Data Source Four.

Archival Data Analysis Procedure

A case study is a research strategy comprised of the logic of the design, which includes specific approaches to data collection and data analysis. (Yin, 1994). As mentioned earlier, this data has already been collected. This case study analyzes that archival data. The researcher used the process of constant comparative analysis, looking at open coding, which induced categories to help understand information relevant to the research questions. Each taped interview has been transcribed. Each document has been encoded using the "open-coding" method (Glaser, 1987; Strauss, 1987; Strauss & Corbin, 1990).

Level I - Coding

The "open-coding" process, or Level I coding (Hutchinson, 1988) produces concepts (codes) that fit the data (Strauss, 1987). Particular attention is paid to data that could generate concepts that relate to "conditions, interactions among actors, strategies and tactics, and consequences" (pp. 27-28) of interest to the research questions.Source One data files were entered into Hyper-Research software to begin the coding procedure. The process began by converting Source One data to first level open codes. Then using the open codes produced from Source One, the researcher continued coding Source Two, Source Three, and Source Four. Each source as it was being coded produced more open codes, which were included when the next data source was coded. When all sources were coded, the process was checked. While repeating the process, some codes were changed to better identify their characteristics.

Level II - Category Development

Each of the concepts generated by open codes were examined to find relationships and to elevate (inductively) the open codes to more abstract levels, or "Level II" codes, (Hutchinson, 1988). Categories were created from the open codes, some categories were then broken down into sub-categories, while a few other categories were collapsed into one category. Then, the data was synthesized for each category and subcategory.

Level III – Theme Construction

The concepts and relationships produced by the Level II coding were analyzed across all participants and important classification variables for the purpose of finding the major constructs/themes "Level III" (Hutchinson, 1988) that will allow the data to speak to the major research questions of the study. This step-by-step process was guided by the process of constant comparative method (Hutchinson, 1988). The purpose of this method is to constantly compare concepts with concepts and themes with themes to produce the similarities and differences that can lead to an understanding of this data. The constant comparative method is designed to produce a conceptualization among all three levels of coding, "weaving the fractured data back together again" (Glazer, 1978, p. 116).

Trustworthiness (Reliability & Validity)

To ensure trustworthiness in this qualitative case study, the researcher did the following. There were prolonged and varied field experiences. The researcher analyzed a class in its natural setting and studied it for the entire semester. In qualitative research, triangulation is one of the more preferred ways in which to establish trustworthiness. There were a variety of data collection methods: open-ended questionnaires, personal interviews, using multiple data collectors in the interview process, and a third persons'

Mid-term peer evaluation. The researcher will look at the research question from at least several different perspectives. There was a varied time series for data collection. The data was collected over four different times throughout the semester. An audit trail was maintained. A researcher can go from the interview to codes to the analysis. The original data was kept through all of the data collection stages.

CHAPTER IV - RESULTS

The following chapter describes the results of this research. The main purpose of this research study is to examine the students experience of Computer Assisted Instruction (CAI) in an educational class structure. This was accomplished by analyzing the multiple sources of data that collectively reflect the student experience of technology in the classroom. While each data source mentioned was analyzed individually at first, it is the collective effect of the data that assisted the researcher to make sense of this holistic experience.

This research dissected the archived data, then analyzed the overall purpose of the study, to examine *the students' experience of Computer Assisted Instruction.* By capturing the natural setting of everyday course events, and by uncovering student experiences about teaching and learning, a view of the implementation of an alternative modality of teaching emerged. This chapter presents the dynamics of the findings of this study with a focus on examining the students' experience of Computer Assisted Instruction. These findings relate to the Grand Tour question that was stated earlier:

What is the students' experience of Computer Assisted Instruction?

Sub-questions narrow the focus of this study, and were used as key questions during the data gathering process (Creswell, 1994). The following sub-questions were:

a) What do the students perceive as the strengths of CAI? b) What do the students perceive as the weaknesses of CAI? and, c) What ideas for improvement to CAI do they have?

From this research, the following three themes have emerged: Course Design, Instructor and the Technology. These themes appear as an intricate part of perceived success when creating and administering a CAI course. The synergy among all three of these themes, D + I + T, is an interactive dynamic.

The following sections present the qualitative findings about student experience of Computer Assisted Instruction. All results are from participant responses to the questions asked during this case study. The findings appeared under three major dynamic themes: course design, i.e., feedback about the structure of the course; technology, i.e., feedback about the hardware, software and the Web site used for the course; and instructor, i.e., feedback about the course instructor. Each of these themes is further broken down into categories relating to that component, and information about each included whatever positive feedback, negative feedback, and improvements in the form of participants' responses made regarding their CAI experience. Also noted is any integration of the three themes within each category.

Course Design Flexibility

Students provided their impressions of what they liked about the course design. As it turned out, the flexibility of the course design was the aspect that they found most appealing. The course design allowed them to work at their own pace and at their own hours, so they could structure the coursework around other obligations. Working students and those who were parents found this flexibility especially beneficial. Students commented positively on aspects of flexibility, including convenience, challenge, and a variety of communication methods, e.g., face-to-face versus CAI interaction, assessments, learning activities and a course orientation.

Convenient

In general, students liked the course design, because they perceived that it was convenient to them. It was self-explanatory, relaxed and presented in a way that was easy to understand. It worked with their schedules, and gave them the freedom to do the work at their own rate. Several praised the course's accessibility. They could access the course from anywhere that had Internet access connection. They could listen to the course lectures on a CD ROM. This helped them complete their work and was conducive for learning. Their comments showed that they took advantage of whichever methods of accessing the course were most convenient for each of them. Students who commented on this positive aspect of the course mentioned liking to do their coursework at home. They also commented on the convenience of having the choice between accessing the lectures via modem from home or listening to the CD ROM instead. Many of their comments addressed the convergence of being able to tailor their time spent on the lecture and assignments to individual schedules; this allowed them to utilize their time more efficiently. Others mentioned how the ease of determining their own schedules affected their stress levels; they could fit in the work when it was best for them. Since students could choose to listen to lectures and do their work when they were most alert and prepared, many felt that they got more out of the time they spent on their work. The students ability to learn on their own time facilitated their independence and motivation. Several students mentioned that they liked having the control to complete coursework at their own rates. They seemed to enjoy this responsibility and learn more, moving ahead only when they felt comfortable with the material they had already covered. Combined, these various convenience aspects of the course gave the students a refreshing sense of freedom. In general, their comments showed that they felt very positively about the freedom they gained from completing coursework where they chose, when they chose, and at their own pace.

> The best part about the course? Convenience...because sometimes if you can't make it to class you can do your studying either at home or wherever.
>
> I commute from Denver every day, and it's nice that I can do it on-line. I've been able to do it from my job when I've had time, and this weekend I can with my computer at home.
>
> The opportunity to do it at your own time and place allows you the ability to focus where maybe in class, a that moment, if it's Monday-Wednesday-Friday at 9:00 you may be there or maybe you're not in terms of your focus.
>
> I can look at things at home and take as much time as I need.
>
> No concerns—makes my school life less stressful because I have more Time! Best is being able to do my work when I want.
>
> Freedom is the most positive aspect of this course.

Challenging

Students found this course design different than their other courses, and they generally responded positively to the challenge of mastering the technology and self-paced learning. In addition to learning the course material, they had to learn how to work with a software program and all of its features. While this structure in some cases initially intimidated students, they seemed to enjoy accomplishing something new. They also responded with increased motivation to the increased self-responsibility over what they were used to with traditional course design.

> I must admit then it has been a challenge. It allows students to challenge themselves in a completely new environment.

> This is the first time I have used a site like this.... I have never responded to anything like this, it's very different.

> Not only did it challenge me...it helped me in my computer skills... It just made me more aware of computers.

> Like it's really nice that...I still know the teacher and you still have that presence but it's more like you're teaching yourself. I liked the whole atmosphere of the whole thing.

> I mean we're all grown-ups so if we don't want to do [the coursework] that's our own problem. It's right there for us to do it.

Variety of Communication Methods

Students also liked the fact that the course design included a variety of ways for them to communicate and gave them a new model for how to learn by use of these communication options. Because of the nature of the course, they had a number of ways to communicate with the instructor, who was available to them both in person and via email and phone. Similarly, students had options for how to communicate with one another. They could go to class at the scheduled times and work with other students who had chosen to come in person. However, they could also use the computer to communicate with each other via email and other on-line features at any time. Or, if they chose, they could call each other. In general, they saw this setup as a nice change and a pleasant experience leading to a different learning style. They found the course much different than their other courses because of their increased use of computers for learning and communication. They found this challenging and fun.

> We all have our own email accounts and phone numbers so if there's any questions, I still have interaction with all the people in the class.

> I wouldn't change anything. When you have something good, stick with it. So far in this class, I have enjoyed the opportunity to try something new and different for me.
>
> I have picked up a lot of stuff. At the beginning, I was like am I ever going to learn all of this stuff. But I really have. It's been helpful. The class has really been fun and easy and I've been telling everybody that you have to take it.

Face - to - Face Versus CAI Interaction

The students had mixed reactions to this portion of the course design. They commented on lecture content, duration, and presentation. Students generally felt that the instructor was available and responsive to their needs and questions. They took advantage of the various ways that they could interact with him and seemed satisfied with his responses.

> The professor was there at the actual time of the class. Any time I've ever had a problem, I'd call him and he would call me right back. Or if I emailed him, he would answer right back.
>
> It's more interactive. You can see it, you can hear it, and you're playing with the keyboard, so it covers everything. I mean so there is still interaction [but] it just the whole time is all on your personal schedule.
>
> If anything, I had more interaction using computers than I had to sit and listen to the professor lecture.

Yet some students gave some negative feedback, as well. In some cases, they missed the traditional classroom model. They felt that the course emphasized the required material more than the interpersonal interaction with the instructor that more traditional courses would have. In this way, they felt that the absence of an instructor detracted from the overall experience of being in a traditional classroom setting. They missed having an instructor stand at the front of the classroom and deliver a lecture in person, complete with eye contact, stories and jokes. Some students expressed the opinion that this dynamic interaction with the professor at the front of the classroom is what distinguishes a university course from non-academic learning experiences. Some students missed the degree of interaction with one another that a more traditional classroom model usually includes. They stressed that this lack of depth of interaction inhibited personal communication skills development and detracted from the personal experience gained in a classroom environment. They craved the ability to interact more with one another and with the instructor in person and believed that this higher level of personal interaction is how they would communicate in the workplace. Additionally, they gave some negative feedback about the lecture's narration and quality. Some students felt that the lectures were too long and repetitive, while another thought that they lacked adequate industry application.

> I miss a teacher in front of the room, cracking jokes or telling stories.
>
> I do like going to classes and having an instructor, because it makes it that much more personal. It was comfortable with the computer, but at the same time, I liked being able to see the instructor in class.
>
> College is absorbing the...knowledge of the professor. I could just get a library card and teach myself the basics of psychology but with my professors I can learn what they have learned IN the classroom.
>
> I would like to see more [industry] application of what is learned.
>
> Being in the Dietetics and Fitness Nutrition concentrations of this major, I will have to interact with people on a personal basis rather than emailing everyone that asks for help.
>
> Computer narration quality and content could be better. This would avoid some of the annoyances of listening.
>
> Audio portion is helpful but too long.

Assessments: Learning Activities

The learning activities for this course included homework assignments, quizzes and tests. Students appreciated the practical, interactive assignments, such as case studies and simulations. They also liked the variety in homework assignments and the way that certain assignments encouraged them to express their personal opinions and based on their own previous work and life experiences. They felt that the quizzes helped them focus on what information would be on the tests, identify areas where they needed to concentrate, and identify what information was most important to retain. Most students felt that the testing procedures were straightforward and covered only information presented in the course without any surprises. This straightforward content combined well with self-paced tests, thus alleviating most stress involved in testing.

> Reading the case study was good because we were able to express our opinions and use what we already know from working and other classes.
>
> The articles make the information more relevant to everyday things in the industry.
>
> I feel that the quizzes help to gauge what you do and don't know. In other words, they "show" you what you still need to concentrate on.
>
> I print out everything first and then I go back and do the lecture and then take the quiz. If I get something [is] wrong on the quiz, I'll go back and retake it, and write down the correct answers on my quiz, so that I have something to study from. So it's like direct facts not like you have to look for all the facts yourself. You get to study the facts and then take the tests.
>
> The best thing would be the tests. Because you have an outline before you go in and take the test and it's over everything you've learned. The outline goes over everything you're learning, everything that needs to be done.

Students did not comment directly about negatives of the assessments but made some suggestions for improvements. For instance, they suggested changing the grading system to include interactive assignments. They also suggested lengthening the amount of time between assignment due dates, and alternating weeks when articles are due. And some students felt overloaded by the assignments and wished for either fewer assignments and quizzes or more time to do them in. They also wanted more simulation exercises, with industry application included in the assignments and the self-quizzes. Some felt that after reading the assigned case studies, they should be required to have more discussion for class participation. Additionally, some students wanted the quizzes to be weighted into the course grade and have less weight on the test grades. Additionally, they wanted more freedom with the testing schedule. They wanted to be able to take the exams as soon as they were ready, mirroring the freedom they had with their homework schedules. Finally, some suggested that the test question format change and only a final, cumulative exam be administered at the end of the semester.

> I would like more application in some assignments or tests than just summarizing an article.
>
> Some time limits are not suitable to finish homework assignments.
>
> I would say have us turn in weekly articles or do the web site but doing both is asking a lot of busy students.
>
> I should be able to test at my own pace...I wish...whenever you are done with that section that you can take the test right there if you want to.
>
> Suggestions I have for your class are less true/false questions on the exam.

Course Orientation

Students also commented on the orientation that they received at the beginning of the course and even the information that they had when they chose to enroll in the course. First, they commented on the information that they found in the course catalog when they signed up for the class. Generally, they responded negatively to the fact that when they enrolled, they did not realize that the course would be taught on-line. They did not receive this information until the first class period. In the future, they suggested, students should have this information before enrollment so that they could make a more informed choice about the course. They also commented on the orientation that was conducted at the beginning of the course. They did not make any specific positive or negative comments about this orientation, but they provided some suggestions on how to improve it. They felt that a more thorough grounding on how the course was set up, and how to use the technology once they understood the setup would be helpful.

> The only thing I would change is to let you know ahead of time that it is a computer course.
>
> One more thing that was a little frustrating was that we didn't sign up for a correspondence course, yet here we are stuck in one.
>
> I think it took me a little bit longer to catch onto how the computers worked and what was expected, and I think maybe if [the instructor] could have gone over that a little bit more at the orientation during the first couple of days of class.
>
> Maybe send a class email prior, so everyone can see how to use the system and see how effective it is. This might even be less work for you [the instructor] when people keep coming to you with questions.
>
> My only suggestion would be to spend more time when you [the instructor] take your class to a computer lab and show everyone how to use the system.

Instructor Interaction

This was a CAI course and, thus, emphasized the computer-student interaction over the instructor-student interaction more than a traditional course design does. Students gave feedback about the instructor. Additionally, they discussed fewer instructor traits than course design traits. However, the instructor traits that they commented upon seem to be traits that influenced their feelings about the whole course. Yet, student appreciation of the instructor's presence and availability was a theme that ran through their comments about the course. The instructor set the tone for the course and provided the technical skills needed to get the students started in their computer interactions, and the students seemed to desire and need interaction with him. They commented about aspects of the instructor including the instructor's knowledge of the material and technology, the instructor's attitude and responsiveness toward the students, the personal aspects of lecture interaction, and the personal and interactive aspect with the assessments.

Instructor's Knowledge Of The Material And Technology

Instructor knowledge of the technology and the material appeared to impress the students. They made numerous positive comments about his knowledge. They appeared to feel that they needed access to this knowledge particularly at the beginning of the semester when they were acclimating to a new learning environment. However, they continued to seek out information from the instructor throughout the course, either in person or by using one of the other tools available for communicating with him. Students appeared satisfied with what the instructor knew and their ability to tap into his knowledge when they needed it. Students had problems using the computer hardware and software during the class, and they needed an instructor who had the technical understanding to solve the problems. Had the instructor lacked this understanding, the students would have been unable to move forward with the coursework. In this new learning environment, the instructor's knowledge was a critical part of helping the students succeed. They made only positive comments about the instructor's knowledge.

> He was there for questions and guidance, because a lot of us didn't have computer experience.

> If anything should go wrong, he was really efficient and on top of it.
>
> He shows us everything we need or want to know.
>
> In both classes I have with this instructor I learned. He's a good teacher.... Every time you stop him he's always telling you something to learn, you know.
>
> During class times you could just raise your hand and he would come over. He would show you step-by-step how to do it.
>
> He was there to help and explain things because some of it I didn't understand. Like charts and things...he played a role in my learning them.

Instructor's Attitude And Responsiveness Toward The Students

Students needed the instructor to teach with a positive and approachable attitude. They also needed him to respond to their learning needs promptly and respectfully. Students appeared to feel that the instructor was upbeat about the course material and about teaching. They also appeared to feel that he responded kindly and quickly to their learning needs. Their positive experience with students-instructor interaction and their confidence that he could meet their needs seemed to help them succeed in this course.

> You know how sometimes teachers are behind their desk and you're nervous to go and talk to them or whatever, just real harsh.... [But this instructor] would walk around and be more laid back in general...it was just nice.
>
> I appreciate how he is always around to talk to and offer advice.
>
> He was right there to answer the questions. But had he not been there he would answer the question with email with enough time for you to get the assignment completed.
>
> I really like the instructor. He is very helpful, very caring, very understanding, always willing to help any student, which is nice.
>
> And you can ask questions, you know, even if you sound dumb like if you don't understand computer stuff.

Personal Aspects Of Lecture Interaction

While students listened to the lectures on-line or on a CD ROM, the course material still had interactive aspects with the instructor. The students needed to interact with the instructor at times in order to grasp the material. These interactions personalized the class for them. A theme of accessibility emerged from students' lecture-related comments about their interactions with the instructor. The fact that he was accessible, when and how students needed him, helped them grasp the lecture materials. More important than any specifics was the fact that they could count on his presence by email, phone, other tools, or in person. Additionally, he showed enthusiasm for the materials. Students made numerous positive comments that showed how these aspects of interaction helped them with the lecture materials.

> The instructor's always been there if you need help. [He] would be wandering around the lab if you needed him...he was always available.
>
> He was always available for you to go and talk to. He would always come into the classes and say hi to everybody and ask how they were doing with the course materials. I think he's really good at it.
>
> It's all been really nice and just easy.... The instructor's always there, so you still have the ability to ask the teacher. He's always like "email me about it and I'll email you back," but if you have a question right then he'll still answer it.
>
> Given that we are interacting w/computers, the instructor still makes it a point to get to all our questions, whether personally or in email.
>
> The instructor was really good. He's...interested in the topics.
>
> I definitely utilized him when I had concerns about the industry. It was good to talk to him about things like that.

The students did not make negative comments or suggestions about their interactions with this specific instructor about the lecture materials. Their negative comments and suggestions instead related to the course structure itself, as described in the previous section of this chapter, "The Flexibility of the Course Design," under "Face-Face versus CAI Interaction."

Personal & Interactive Aspect with the Assessments

Students made comments about how the instructor delivered the assessments, including the homework assignments, quizzes and exams. With homework assignments, students seemed to want improved communication about assignment due dates. In some cases they were surprised by a due date appearing when they had not expected it; they wanted to hear this ahead of time from the instructor. Feedback was another area some students said the instructor needed to improve. They wanted swift, informative feedback on their homework assignments, both about whether the instructor had received it and his comments regarding their performance. They also wanted to obtain the correct answers immediately after completing any quiz or test they took so that they could measure their performance. Additionally, some students suggested changes in test preparation, wishing for a formal review session with the instructor. Students did not make specific positive or negative comments about the instructor's delivery of the assessments, just suggestions for improvement.

> The only other suggestion would be to make it clearer when an article needs to be reviewed.
>
> Need feedback that homework was turned in.
>
> We need feedback on assignments; there are soo many!
>
> After you take the quiz or test, you should be able to get the answers right away.
>
> Suggest a review before the tests, attendance required. Tests are not easy.

The students did not make negative comments or suggestions about the assessments in this section. Their negative comments and suggestions instead related to the course structure itself, as described in the previous section of this chapter, "The Flexibility of the Course Design," under "Assessments: Learning Activities."

Variety of Technology Tools

Because this course utilized CAI, feedback on the technology used in the course was extensive. Technology that delivered the course materials and facilitated two-way communication was a critical factor in the students' overall success in the course. In spite of this technological success, student feedback about the technology was mixed. They gave strong positive and negative comments and had numerous suggestions for improving the shortcomings that they perceived. One theme that emerged from their comments was an appreciation for the variety of tools available for use in learning the course material. However, frustration resulting from the need for more individual technological expertise, and glitches in the technology also was evident. Students specifically commented on the accommodation of different learning styles, learning tools and software accessibility and the course software; WebCT- bulletin board learning; audio - lecture narration, classroom email system, computer competency of the students, student attitudes toward the technology, assessments - technological learning activities and the necessity for computer orientation.

Accommodation of Different Learning Styles

The WebCT software format of the course offered the students a variety of ways to learn. Students could listen and view class lectures utilizing PowerPoint slide presentations and listen to audio presentations. They could participate in "class learning activities", for example review and summarize articles posted on the Web site. Last, but not one of the students favorites, was to read and refer to the textbook. This variety of available methods was an asset for the students; it gave them the chance to learn the material at their convenience, repeat the materials as needed, and to choose the media most conducive to their particular learning styles.

Students' comments about this accommodation were positive. Some specific comments pertained to their ability to repeat their review of the materials whenever the need arose. Others noted their pleasure at having so many combinations of material to assist them in learning the material. Some students commented on the uniqueness of this opportunity to learn in a different way.

> [I like] that there are three ways you can actually learn. There's visual, audio and hands-on.
>
> I like this course...it's organized. The listening and the seeing of the lecture or the Power Point information has worked well with my learning style.
>
> You can see it, you can hear it, and you're playing with the keyboard, so it covers everything.
>
> You can pause, you listen, and you see and you can print it out so you can write it. There are tons of different options.
>
> It just depends on how you learn. Cause some people can hear better [while] some people are visual; it has all of those things.
>
> It's just a whole different way of learning, too. Instead of like trying to be in their classroom and trying to take notes or trying to impress the professor, be aware that you can [learn] at your own pace.... Just to compare it to other ways of being taught.

Learning Tools and Software Accessibility

Students made numerous comments about the tools available for them to use in the course. These tools included WebCT software as a whole, the bulletin board, the audio portion of the course, and email. Some comments addressed the access that students had to the tools in general. Other comments addressed specific tools. Students seemed to like having access to a variety of tools. As discussed previously, some seemed satisfied with their ability to get to the tools that they needed, and what these tools provided for them.

> Having recent articles posted up keeps us caught up on everything that is going on with respect to the industry, which is nice.
>
> It's easy to communicate with the instructor and easy using all of the resources that are provided on web-CT.
>
> I think that this [technology] is a good way [for] communicating outside of class.

However, the students also disliked various elements of their access to the course materials. For instance, they were frustrated that some of the computer hardware in the computer lab malfunctioned. Others complained about the insufficient number of computers in the lab, and about having to share the lab equipment with other students. Some students also had concerns about their home computers being incompatible with some of the course software.

> Concerned about access to computer from home. Unsure if I will always being able to access the information needed from the modem.
>
> Some times the program is not working up to par and I am not able to post my assignment on the Bulletin Board.
>
> It was kind of a problem, you know. Some of the students that were off campus might have a computer that was an antique like a 486 and they might not be able to connect with the Website.
>
> I don't like not having enough computers in one room to take quizzes.
>
> I also don't enjoy sharing headphones with everyone else at school who uses these computers.

The Course Software WebCT

Students liked the way that they could find all the information they needed using the WebCT platform. Many students found WebCT user-friendly, once they got accustomed to using it.

> The [software program] WebCT is an easy program to follow.
>
> Once mastering how to use [WebCT software], it makes learning and wanting to learn faster, easier and convenient.
>
> [WebCT is] convenient, easy to learn, and gets you to learn on computer.
>
> It is nice to share students' opinions through Bulletin Board and the web page...don't think it would be possible to share all the information and opinions during a regular short class period.
>
> I think using the WebCT [software] is a pretty good idea. It allows students to interact with computers, which will be beneficial in the long run.

They offered some negative comments about the WebCT software as well. Their complaints centered on the initial difficulty that some of them had in learning to use the software. It appeared, however, that even the students who made these negative comments felt that they had mastered the software with time.

> WebCT [software] gets difficult, but that was in the beginning when everyone was still learning.
>
> I like getting information on the website, but it took some time learning how to use the site.

Bulletin Board Learning

The Bulletin Board tool in WebCT gave students the ability to express themselves, and helped them learn about their classmates' opinions. Students used this feature to post their opinions on-line. The Bulletin Board allows students and instructors to engage in asynchronous or "threaded" discussions on different topics or forums. Students and instructors can post comments and send files to those students who are registered in the class and who have access to the discussions. Students like using the Bulletin Board, especially being able to express themselves and being able to read the opinions of other students. They also liked getting class news via this tool. Some students were learning the use of the Bulletin Board tool for the first time. Students considered this a skill that they saw would transfer to using the Internet outside of the context of this course.

> The Bulletin Board is very beneficial to me.
>
> I sometimes read a few before I make my comments because what other people say often makes me think things and see things from a different viewpoint. I also like being able to see what the other students are thinking and how they feel about the posted Bulletin Board articles.
>
> I am a big fan of the on-line class. It's easier to express yourself posting your opinions on the Bulletin Board and feelings on the articles. It's really convenient; that is the greatest thing I liked.
>
> I like...receiving news about the class on the Bulletin Board Web site.
>
> Before this class I would use the computer [just] for emailing several times a week and also to look things up on the computer. This [class] has really broadened my scope of understanding the computer via the Bulletin Board.

Students had no negative comments about the Bulletin Board, but did have some suggestions about the Bulletin Board maintenance. They wanted it to be easier to use, and for it to be less cluttered and easier to read.

> I need to learn more about how the Bulletin Board works.
>
> The only suggestion I have is to maybe clean up the Bulletin Board. It gets difficult to find everything needed for that week.
>
> I think that the instructor should delete the older messages on the Bulletin Board.

Audio: Lecture Narration

Students had two ways to access the audio portion of the course: (1) by listening to the CD ROM; or, (2) by using their Internet connections. Particularly helpful to students was the ability to listen to these lectures repeatedly, or to skip back to a portion of the lecture that they did not grasp at first.

> I like how I can go back and listen to lectures if I don't understand.
>
> I like being able to listen to lectures as many times as needed...that is the best part.
>
> There are always little things that are going to slip by you but for the most part [I like the audio portion]. What's nice is that you can always go back [and listen to] the previous material.
>
> I used the CD disc, and it was just like sitting in the classroom.

However, students did have some negative comments about the audio portion. Although technology is an asset to learning, it is not fail-proof. Lectures had audio difficulties at times, such as playing too fast or cutting out, and these glitches made the audio portion delivery less smooth and efficient than it otherwise would have been. The audio portion also took some time to transfer from the university server to the students' home computers.

> Some of the lectures [had] having audio difficulties. Computer narration quality...could be better.
>
> The worst part would have to be the little problems that cause you to miss a part of the audio lecture. Ex.: When the program goes in to fast-forward for no reason.
>
> Bad example: the sound is messed-up in a few places in the program and that was frustrating when trying to listen to lecture.

> The web Real Player audio files are sometimes boring for the entire lecture due to the...time it takes to load up [from the university server].
>
> Audio portion is helpful but the voice speeds up in some slides.

Even though students had voiced their positive and negative comments regarding the lecture in this section, they also had positive and negative remarks related to the course structure in the previous section of this chapter, "The Flexibility of the Course Design," under "Face-to-face Versus CAI Interaction." Additionally, students expressed positive comments in another previous section of this chapter, "Interaction with the Instructor," under "Personal & Interactive Aspects with the CAI Lectures."

Classroom Email System

Finally, the students gave feedback about the email tool portion of the technology. WebCT contains an internal email system for each course. This allows students to communicate with one another, or for student/instructor communication to occur. Students found it to be a convenient way to access and send information about the course.

> The best thing about email is that I can get information about the class whenever I need it.
>
> As far as the email and Bulletin Board go - I like them.
> I don't have to worry about catching you [the instructor], I can just email you if needed.

However, students made some negative comments about the email tool. Some students expressed frustration with forgetting to read their course emails. Other comments related to technical difficulties that students experienced with email, or their inexperience with the tool:

> Sometimes I forget to read the email messages. I think that was one of the biggest problems with WebCT.

> The last time I used the email site, I had a hard time finding what I needed to find.
>
> Even though I misunderstood the email format earlier, I do see the positive aspects of its use.
>
> It was confusing and frustrating at first as far as how to check emails....

Students also gave some suggestions about the tool. One wanted the teacher to send out class emails to their personal email accounts rather than their WebCT accounts, because students would sometimes forget to check the student WebCT accounts. They also wanted emails sent out that would remind them about due dates. One student requested an additional feature in the tool.

> Teacher should email students about assignments on their normal school email accounts and not on the students WebCT account.
>
> I wish there was some way to save your email before it is sent and come back and finish it later.

Computer Competency of the Students

Student experiences in the course varied, with some of this variance appearing to come from the level of comfort and competence with computer use that each student brought into the course. Generally, those students who struggled with the technology seemed to overcome this difficulty as the semester progressed. In some cases, they indicated that this increased comfort would carry over to their other uses of computers in the future.

> Actually it works better than I thought it would. I just thought that there would be more computer glitches, downtime on computer or it would be pretty frustrating, but it wasn't.
>
> One of the instructor's hopes was that we would feel more comfortable on the computers and I do.

I'm not computer friendly, but I thought it was a pretty good program, even if you don't know much about computers. It's pretty simple and self-explanatory.

Do you think [the CAI course] helped you in other classes? Oh yeah. I can do all kinds of stuff now. I was really apprehensive [at first]...definitely take it. It's worth it.

I have become more proficient in use of computers in general, as well as some of the more specific aspects of email.

The technological skills of some students were a problem. Orientation for those at entry level was a necessity, which frustrated students who were more technically advanced. However, once these entry-level students acclimated to the computer, the course progressed smoothly. Students had some negative feelings about this initial difficulty.

The frustrating part was probably the first two days of class.

Unfortunately, I am still learning how to do everything, but it is slowly coming to me.

The first two or three days everybody was a little intimidated.

Student Attitudes Toward the Technology

The final aspect of the student comments about the course technology concerned their attitudes toward the technology. In their comments, the students acknowledged that using computers is vital to their futures. They seemed to perceive that this course gave them valuable computer experience that they would be using again. They had several positive things to say about this.

I think being proficient with computers is a very important skill to learn.

I think it is very important for all college graduates to have a good background in computers.

[Computer use] is a valuable skill to learn. Computers are the way of the future.

> In the long run…[using WebCT] makes sense.
>
> I just think that [the computer skill] is a lot of valuable information that you will use if you go into food science.
>
> My learning has now been taken to a new level, and I love it! I really enjoy using the computer.

Assessments: Technological Learning Activities

The technological assessments utilized in this course -- homework, quizzes and tests -- were minimally commented upon by the students. While students seemed to find it helpful to have the quizzes and tests on-line, they had some issues with the technological delivery of these assessments. Some students commented positively on their ability to access quizzes and tests online, their ability to access these materials multiple times and their ability to print out the material.

> I really like it when teachers place practice quizzes on the Web; I think that this really helps a lot, at least for me it does.
>
> Each unit had a test or quiz at the end of it. You could take those again and again, and you could also print them out and study from them.
>
> Taking quizzes from my home computer is a unique idea.

Students did voice some complaints about the technological delivery of these assessments. Their frustration seemed intertwined with inexperience in using the software features in WebCT and other complaints about faulty materials. The on-line quizzes gave them difficulty, and they expressed reactions ranging from anxiety to annoyance.

> I have had some frustration with the posting of self-quizzes, in that I have deleted what I wrote when I returned to read the questions.

> I didn't know exactly what would be on the quizzes, and sometimes the same questions were asked twice or three times in a quiz. That was kind of frustrating.
>
> The last quiz was really frustrating.
>
> I think when I send the emails or...when we do self-tests, or submit the quizzes on-line, I think did it really go through, will I get credit?
>
> [You have to] switch between so many different screens in order to answer one question.

The main suggestion of students regarding the technological assessments was feedback. The students felt their experience with homework, quizzes and tests would be enhanced if they were given online feedback on these assessments. The purpose for the online-feedback was so they could use WebCT to track their scores on quizzes and tests. This feedback would help them to know that their work had been received and credited, would help them gauge their progress with the materials, and give them an idea of their course grade to date.

> I wish there was a way to access where we can see how well/bad we are doing and where we need to work on things, how far we have gotten, what we still need to turn in, homework assignments, etc.
>
> Need feedback that homework was turned in. It is hard to know where you are and ...[which assignments are due].

Even though students had voiced their positive comments, negative comments and suggestions to improve assessments, they also had positive remarks and suggestions for improvement related to the course structure.

The Necessity for Computer Orientation

Most students appeared to feel that this computer orientation was necessary. It helped them understand the software through a step-by-step explanation by the instructor. Students with minimal computer experience also had the chance to ask the instructor for one-on-one help as needed. The students learned the basics of the technology during this portion of the course. Later, as they progressed through the coursework, they learned other aspects of using the computer and course technology. Students seemed to want more from the specifics of the orientation, while at the same time expressing their appreciation for the instructor's approach to the orientation.

> As a result of taking this class the computer has given to me assistance in learning.
>
> Even after the first couple of classes, the instructor was more than willing to help anyone who needed it. I learned a lot about how to get through this program and computers themselves.
>
> By using the computer in class it has assisted me in learning in that I now have more knowledge of how computers and web sites work.

Some students had negative comments about the orientation. They felt that more time should have been dedicated to the orientation, including giving more hands-on demonstrations. Some said they were confused and never really understood how all the WebCT tools worked.

> At the beginning a lot of people were confused about how things worked...[Due to dates, submitting quizzes correctly, etc.].
>
> Complaints from students regarding the course were not spending enough time instructing students on how to use the computer program. If you don't know how to access all the info, it gets a little frustrating.
>
> At the beginning there was just a little bit of confusion.

Some of the suggestions on improving the orientation process were an email to the students from the instructor before the first day of class, more thorough foundation on how the course was structured, and explanations on how to utilize the technology once the course structure was ascertained. Students also commented on the orientation that was conducted at the beginning of the course. They did not make any specific positive or negative comments about this orientation, but they had some suggestions on how to improve it.

> Maybe send a class email prior, so everyone can see how to use the system and see how effective it is. This might even be less work for [the instructor] when people keep coming to [him] with questions.
>
> I think it took me a little bit longer to catch on to how the computers worked and what was expected, and I think maybe if [the instructor] could have gone over that a little bit more at the orientation during the first couple of days of class.
>
> More time should be spent at the beginning showing stuff about the software.
>
> My only suggestion would be to spend more time when you [the instructor] take your class to a computer lab and show everyone how to use the system.
>
> I suggest that you should walk students through the first few exercises.

Summary

This chapter revealed the students' experiences using CAI in a food purchasing course, utilized qualitative data collection instruments to extract participant responses. The participant responses uncovered emerging themes of Course Design Flexibility, Instructor Interaction and the Variety of Technology Tools.

Students provided their impressions of what they liked about the course design. As it turned out, the flexibility of the course design was the aspect that they found most appealing. The course design allowed them to work at their own pace and at their own hours, so they could structure the coursework around other obligations. Working students and those who were parents found this flexibility especially beneficial. Students commented positively on aspects of flexibility that included the course was convenient, challenging, provided a variety of communication methods, there was face-to-face versus CAI interaction, assessments; including learning activities and a course orientation.

This was a CAI course and, thus, emphasized the computer-student interaction over the instructor-student interaction more than a traditional course design does. Additionally, student appreciation of the instructor's presence and availability was a theme that ran through their comments about the course. The instructor set the tone for the course and provided the technical skills needed to get the students started in their computer interactions, and the students seemed to desire and need interaction with him. They commented about aspects of the instructor including the instructor's knowledge of the material and technology, instructor's attitude and responsiveness toward the students, the personal aspects of lecture interaction, and the personal & interactive aspect with the assessments.

Technology that delivered the course materials and facilitated two-way communication was a critical factor in the students' overall success in the course. One theme that emerged from their comments was an appreciation for the variety of tools available for use in learning the course material. However, frustration resulting from the need for more individual technological expertise, and glitches in the technology also was evident. Students specifically commented positively on the accommodation of different learning styles, learning tools and software accessibility.

CHAPTER V-DISCUSSION

This study found qualitative evidence that the use of computer-assisted instruction (CAI) enhanced the learning experience within a group of university students enrolled in a food service management course. Students were exposed to CAI as an integral component of a course offered by a university located in the western United States. The course was taught by the researcher and was conducted using a CAI delivery mode, encompassing an extensive constellation of on-line tools facilitated through the use of WebCT software. The course required students to master the content and the working procedures of inventory, cost and quality control techniques relevant to the purchasing, receiving, and storage of food on a commercial scale.

The design implemented in this study was essentially exploratory. It was intended to discover the perceptions of students about their learning experience through qualitative data collection instruments. Accessibility to personal microcomputers has increased as has the research comparing CAI with traditional instruction. Several studies have shown that CAI was more effective than traditional instruction (Gott, 1995), while others showed no significant difference (Moore & Kearsky, 1996; Wilson, 1996).

Consequently, the explanatory design in the present study was formulated in response to the mounting criticism that the majority of CAI "efficacy" studies that have been published to date measure learning outcomes solely by pre-intervention/post-interventions differentials on standardized test scores (Crook, 1994; Fletcher-Flinn & Gravatt, 1995; Kirkpatrick & Cuban, 1998; Johnson, 2001). Consistent with Crook 's

(1994) recommendation, the present study goes "beyond input-output designs that characterize much research in the area (of CAI learning effects)" (p. 9).

As Fletcher-Flinn and Gravatt (1995) have argued, the benefits of CAI may well include facets of the learning experience that cannot be captured through customary pre/post intervention test score designs. In other words, CAI may possibly assist with student learning and include the possible benefits of:

> "time savings for students as well as teachers, cost effectiveness, the presentation of realistic problems requiring interactive hypothetical-deductive reasoning, immediate feedback and self-evaluation, opportunities for collaborative learning in small groups, and ease of teacher monitoring and control are equally valid measures of any instructional program." (p. 232).

This case study was constructed to look at these neglected aspects of CAI learning experience by generating qualitative information from course participants at a western U.S. university. All of the qualitative data collection instruments were constructed to elicit student assessments and comments concerning their experience with using CAI in this course. Three themes, in particular, emerged from the course under investigation—Course Design Flexibility, Instructor Interaction, and the Variety of Technology Tools.

Case Study Findings & Other Research Studies

Course Design Flexibility

Consistent with both this study and the observations of scholars in the field of CAI, student-learning experience was generally positive (Chambers & Specher, 1983; Anglin,1995; Burbules & Callister,2000). The course design facilitated communication with the instructor as well as with other students enrolled in the class by utilizing software tools such as; e-mail and the Web-CT Bulletin Board. Further, many participants in this study found it interesting to learn the views of their classmates through the use of the Bulletin Board. Similarly, scholars have commented on the fact that on-line communication between students and faculty and among students collectively offers a chance for more timid students to express their views on-line where they would likely not communicate in a traditional classroom setting. In addition, on-line communication can enhance a student's writing skills and enable the instructor to develop a more in-depth student knowledge and understanding than is possible in the traditional setting (Feenberg, 1999).

Some participants in this study reported that the flexibility of the computer-assisted instruction enabled them to learn during periods of their daily/weekly schedule when they were fresh, and thereby, better prepared to make instructional gains. Several students asserted that the flexibility of the CAI course format gave them a sense of being "in control" or of being "free", and this contributed to their self-confidence as learners. The flexibility of the course design included both synchronous and asynchronous instructional modalities with benefits for student motivation (Yang, 1992). In fact, the vast majority of the participants in this study expressed their opinions that the flexible course design of this case study was an added plus to their life styles and daily schedules.

This study did not seek conclusions about learning achievement. However, given the reported relationships between such variables as reduced stress or student's personal control on the one hand, and learning outcomes on the other, it can be inferred that positive student experience with a flexible course design may well have made for a positive impact on learning. Such indirect associations are consistent with results reported by Niemiec, R., Sikorski, C., and Walberg, H.J. (1996) and Schacter and Fagnano (1999).

CAI also proved to be a valuable tool for the case study simulations that comprised a significant part of the course's lesson plan. Many students ascribed the highest value of technology usage to utilization of the simulation learning activities. In this study, participants were given real-life simulations found in the hospitality industry to solve. Consequently, problem-solving applications not only allowed the participants to improve their logical reasoning skills by giving them "real" situations, but they were able to familiarize themselves with problems they will incur in their careers. Existing software can enable instructors to increase CAI's scope from lower- to higher-order functions (Merrill, 1996b).

Students were also enthusiastic about lectures delivered over the Internet or via CD-ROM. These modalities enabled them to review portions of the lectures that they did not fully understand upon initial exposure. This design of the lecture is likewise supported in the literature. According to Feenberg, (1999)

> "on-line distance learning, in particular, holds tremendous promise in this regard, offering the potential for great improvements over previous models. With the Internet, for the first time, we have an educational technology that supports rapid and convenient communications, and there's every reason to think that Socratic dialogue can flourish in this medium" (pp. 1-2).

Findings of the present case study indicate that time and convenience benefits are particularly valued by students who characteristically have work duties and family obligations that must be met along with the time needed to fulfill university course requirements. The asynchronous elements of the CAI instructional delivery format, (including Internet web postings and course presentations, as well as lecture materials inscribed on CD-ROMs), enabled students to work at their own pace, to set hours of their own choosing, and thereby, schedule coursework in a manner that minimized conflict with their other responsibilities. Participants found this "convenience" dimension of course flexibility to be of substantial benefit, especially students engaged in professional employment and/or parenting. Students living off campus (the majority of the participants) often pointed to a reduction in commuting time (and expense) as an advantageous feature of using CAI in this course. The capacity to attend class at home then was perceived by the vast majority of study participants as a decided advantage over conventional classroom delivery.

Hara and Kling (2000) suggested that the inexpensiveness and convenience for the working student or the student with extensive family commitments make the on-line course attractive to universities, while Feenberg (1999) suggested that what is attractive to universities is the low-cost factor involved with CAI. Feenberg correlated cost efficiency with the conceptual basis of the Industrial Revolution. Skilled workers are expensive, and while technology can never totally replace teachers, there are those, according to Feenberg, who believe that technology can lessen the cost of educational labor, the single largest item in most university budgets.

Reliance upon lectures delivered on-line over the Internet and/or through CD-ROM had drawbacks in the view of some study participants. There were complaints about poor narration sound quality. Accustomed to personal contact in face-to-face student-teacher encounters, some study participants reported subjective "losses" in terms of the nuances of course material presentation, such as; eye contact, and/or "personalized" communications (jokes, stories, anecdotes, etc.), typical of the researcher's traditional "in-class" teaching style. Others expressed their concerns about the excessive length of the lecture sessions. There appears to be a split of opinion on this topic in the literature. Some of the literature indicated that the lack of nonverbal communication cues such as gestures and facial expressions which are present in the face-to-face interaction, heightened students' anxieties about determining the instructor's expectations (Kuehn 1994; McIsaac & Gunawardana 1996). In contrast, there is some literature that reports the advantages of on-line Internet courses (Feenberg, 1999). Feenberg pointed out that

> "for instantaneous back and forth of real-time discussion, they [on-line courses] substitute a slower but still engaging day to day rhythm. With time to think and compose questions and answers, students who might never have participated in a face-to-face setting bring forward their ideas. The use of writing imposes a discipline and helps focus thinking. From an educational standpoint, there is little doubt that competent teachers under these conditions can be effective at sustaining a true equivalent of classroom interaction" (pp. 6-7).

Some students in the present case study, complained about the lack of orientation with the technology usage. Some participants, especially among the computer novices in the class, were distressed that the orientation session offered by the instructor during the first week of class was not adequate. Hara & Kling, suggest that the inadequacy of orientation sessions could be caused by the labor-intensive nature which CAI courses entail, as well as the instructional skill, experience, and dedication required of the CAI instructor.

> Hara and Kling (2000) reported that at least one university required students enrolled in distance education classes to take an on-line orientation prior to beginning their studies. According to this study, if educators can assist participants in understanding "the complexities of asynchronous text-based communication", the level of students' capabilities for learning through CAI can be raised (p. 23).

It is suggested that these concerns could be rectified or mitigated prior to course initiation, by having a technological specialist called in to design or conduct technology usage orientation sessions.

Instructor

Some participants, notably those with greater computer experience, entertained very high, even unrealistic, expectations concerning instructor evaluation feedback related to homework, quizzes and tests submitted to the instructor over the Internet. As a working procedure, the instructor refrained from transmitting such feedback until such time as all students in the course had completed the assignments. Moreover, the notion that the instructor could instantaneously offer comments upon work submitted via the Internet failed to take into account inherent limitations on the instructor's available time.

Hara and Kling (2000) found this feedback issue to be of concern among the students throughout the term. Their study suggested that "'prompt unambiguous feedback' is much more difficult in text-based asynchronous courses than the face-to-face conditions" (p. 22). As this researcher discovered, many of the students worked on the course during evening hours or on weekends. Instantaneous feedback at these times would require an instructor who is available twenty-four hours a day, seven days a week. The Hara and Kling study suggested that both students and instructors should learn how to manage their respective expectations about feedback, so that feedback can be accomplished in a more expeditious, reliable way.

Participant evaluation of interaction with the instructor was positive. Several informants emphasized the reliability and timeliness of instructor responses to their course-related inquiries. The results strongly suggest that participants relied heavily upon the instructor's familiarity with computer-based technologies. That being so, an educator with relatively advanced working knowledge of technologies may have a similar positive experience. Feenberg (1999) emphasized that an on-line course enhances the interaction between the instructor and the students.

In his view,

> "courses animated by a live professor will generally be designed under his or her control in relatively simple and flexible formats. No computer professionals need be involved. As in the conventional classroom, much of the interest of the product will lie in the interaction among students and between students and teachers" (p. 6).

Participant perceptions of instructor performance were highly favorable. Data results confirmed positive feedback regarding the instructor's capability to teach both the contents of the food service management course and to instruct students in technology usage. The participants found the instructor to be knowledgeable about both the content and the instructional media of this course. Several participants added that the instructor maintained a positive attitude and was highly responsive to their questions, concerns, and comments. This research recognizes the students' concerns, especially those with less developed computer skills, as they tended to rely upon the instructor for assistance in using the course's technology. As Feenberg aptly stated, "there is something about dialogue, and the active involvement of the teacher, that is fundamental to the educational process and that must be woven into the design of any new instructional tool" (Feenberg, 1999, p. 1).

In Hara and Kling's (2000) case study, constructed to facilitate communication flows between students and the instructor and among students, researchers analyzed the limitations in both the instructional design and course when using CAI. The course utilized a web site with a Bulletin Board that enabled the instructor to disseminate information to students. Such information included both course-related administrative matters (e.g., notification of an assignment due dates) and ancillary materials (e.g., the posting of text or links to recent articles on food purchasing which appeared in professional periodicals). Students were able to (and encouraged to) read and post messages to this electronic Bulletin Board. However, the Bulletin Board became "too cluttered" over time, and it was suggested that the instructor periodically purge the site of content that had become irrelevant, e.g., dates of past assignments.

It was, however, through e-mails and on-line chats that most participants in this study found means for communicating with the instructor and with each other. These tools offered advantages over conventional methods, such as face-to-face or telephone communication. Most participants appreciated the ease of e-mailing the instructor with their questions and comments. Without leaving their at-home computer terminals, participants were able to "speak" with the instructor in a manner that they reported to be convenient and highly reliable. The instructor endeavored to amplify positive experience in course-related communication by responding to messages from students in as timely a manner as possible. At the same time, students also could access the instructor through conventional modalities. The importance of communication is supported by Gavriel Salomons (1996) research: "embedding learning in a communicative-intensive social context may affect cognitions, motivations, self-concepts, attitudes, and the qualitative nature of interactions, which far transcend the traditional measures of achievement" (p. 899).

As mentioned in the previous section on Course Design Flexibility, some students in this research study continued to have problems with the technological dimension of the course. Typically, they relied upon the course instructor for assistance in these cases. Based upon the data received from the students in this course, the researcher has concluded that instructors utilizing CAI must be prepared to perform dual roles as experts in their field and as teachers of computer usage. Results from several recent research studies (e.g., Fabry & Higgs 1997; Rogers 2000) strongly suggest that most primary and secondary school teachers are not prepared to carry out both of these roles. Additionally, researchers have observed that CAI program developers "have been less successful in teaching the higher order skills emphasized at higher educational levels" (Kulik & Kulik, 1991, p. 76). This would suggest that a similar deficit among instructors in computer knowledge/skills exists at the university level. Educators at all levels need not be computer "experts" to maximize the benefits of CAI for their students. They must, however, be well versed in technology in order to teach students the basics, and to answer more advanced questions as they arise. In conclusion, the findings of this researcher suggest that the full potential of CAI can be achieved through educators' upgrade of their technological knowledge and skills.

Technology Tools

The advantages of technology were noted by participants in several features of the course, including lecture and case study simulations. Many participants commented that the case study simulations were interesting and challenging, and that they learned practical application of the course materials.

Several participants mentioned that the use of asynchronous tools and, more particularly, of multiple, over-lapping modalities (e.g., "streaming media" lectures using the internet and a (CD-ROM) version of lecture materials) allowed them to review efficiently select aspects of lessons that they had not fully grasped upon initial exposure. The Hara & Kling(2000) article supports this broad public appeal for CAI courses that use multiple software tools and modes of delivery. They also advocate that students who were well versed in technology usage appreciated the range of tools and media used in the course.

This case study found that students judged the WebCT software employed in the course to be very "user-friendly." Many of those participants, who initially reported a low degree of familiarity with computer-based technology, had a much different experience. The participants falling into this category eventually mastered the essential features of the software and hardware used in a fairly short period of time. These students were eventually able to overcome their technological deficits, and indicated that exposure to CAI in this course dramatically increased their computer skills and reduced their general anxiety about using technologies. However, even experienced technology users expressed frustration about the hardware malfunctions at the on-campus computer laboratory and about occasional technology "glitches." The literature suggests that frustration caused by technological malfunctions and infrequent or lack of prompt feedback from the instructor were major problems in other distance courses (Hara & Kling, 1999a). As was the true in the study reported here, such findings led to what Feenberg (1986) commonly referred to as "communication anxiety". The (Hara & Kling, 1999a) study focused on lack of the instructor's feedback as a major concern of the students. Conversely, participants of this study expressed positive comments about the instructor's prompt feedback and his readiness to assist them with the technological difficulties that they encountered.

Student familiarity with computer information technologies was highly variable. As reflected in the participant data as the course unfolded, many participants were eventually able to master the instructional technologies that they were required to use. Among these participants, the initial challenge translated to a real source of important and valued learning. Several of these technology novices reported that their attitudes toward computer-based instruction, computer technology at-large, and their confidence in the use of technology, underwent substantial improvement as a result of CAI exposure in this course.

Implications for Practice

Orientation

From the researcher's standpoint, as well as the collective perspective of students, who came to the course with a high degree of computer familiarity, a single orientation session in technology usage was deemed adequate. Without a doubt, some of the latter reported being "bored" by the orientation. Nevertheless, given the subsequent problems that the novices in the class reportedly encountered in the use of technologies, for some students, a single, weekly orientation session was clearly not sufficient for some students. Although most of those reporting negative experiences with the technology usage dimension of the course ultimately overcame these problems, three remedial suggestions for improvement emerged:

1) First, students should be screened to determine the level of their computer knowledge and experience.

2) After screening identifies those students who need help, they can be sent to resources centers on campus or at schools that may provide assistance to help with the use of technology or software tools.

3) Novices should be exposed to multiple orientation sessions.

4) Additional orientation sessions should be available to novice computer users as needed, during the semester.

5) All of the technologies and tools that will be used throughout the course should be introduced in the initial orientation session(s).

Instructor's Dual Role

An important implication of this study is the need for administrators to collaborate with faculty when teaching with technology. Administrators should assess the personal and professional needs of university faculty for technology use in teaching. There is reason to believe that these needs may differ by discipline. Second, faculty and administrators should work cooperatively to obtain resources to develop an ongoing program for improvement of faculty technology skills in the form of professional development programs.

Another specific educational implication of this study is that the optimal learning experience effects of CAI will only be realized if two conditions are met. First, the course as a whole, both content and delivery, must be effectively designed. Second, and perhaps more important, instructors must be fully-versed in both the disciplinary field in which they are engaged (here food purchasing) and in the technologies through which course materials are delivered. It is not enough for the instructor to understand CAI technologies. He or she must be able to explain and teach students with variable knowledge in technology the tools and features of the CAI course, and how to troubleshoot technological "glitches".

As noted, some students were dismayed to find that the course in which they had enrolled would be conducted, in part, through the Internet, and therefore, the nature and requirements of all such courses should be spelled out in course catalogs.

Recommendations for Future Research

Based on the findings several recommendations are offered for consideration. This research study should be replicated altering the methodology so individual participant responses to qualitative questions can be tracked from the beginning of the research to the finished report. This research study should be replicated using the suggestion above along with using a time series analysis to analyze the participant responses, and qualitative data collection instruments, i.e.; questionnaires, personal interviews, etc.

Additionally, what we could be presenting is an ecology model of teaching without the person variable being included. What we are presently talking about is "case variable outcomes". We have an environment here that includes; The flexibility of Course design, Instructor Interaction and the Variety of Technology Tools. But the middle piece of what kinds of students have what kinds of experiences under these environmental conditions and outcomes is missing. This is because items about the student were not collected such as; learning styles, environmental data, personality styles, demographics or anything about the research participants. So we have a three piece (stool) model with one leg missing. However, for future research all three of the pieces of the model should be present, which would add to the research and answer some the questions about why this worked for some students and not others. In this research we know about the behavior (that is what happened), we also know about what the environment was like but, what we do not know anything about the research participants.

This Research analyzed the students experience using CAI. However, it would also be useful to analyze the discourse from the "writing level". At what level are these students writing? This might be another variable to assess what level students are reading up front, that is; from the first time that they submit written assignments to the instructor on the Bulletin Board. This "rich data" could have been analyzed to get some judgment of where students are coming from at the beginning of the course.

Conclusion

Throughout the suggestions and comments made by the participants of this study, one major reality was voiced, "computers are the way of the future, and knowledge and skills in their application and use are essential for future success." This perception is supported by the research literature. According to the Center for Research in Mathematics at North Carolina State University (1989 survey) for practice and the use of technological tools in the classroom, approximately 80% of the 600 participants either agreed or strongly agreed that computers can do certain tasks which cannot be accomplished easily using the "chalkboard" or the "overhead projector." (Berenson & Stiff, 1989). In the near future computer literacy skills will be required of most people employed to function in the workplace as well as society (Bostock & Seifert, 1987).

References

Airasian, .W. (2001). *Classroom Assessment: Concepts and Applications*. Boston, MA: McGraw-Hill, 4th Ed.

Alkin, M., & House, E. R. (1996). Evaluation of Programs. In M. Alkin (Ed.), *Encyclopedia of Educational Research*. New York: MacMillan, 2, 462-467.

Alspaugh, J.W. (1999). The Relationship Between the Number of Students Per Computer and Educational Outcomes. *Journal of Educational Computing Research, 21 (2)* 141-150.

Altrichter, H., Posch, P., & Somekh, B. (1993). *Teachers Investigate Their Work: An Introduction to the Methods of Action Research*. London: Routledge.

Anglin, Gary J. (1995). *Instructional technology: Past, present and future*, 2nd Ed., Libraries Unlimited, Inc.: Englewood, CO.

Apple Computer. (1995). *Changing the Conversation about Teaching, Learning and Technology: A Report on 10 Years of ACOT Research*.

Armsey, J.W., & Dahl, N.C. (1973). *An inquiry into the uses of instructional technology.* Colorado State University: The Ford Foundation: New York.

Bacig, T.C., Evans, R.A., & Larmouth, D.W. (1991). Computer-Assisted Instruction in Critical Thinking and Writing: A Process/Model Approach. *Research in the Teaching of English, 25* (3), 365-381.

Becker, H.J. (1984). School Use of Microcomputers: Report #3 from a National Survey. *Journal of Computers in Mathematics and Science Teaching, 3*, 26-32.

Becker, H.J. (1992). Computer-Based Integrated Learning Systems in the Elementary and Middle Grades: A Critical Review and Synthesis of Evaluation Reports. *Journal of Educational Computing Research, 8* (1), 1-41.

Becker, H.J. (1994a). How exemplary computer using teachers differ from other teachers: implications for realizing the potential of computers in schools. *Journal of Research on Computing in Education, 26* (3), 291-321.

Becker, H.J. (1994b). Making sense of new technologies. *Executive Educator, 16*, 12-14.

Becker, H.J. (1996). *Analysis and Trends of School Use of New Information Technologies*. Washington: Office of Technology Assessment.

Blanchard, J. (1999). Technology, communication, and literacy: Critical issues. *Computers in the Schools, 15* (1), 1-4.

Bonk, C. J. and Cummings, J. A. (1998). A dozen recommendations for placing the student at the centre of Web-based learning. *Educational Media International, 35(2)*: 82-89.

Burbules, N.C., & Callister, T.A. (2000). *Watch It: The Risks and Promises of Information Technology for Education*. Boulder, CO: Westview Press.

Carnevale, D. (2000, February). Assessing the quality of online courses remains a challenge, Educators agree. *Chronicle of Higher Education*.

Cassady, J. (1998). Student and instructor perceptions of the efficacy of computer-aided lectures in undergraduate university courses. *Journal of Educational Computing Research. 19* (2), 175-189.

Chambers, J., & Specher, J. (1983). *Computer-Assisted Instruction*. Engelwood Cliffs, NJ: Prentice-Hall.

Christmann, E., Lucking, R., & Badgett, J. (1997). The effectiveness of computer-assisted instruction on the academic achievement of secondary students: A meta-analytic comparison between urban, suburban, and rural educational settings. *Computers in the Schools, 13* (3/4), 31-40.

Clark, R E. (1996). Media use in education. In M. Alkin (Ed.), *Encyclopedia of Educational Research, 3*, 805-814. New York: MacMillan.

Clark, R.E. (1985). Confounding in educational computing research. *Journal of Educational Computing Research, 1* (2), 137-148.

Clark, Richard E. (1994). Assessment of distance learning technology. In Technology assessment in education and training (E. Baker, H, O'Neil, Jr., Eds.), Chapter 3, pp. 63-78.

Cooper, L. (2001, March). A comparison of online and traditional computer applications classes. *T.H.E. Journal, 28* (8), 52-58.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Sage Publications: Thousand Oaks, CA.

Creswell, J.W. (1994). *Research design: Qualitative & quantitative approaches*. Sage Publications: Thousand Oaks, CA.

Crook, C. (1994). *Computers and the Collaborative Experience of Learning*. London: Routledge.

Davidson, N., & O'Leary, P.W. (1990). How cooperative learning can enhance mastery teaching. *Educational Leadership, 47* (2), 30-36.

Digby-Junger, R. (2000). Internet. In T. Pendergast & S. Pendergast (Eds.), *Encyclopedia of Popular Culture, 2* pp. 495-498. Detroit: St. James.

Dwyer, D. (1994). Apple classrooms of tomorrow: What we've learned. *Educational Leadership, 51*, 4-10.

Egan, K. (1997). *The Educated Mind.* Chicago: University of Chicago Press.

Ellsworth, J. (1997). Curricular integration of the world wide web. TechTrends, 42 (2), 24-30.

Ely, D.P. (1996). *Trends in Educational Technology*. Syracuse, NY: Syracuse University.

Fabry, D.L., & Higgs, J.R. (1997). Barriers to the effective use of technology in education: Current status. *Journal of Educational Computing Research, 17* (4), 385-395.

Feenberg, Andrew (1986). Network Design: An Operating Manual for Computer Conferencing. *IEEE Transactions on Professional Communications* 29(1).

Feenberg, Andrew (1993). "Building a Global Network: The WBSI Experience," in L. Harasim, ed., *Global Networks: Computerizing the International Community.* Cambridge, MA: MIT Press.

Feenberg, Andrew (1995). *Alternative Modernity*. Berkeley: University of California Press.

Feenberg, Andrew (1999). "Distance Learning: Promise or Threat?" *Cross talk, vol. 7, no. 1.*

Ferrell, B.G. (1986). Evaluating the impact of CAI on mathematics learning: Computer immersion project. *Journal of Educational Computing Research, 2* (3), 327-336.

Fisher, M.M. (1997). The voice of experience: Inservice teacher technology competency recommendations for preservice teacher preparation programs. *Journal of Technology and Teacher Education, 5* (2/3), 139-147.

Fishman, B.J. (1999). Characteristics of students related to computer-mediated communications activities. *Journal of Research on Computing in Education, 32* (1), 73-97.

Flagg, B.N. (1990). *Formative Evaluations for Educational Technologies*. Hillsdale, NJ: Lawrence Erlbaum.

Fletcher-Flinn, C. M., & Gravatt, B. (1995). The efficacy of computer-assisted instruction (CAI): A meta-analysis. *Journal of Educational Computing Research, 12* (3), 219-242.

Fraenkel, J.R., Wallen, N.E. (1993). How to design and evaluate research in education. New York: McGraw-Hill.

Garner, R., & Gillingham, M. (1996). *Internet Communication in Six Classrooms: Conversations Across Time, Space and Culture*. Mahwah, NJ: Lawrence Erlbaum.

Gay, L.R. (1996). Educational research: Competencies for analysis and application. 5th Ed., Florida International University. Englewood Cliffs, NJ: Merrill.

Geisert, P.G., & Futrell, M.K. (2000). *Teachers, Computers, and Curriculum: Microcomputers in the Classroom*. Boston: Allyn & Bacon.

Grabe, M. (1984). Evaluating the educational value of microcomputers. *Computers in the Schools, I* (4), 35-119.

Green, K.C. 1997. Drawn to the Light, Burned by the flame? Money, *Technology and Distance Education. ED (May) 11*(5):J1-J8

Gunawardena, C. N. (1992). Changing faculty roles for audiographics and online teaching. *The American Journal of Distance Education, 6(3):* 58-71.

Gunderson, L., & Anderson, J. (1999). An exploration of internet access for literacy teachers and learners. *Computers in the Schools, 15* (1), 5-11.

Hagler, P., & Knowlton, J. (1987). Invalid implicit assumptions in CBI comparison research. *Journal of Computer-Based Education, 14* (3), 84-88.

Hara, N. and R. Kling. (1999a). Students' Frustrations with a Web-Based Distance Education Course: A Taboo Topic In the Discourse. (revision of Sept, 1999). Center for Social Informatics, Indiana University WP 99-01-C1

Hara, N. and R. Kling. (1999b). Students' Frustrations with a Web-Based Distance Education Course. First Monday. 4(12) (December) http://www.firstmonday.dk/issues/issue4_12/index.html

Hara, N. and R. Kling. (2000). Students' Distress with a Web-Based Distance Education Course. First Monday. 4(12) (January)

Harasim, L. M. (1987). Teaching and learning on-line: Issues in computer-mediated graduate courses. *Canadian Journal of Educational Communication, 16(2):* 117-135.

Harasim, L., Hiltz, S. R., Teles, L., & Turoff, M. (1995). *Learning Networks: A Field Guide to Teaching and Learning Online*. Cambridge, MA: MIT Press.

Hayes, J. (1995). Equality and technology. *Learning and Leading with Technology, 23* (2), 51-53

Heller, P., & Hollabaugh, M. (1992). Teaching problem solving through cooperative grouping. Part 2: Designing problems and structuring groups. *American Journal of Physics, 60* (7), 627-636.

Heller, P., Keith, R., & Anderson, S. (1992). Teaching problem solving through cooperative grouping. Part 1: Group versus individual problem solving. *American Journal of Physics, 60* (7), 627-636.

Houghland, S. (1994). Computer accessibility: Who's using computers in early childhood classrooms? *Day Care and Early Childhood Education, 22* (2), 45-46.

Hwang, R., & Chao, M.S. (1998). A new online paradigm for developing courses, teaching and learning: A Project in the Asynchronous Learning Environment at Ching Cheng University.

Jafari, A. (1999, October/November). Putting everyone and every course online: The oncourse environment. *WebNet Journal*, 37-43.

Jaffee, D. (1998). Institutionalized resistance to asynchronous learning networks. Journal of Asynchronous Learning Networks, 2 (2).http://www.aln.org/alnweb/journal/vol2_issue2/jaffee.htm

Jamison, D., Suppes, P., & Wells, S. (1974). The effectiveness of alternative instructional media. *Review of Educational Research, 44* (1), 1-67.

Januszewski, A. (2001). *Educational Technology: The Development of a Concept.* Englewood, CA: Libraries Unlimited.

Johnson, D.L. (1994). Who Are the telecommunications disadvantaged? *Computers in the Schools, 11* (1), 1-3

Johnson, D.L. (1995). The question of student access to the Internet. *Computers in the Schools, 11* (3), 1-6.

Johnson, D.L. (1997). Integrating technology in the classroom: The time has come. *Computers in the Schools, 13* (1/2), 1-5.

Johnson, D.L. (1999). A computer for every student? It ain't going to happen. *Computers in the Schools, 15* (2), 1-4.

Johnson, D.W. (2001, February). How do you measure success?: Lessons on assessment and evaluation from the LEAD Center. *Syllabus Magazine, 14* (7).

Johnson, D.W., Johnson R.T., & Holubec, E.J. (1990). *Circles of Learning.* Edina, MN: Interaction.

Johnson, J.L. (1999). Distance education and technology: What are the choices for higher education? *Journal of Educational Computing Research, 21* (2), 165-181.

Johnson-Gentile, K., Clements, D.H., & Battista, M.T. (1994). Effects of computer and non-computer environments on students' conceptualization of geometric motions. *Journal of Educational Computing Research, 11* (2), 121-140.

Kafai, Y.B., & Sutton, S. (1999). Elementary school students' computer and Internet use at home: Current trends and issues. *Journal of Educational Computing Research, 21* (3), 345-362.

Katz, R. (1999, March/April). Time to assess. *Educom Review, 34* (2).

Kinser, J., Pessin, B., & Meyertholen, P. (2001). From the fields to the laptop. *Learning and Leading with Technology, 28* (5), 14-17, 48.

Kirkpatrick, H., & Cuban, L. (1998, Summer). Computers make kids smarter--right? *Technos Quarterly, 7* (2).

Kowalski, J. (1998, August). The benefits of information technology. ERIC Digest. ERIC *Clearinghouse on Information and Technology*, Syracuse University (http://ericir.syr.edu/ithome/digests/edoir9804.html).

Krendl, K.A., & Lieberman, D.A. (1988). Computers and learning: A review of recent research. *Journal of Educational Computing Research, 4* (4), 367-389.

Krumhout, O., & Butzin, D. (1993). Integrating computers into the elementary school curriculum. *Journal of Research on Computing in Education, 26*, 34-45.

Kuehn, S. A. (1994). Computer-mediated communication in instructional settings: A research agenda. *Communication Education, 43:* 171-183.

Kulik, C.C., & Kulik, J.A. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computers in Human Behavior, 7*, 75-94.

Kulik, J.A. (1983, September). Synthesis of research on computer-based instruction. *Educational Leadership*, 19-21.

Kulik, J.A. (1994). Meta-analytical studies on findings in computer-based instruction. Technology *Assessment in Education and Training*. Eds. E.L. Baker and H.E. O'Neil, Jr. Hillsdale, NJ: Lawrence Erlbaum, pp.9-23.

Kulik, J.A., Bangert, R.L., & Williams, G.W. (1983)). Effects of computer-based teaching on secondary school students. Journal of Educational Psychology, 75 (1), 19-26.

Leigh, P.R. (1999). Electronic connections and equal opportunities: An analysis of telecommunications distribution in public schools. *Journal of Research on Computing in Education, 32* (1), 108-127.

Levine, T., & Donista-Schmidt, S. (1997). Commitment to learning: Effects of computer experience, confidence and attitudes. *Journal of Educational Computing Research, 16* (1), 83-105.

Marra, R.M., & Carr-Chellman, A.A. (1999). Undergraduate education students' perspectives on classroom techniques: A qualitative analysis. *Journal of Educational Computing Research, 21* (3), 283-303.

McIsaac, M. S. and Gunawardena, C. N. (1996). Distance education. In D. Johnassen (Ed.), Handbook of research for educational communications and technology. New York: NY: Macmillan, pp. 403-437.

McKenzie, J. (1996). Designing staff development for the information age. *From Now On, 1* (4), 1.

Melheim, W. (1997). Instructional utilization of the Internet in public school settings. *TechTrends, 42* (2), 19-23.

Mendels, P.(1999) Study Finds Problems With Web Class., New York Times (Sept 22).

Mendels, P.(1999) Survey Finds Teachers Unprepared for Computer Use., New York Times (Sept 8).

Merrill, P., Hammons, K., Vincent, B.R., Reynolds, P.L., Christensen, L., & Tolman, M. (1996). *Computers in Education.* Boston: Allyn and Bacon.

Mertens, Donna M. (1998). *Research methods in education and psychology, Integrating diversity with quantitative & qualitative approaches.* Thousand Oaks, CA: Sage Publications.

Mevarech, Z.R. (1993). Who benefits from cooperative computer-assisted learning. *Journal of Educational Computing Research, 9* (4), 451-464.

Mevarech, Z.R., Silver, O., & Fine, D. (1996). Learning with computers in small groups. *Journal of Educational Computing Research, 7* (2), 233-243.

Miles, M.B., & Huberman, A.M. (1994). *Qualitative data analysis: An expended sourcebook.* Thousand Oaks, CA: Sage Publications.

Morrell, P.D. (1992). The effects of computer-assisted instruction on student achievement in high school biology. *School Science & Mathematics, 92* (4), pp.177-181.

Moursund, D. (2001). The learner and teacher aides of the digital divide. *Learning and Leading with Technology, 28* (5), pp.4-5, 48.

Newby, T., Stepich, D., Lehman, J., & Russell, J. (2000). *Instructional Technology for Teaching and Learning.* Upper Saddle River, NJ: Prentice-Hall.

Niemiec, R., & Walberg, H. J. (1985). Computers and achievement in the elementary schools. *Journal of Educational Computing Research, 1* (4), pp.435-440.

Niemiec, R., & Walberg, H.J. (1987). Comparative effects of computer-assisted instruction: A synthesis of reviews. *Journal of Educational Computing Research, 3* (1), pp.19-31.

Niemiec, R., Sikorski, C., & Walberg, H.J. (1996). Learner control effects: A review of review and a meta-analysis. *Journal of Educational Computing Research, 15* (2), pp.157-174.

Patton, M. Q. (1980). Qualitative evaluation methods, *Thousand Oaks, CA; Sage Publications.*

Patton, M. Q. (1990). *Qualitative evaluation methods*, Thousand Oaks, CA; Sage Publications.

Pelligrino, J.W., Baxter, G.P., & Glaser, R. (1999). Addressing the 'Two disciplines' problem: Linking theories of cognition and learning with assessment and instructional practice. *Review of Research in Education: Vol. 24*. A. Iran-Nejad and P.D. Pearson, Eds. Washington: American Educational Research Association, pp.307-353.

Piaget, J. (1965). *The Moral Judgment of the Child*. New York: Free Press.

Pittman, V.V., (1986). Station WSUI and the Early Days of Instructional Radio. *The Palimpsest: Vol. 67* (2), pp. 38-52.

Punch, K.F. (2000). *Developing effective research proposals*. Thousand Oaks, CA: Sage Publications.

Rakow, S.J. (1985). Excellence in school science. *School Science and Mathematics, 85* (8), pp.631-634.

Ren H.H., & Chao, M.S. (1998). A New Online Paradigm for Developing Courses, Teaching and Learning: A Project in the Asynchronous Learning Environment at National Chung Cheng University.

Rickard, W. (1999, January-February). Technology, education and the changing nature of resistance. *Educom Review, 39* (1).

Riley, P., & Gallo, L.C. (2000, January). Electronic learning environments: Design considerations. *T.H.E. Journal*, pp.50-54.

Robinson-Staveley, K., & Cooper, J. (1990). The use of computers for writing: Effects on an English composition class. *Journal of Educational Computing Research, 6* (1), pp.41-48.

Roblyer, M.D. (1992). Computers In Education. *In MacMillan Encyclopedia of Computers*. G. Bitter (Ed.). New York: MacMillan, pp,332-345.

Roblyer, M.D.(1997). *Integrating the Internet Into Your Classroom: Teaching with the CCCNet Curriculum*. Upper Saddle River, NJ: Prentice-Hall.

Roblyer, M.D., Castine, W.H., & King, F.J. (1988). Assessing the impact of computer-based instruction. *Computers in the Schools, 5* (3/4), pp.11-149.

Rogers, E. (1995). *Diffusion of Innovations*. New York: Free Press.

Rogers, P. (2000). Barriers to adopting emerging technologies in education. *Journal of Educational Computing Research, 22* (4), pp.455-472.

Russell M. & Haney, W. (2000, March 28). Bridging the gap between testing and technology in schools. *Education Policy Analysis Archives, 8* (19).

Ryan, R. (2000, January). Student assessment comparison of lecture and online construction equipment and methods classes. *T.H.E. Journal*, pp.78-83.

Ryser, G., Beeler, J.E., & McKenzie, C.M. (1995). Effects of a computer-supported intentional learning environment (CSILE) on students' self-concept, self-regulatory behavior and critical thinking ability. *Journal of Educational Computing Research, 13* (4), pp.375-385.

Salomon, G. (1996). New information technologies in education. *Encyclopedia of Educational Research*. M. Alkin (Ed.), New York: MacMillan, Vol.3, pp.892-903.

Salvia, J., & Ysseldyke, J. (2001). *Assessment*. Boston: Houghton-Mifflin.

Sammons, M.C. (1994). Motivating faculty to use multimedia as a lecture tool. *T.H.E. Journal, 21* (7), pp.88-90.

Scardamalia, M., & Bereiter, C. (1996). Computer support for knowledge-building activities. *CSCL: Theory and Practice of an Emerging Paradigm*. T. Koschmann (Ed.), Mahwah, NJ: Erlbaum.

Schachter, J., & Fagnano, C. (1999). Does computer technology improve learning and achievement? How, when, and under what conditions. *Journal of Educational Computing Research, 20* (4), pp.329-343.

Scheffler, F.L., & Logan, J.P. (1999). Computer technology in schools: What teachers should know and be able to do. *Journal of Research on Computing in Education, 31* (3), pp.305-322.

Scott, T., Cole, M., & Engel, M. (1992). Computers and education: A cultural constructivist perspective. *Review of Research in Education, 18*, pp.191-251.

Sherman, L.W. (1988). A comparative study of cooperative and competitive achievement in two secondary biology classrooms: The group investigation model versus an individually competitive goal structure. *Journal of Research in Science Teaching, 26* (1), pp.55-64.

Sherry, L., & Lurie, J. (1997). Linking Internet, learning, and assessment. *Technology and Assessment.*

Sivin-Kachala, J. (1997). *Report on the Effectiveness of Technology in the Schools.* New York: Software Publisher's Association.

Soon-Choi, B., & Gennaro, E. (1987). The effectiveness of using computer simulated experiments on junior high students' understanding of volume displacement. *Journal of Research in Science Teaching, 24* (6), pp.539-552.

Stake, R.E. (1995). *The art of case study research.* Thousand Oaks, CA; Sage Publications.

Strauss, A. & Corbin, J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques.* Newbury Park: Sage Publications.

Strauss, H. (1999, January-February). The future of the web, intelligent devices and education. *Educom Review, 34* (4).

Susman, E. (1998). Cooperative learning: A review of the factors that increase the effectiveness of cooperative computer-based instruction. *Journal of Educational Computing Research, 18* (4), pp.303-322.

Taylor, S.J., & Bogan, R. (1998). *Introduction to qualitative research methods: A guidebook and resource.* New York: John Wiley & Sons.

Tergan, S.O. (1997). Conceptual and methodological shortcomings of hypertext/hypermedia design and research. *Journal of Educational Computing Research, 16* (3), pp.209-238.

Tierney, R.J. (1996). *Redefining computer appropriation. Education and Technology: Reflections on Computing in Classrooms.* C. Fisher, D.C. Dwyer and K. Yocam (Eds.), San Francisco, CA: Jossey-Bass, pp.169-183.

Tuckman, B.W. (1999). *Conducting Educational Research.* Fort Worth, TX: Harcourt Brace College Publishers.

United States Department of Commerce. (2000). *Falling Through the Net: Defining the Digital Divide.* Washington: Department of Commerce.

United States Department of Education. (2000). *The Condition of Education: 2000.* Washington: United States Department of Education.

Vygotsky, L.S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.

Weight, B., & Bishop, T. (2000). Epilogue: The human promise. *The Online Technology Guide*. K. White and Bob Weight (Eds.), Boston: Allyn & Bacon,pp.183-188.

Werstch, J. S. (1985). *Vygostky and the Social Formation of the Mind*. Cambridge, MA: Harvard University Press.

White, K. (2000). Face-to-face in the online classroom. *The Online Technology Guide*. K. White and Bob Weight (Eds.), Boston: Allyn & Bacon, pp.1-12.

Yang, Y. (1991-92). The effects of media on motivation and content recall: Comparison of computer and print-based instruction. *Journal of Education Technology Systems*, *20* (2), pp.95-105.

Appendix A: The Description of the Case

The Description Of The Case

The case study was designed around a course offered by the Department of Restaurant and Resort Management. The course was offered to both undergraduate and graduate students, and was a required course for these students in this department. The course focused upon food purchasing and production in a food service system. The purpose of the course was to improve the student's understanding of these components and their relationships to one another. Students were taught the mechanics of purchasing food of appropriate quality and quantity in order to meet food production and service requirements. Students learned the importance of a control system, including inventory, cost and quality control as it relates to purchasing, storage, and preparation. General issues of food service operations were also addressed such as, equipment needed, food safety, and current topics in the food service industry. The course objectives were written in terms of student learning objectives. These objectives were available on the course's World-Wide Web site. The majority of these objectives were closely tied to a series of case studies. Students were asked to learn background material relevant to decision-making activities related to those case studies. This course included an emphasis on web-based learning. Web Course Tools (WebCT) was utilized as the framework for the course.

The class web site has a news page (bulletin) that provided all guidelines for the class to include: all announcements, any changes, correspondence regarding assignments and current events. WebCT provided an interface for class discussion groups, e-mail, chat, taking on-line quizzes, and on-line grade book.

Beginning of the Case

The course was scheduled to meet Monday, Wednesday and Friday, 50 minutes per session, from 12:10 pm until 1:00 pm. The beginning sessions met in the assigned classroom for the course, Gifford Building 213, and not the computer laboratory. As soon as the researcher had permission and approval for the research, data collection for the case study began. Session One included the distribution and explanation of the consent forms; a copy is attached to this document.

Explaining Consent Forms

Consent forms were utilized to define the pool of students participating in this study. Students were told that if they were under 18 years of age, they would need a parent or legal guardian to sign and return the form no later than the following week before they could participate in this study. Students were instructed during this session that their participation in this study was strictly voluntary and their election not to participate would not affect the outcome of their grade in the course. The instructor would have no knowledge of those participants' identities in this study or how they responded to any questions during this study. Those students of age were instructed that they could then sign the consent form and place them in envelopes provided, or turn them into the instructor's assistant during that session. The instructor's assistant, under the direction of the principal investigator, listed those students who participated in this study.

Class Setting

At the beginning of the research, the investigator held an orientation that explained and demonstrated the software to be used during this case study. The software utilized, WebCT, allowed faculty to observe student progress and student interactions on the Web site, and permitted faculty to design their courses and place them on the Web in a password-protected environment. A portion of the discussion explained the specific design of this food purchasing course, FN311, using WebCT. By the end of orientation, a thorough explanation of the computer hardware and software utilized in this case study had been presented.

The participants began the research study by listening to a narrated PowerPoint slide show explaining the use of the university software (WebCT). Additionally, all participants were given their own personal CD-ROM, which contained the lectures and all course materials. As part of their orientation, students were asked to read one of many course content related articles that were used as on-line practice. Each student was directed to post feedback on the course Bulletin Board about his or her interpretations of the article's content and the relationship to the reading assignment in Chapter One of the textbook. A copy of the course syllabus in Appendix G provides the objectives and content of this food purchasing course, FN311.

When the researcher had permission and approval for this case study, the participants were instructed to meet weekly, Monday, Wednesday and Friday, 50 minutes per session, from 12:10 pm until 1:00 pm in the university computer laboratory. Single case studies, student evaluation of current purchasing trends obtained by researching articles from the World Wide Web, and inventory simulations were used as learning activities for this course. To assist in student performance, a five-question, mini-quiz was assigned after each lecture. Quizzes were graded on-line, which provided immediate feedback to students. After submitting the quiz to grade, the software enabled the instructor to place comments next to the correct or incorrect answers, which verified what page in the text the material could be found for review. There was no penalty assessed for wrong answers.

Three on-line tests were administered during the semester, along with one cumulative exam. Students were required to be present during all tests that were proctored by the instructor and, usually, two teachers' assistants. Tests were password protected. When all students were ready, the instructor told them the password. Each test was graded on-line; however, the instructor waited until all students were finished and student attendance was verified before releasing test grades and feedback to students. Several tools used for students to access and understand content were textbook reading assignments, PowerPoint narrated lectures and class bulletin board. Also, email and the WebCT chat room were used to complete learning activities and communicate with the instructor.

Instruments Utilized in Obtaining Archival Data

Data was collected four times during the research study. Each of the four data collections represented the opinions and responses of students' experiences regarding the CAI course.

Student Pre-questionnaire

The pre-questionnaire contained six open-ended questions that were emailed to all participants in this research study for their responses. The responses were retrieved from a password protected email site that was not accessible by the researcher or the instructor. All emails were transcribed via third party using WordPerfect (version 5.1.) with no identifier as to the source. These data files were stored on 3.5-inch Microfloppy disks. These WordPerfect files were later changed to text files. The responses to the pre-questionnaire are identified as "Data Source One" of the archival data.

Mid-term peer evaluation

A midterm peer evaluation was conducted by the CSU Director of the Center for Teaching and Learning. To complete the midterm evaluation, students were asked for their responses to six open-ended questions regarding their experiences to date in the CAI course. Student responses are recorded on a "Student Course Survey" form to use for this process. The student course survey form has ten numbered spaces (#17-26). Five spaces are usually reserved for instructor-generated questions (#17-20) and six for student responses (#21-26). One group is asked to volunteer what they consider their number one appreciation, which is then listed on the board or overhead. That item becomes #21. Then surface a second appreciation, which becomes #22. A third becomes #23. Next, the entire class is used to assess concerns and recommendations (#24-26). Similar to the process described above, another group is asked to volunteer what they consider their number one concern but to link a concern with a specific recommendation. The first concern and recommendation are listed on the board or overhead. That item becomes #24. Then surface a second concern and recommendation, which becomes #25. A third becomes #26. For groups which insist that they have something important to add, you can note that there is space on the back of each form for written responses.

The written student responses were recorded on a "Student Course Survey" form used for this evaluation. Then, the hard copies from the midterm peer evaluation were collected by the facilitator to protect the documents for subsequent data analysis. The written student responses recorded on the "Student Course Survey" form are identified as "Data Source Two" of the archival data.

Student Post - questionnaire

The post - questionnaire contained six open-ended questions which were emailed to all participants in this research study for their responses. The responses were retrieved from a password protected email site that was not accessible by the researcher or the instructor. All emails were transcribed via third party using WordPerfect (version 5.1.) with no identifier as to the source. These data files were stored on 3.5-inch Microfloppy disks. These WordPerfect files were later changed to text files. The responses to the post - questionnaire are identified as "Data Source Three" of the archival data.

Post-personal Student Interviews

The post - personal interviews contained eight open-ended questions and were conducted the last week of the semester. These post - personal interviews were conducted by third parties; three different doctoral students, administered these interviews over a three day period. The participants volunteered for these personal interviews, which were approximately 30 minutes in length. The responses were tape-recorded , with the full knowledge and agreement of the participants. These recordings were verbatim accounts.

The audiotapes were collected by the facilitator to protect them for subsequent data analysis. This information was then archived. After the semester had ended, each of the interviews was transcribed via third party using WordPerfect (version 5.1.). These data files were stored on 3.5-inch Microfloppy disks. These WordPerfect files were later changed to text files. The post-personal interviews will be referred to as "Data Source Four" of the archival data.

All of the data for this research was held in security by the chairperson for the Department of Food Science and Human Nutrition, as each data source was being collected. At the end of the semester after the final grades sheets were compiled, the researcher received the data for this project from this archive.

Colorado State University

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH PROJECT

Project Title: Students' Perception of "Computer Assisted Instruction".
Principal investigator: William Timpson, Ph.D., Director Center for Teaching & Learning
Co-investigator: Richard Donnelly, Instructor
Contact name and phone number for questions/problems: Richard Donnelly, Instructor (970) 491-3890 Donnelly@ cahs.colostate.edu
Purpose of research The objective of this research project is to analyze the students' perception of "Computer Based Instruction" which may lead to enhancement and delivery of course content using technology. The use of "Computer Based Instruction" is relatively new and there has been little research that analyzes the students' perception.
Procedures to be followed: Students in the FN 311 Food Service Systems-Production and Purchasing class) will be Using Web-CT to complete assignments, view and listen to narrated Power point slide shows as part of the class requirements. They will be asked via Web-CT several open ended questions regarding their experience during the course. Richard Donnelly is one of the instructors for this class and has the responsibility of communicating with students and monitoring their progression through course content and for participation. To analyze student assessment of the course content quality, Richard Donnelly will analyze this on-line information for each student of this Case study in qualitative research using the methods of content analysis and deductive coding. At the end of the semester, students will be asked if they would like to be interviewed or answer survey questions explaining their experience. The survey will be sent to students using Web-CT. The students may return the survey via Web-CT or they may mail or fax the survey back to Richard Donnelly. The survey will be completed anonymously.
Risks: This project is for educational research only. There are no known risks. It is not possible to identify all possible risks in research study, but the researchers have taken reasonable safeguards to minimize I'll known and possible, but unknown, risk.
Benefits: There are no known benefits for you, but your experience will help us with development of future online course material.
Confidentiality: All information given by you will be confidential and used for research purposes only. No one will have access to any identifying information, such as your name and your name will not be used in any data analysis. Final reporting for the project will not show any names or other identifying information in order to keep confidentiality.
Participation: Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled. Your signature acknowledges that you have read and understand the information stated and willingly signed this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document containing (1) one page.

Participant name (printed)____
Participants signature ______________________________Date __________
Investigator or co-investigator signature _________________Date ___________

Page 1 of 1 Subject initials ___ Date ____

Appendix B: Student Pre-Questionnaire

Student Pre-Questionnaire

Qualitative questions asked on the Student Pre-questionnaire.

1. Could you describe your experience in the course this semester?

2. What is your perception of the course that was taught this semester using web-CT?

3.Could you give me some examples of what was good about your experience in the course this semester?

4. Could you give me some examples of what was not so good about your experience in the course this semester?

5. If you could change anything regarding the course- what would it be and how would you change it?

6. Is there anything else you would like to tell me about your experience in the course?

Appendix C: Mid-term Peer Evaluation

<u>MID-SEMESTER</u>
STUDENT FEEDBACK:

Questions from Dr. Timpson during the in-class Food Purchasing course (FN311) Mid-term evaluation

Using the student course survey form, please indicate in Part III the degree to which you agree or disagree with each statement according to Dr. Timpson's Directions.
The following questions were written and provided by Dr. Timpson for students to answer. If they did not choose to answer the questions students wrote their questions and comments in Part IV.

Appreciations

12.The course offered a variety of ways to learn material.

13. The course allowed you to learn at your own pace.

14. The course was designed to allow student's ample opportunity to review.

Concerns & Recommendations

15. Advance notice of the course design would have been helpful.

16. The opportunity to take the entire course at students own pace (including examinations).

17.The debriefing process (the mid-term peer review) if conducted earlier in the semester would be of more value.

18. Was a third party facilitator needed?

<u>MID-SEMESTER</u>
STUDENT FEEDBACK:
THE CLASSROOM MEETING
RECOMMENDED STEP-BY-STEP PROCESS

Instructors will need to obtain the "Student Course Survey" form from the Office of Instructional Services to use with this process.

NOTE: This process should take 25-30 minutes depending on the size of the class and the amount of interest which gets stirred up. Remember that there is an important relationship to learning here, both an opportunity to open new avenues of communication with students as well as provide a reason for students to think more deeply about their own learning, to take some responsibility in articulating what works for them and what they may need. If you are facilitating this process for someone else, you will obviously need to have a conversation ahead of time so that you can have the instructor supplied questions in hand. It can also prove useful to observe one class before the session when you will be asking for student feedback so that you can get a feel for the space and the students. In addition, we can also recommend that you stick with what the students reported before offering your own observations. In general, you want to avoid subjective judgments (e.g., "That was a good class.") and let the instructor take the lead on asking for your opinions and ideas.

1. Review the rationale, goals and procedures

Given the need to be efficient with time and conserve your attention to course content, we think it important that you remind yourself of the goals and procedures, especially if this process is new to you.

2. Hand out Student Course Evaluations

Using the existing form will ensure consistency with campus policies as well as allow you to machine score the results and get a prompt analysis. In a large class, this can take time, so be conscious of doing this as efficiently as possible.

3. Explain rationale and procedures to students

Thank the students in advance for their time and attention. If you are facilitating the session for someone else, ask the instructor to stress the importance of this feedback and then remind the students that you are there at the instructor's request because s/he is genuinely interested in student feedback and wants to consider any improvements which might surface. Emphasize that you are conducting this assessment to affirm what is going well as well as to identify concerns and recommendations for making improvements while there is still time in the semester to make changes. Ask for any questions.

4. Note spaces for instructor questions and group responses

The student course evaluation form has ten numbered spaces (#17-26) where you can specify questions which the instructor has and get group responses for recommendations which the students generate. We recommend reserving five spaces for instructor generated questions (#17-20) and six for student responses (#21-26).

5. Give students up to 4 instructor provided questions (#17-20)

Using either the board or the overhead, have students write in a phrase which captures what you or the instructor want to ask. For example, some instructors will want to know about certain aspects of lecture, if the pace is right or if the examples are helpful, questions which are more specific than what is asked in the general section of the Course Evaluation from (i.e., items #1-15).

6. Have students complete the evaluation form individually

This should require approximately 5-7 minutes. If students finish in less time, then you can encourage them to write out specific comments in the open space provided or on the back.

7. Have students form small groups to explore areas of agreement

If you are in a large lecture hall with fixed seating, students can check with those around them. Allow 6-7 minutes for this. Remember that the small group time helps students clarify their ideas as well as find areas of agreement. Becoming more conscious of their own learning can help you get more useful feedback as well as improve their own chances of success in other classes and beyond. There is no substitute for self-reflection.

8. Use the entire class to assess appreciations (#21-23)

Now ask one group to volunteer what they consider their number one appreciation. List that on the board or overhead. That item becomes #21. Then surface a second appreciation which becomes #22. A third becomes #23. For groups which insist that they have something important to add, you can note that there is space on the back of each form for written responses.

9. Use the entire class to assess concerns and recommendations (#24-26)

Similar to the process described above, ask one group to volunteer what they consider their number one concern but to link a concern with a specific recommendation. List the first concern and recommendation on the board or overhead. That item becomes #24. Then surface a second concern and recommendation which becomes #25. A third becomes #26. For groups which insist that they have something important to add, you can note that there is space on the back of each form for written responses.

10. Concluding activities and comments

When they finish, plan to collect the responses in as efficient a manner as possible. Thank students for their time and attention. Note that either you or the instructor will get all their responses and will then be able to discuss what changes might be possible.

Appendix D: Student Post – Questionnaire

Student Post – Questionnaire

Qualitative questions asked on the Student Post – Questionnaire.

1. Could you describe your experience in the course this semester?

2. What is your perception of the course that was taught this semester using web-CT?

3. Could you give me some examples of what was good about your experience in the course this semester?

4. Could you give me some examples of what was not so good about your experience in the course this semester?

5. If you could change anything regarding the course- what would it be and how would you change it?

6. Is there anything else you would like to tell me about your experience in the course?

Appendix E: Post- Personal Student Interviews

Post- Personal Student Interview- Questions

Time: ____ **CD-ROM Version: Yes____No____**
Day ____
Name:____________________
Evaluation Questions for FN311 .

1. Please describe your experience, so far, in FN311 this semester?

2. What is your perception of the FN311 course taught this semester using web-CT?
Did you use a CD-ROM disk? If yes, tell me about that experience.

3. Could you give me some examples of what was good about any experience in the course this semester?

4. Could you give me some example of what was not so good about your experience and suggestions of how to change that to be better?

5. If you knew at the beginning of this course, what you know now, What advice would you give to a student currently registering to take this class next semester?

6. If you could change anything regarding the course- what would it be and how would you change it?

7. Was there any difference in learning class material (like course content) whether the instructor was physically in the computer lab or not?

8. Do you feel like you have learned the course material?

9. Is there anything else you would like to tell me about with your experience in the FN311 course?