COMPUTER LITERACY AND THE COMMUNITY COLLEGE STUDENT

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THESIS: COMPUTER LITERACY AND THE COMMUNITY COLLEGE STUDENT

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ABSTRACT

Computer science faculty at most universities claim computer literacy courses are no longer relevant. Results of this study showed that the urban community college student benefited from computer literacy instruction, regardless of age, prior computer experience, or pre-course computer proficiency. The students were enrolled in introduction to computer science for non-majors. They were grouped based on enrollment in a day, evening, or online course to control for possible demographic influence on computer skill. A self-assessment survey of computer skills was administered pre- and post-course to measure the effect of instruction on knowledge of computer hardware, operating systems, computer applications, Internet literacy, and multimedia. All student groups showed statistically significant improvement in computer aptitude. They achieved proficiency scores equal to or exceeding those of university students. Computer literacy instruction is advantageous to the community college student. It promotes computer mastery and ensures opportunity and accessibility to technology.

CHAPTER I

INTRODUCTION

Background

There is no doubt about it. Americans are wired. The use of a computer has become so commonplace that it is difficult to imagine when it was not a part of our everyday experience at work, at school, or at home. The latest statistics indicate that some 70 million computer users in the United States send or receive email daily via the Internet (The Pew Charitable Trusts, 2006). Over 75% of American homes possess a computer (Piller, 2006).

However, computing history reminds us that computer machinery was not always designed for general use. The first electronic computing machine, the Electronic Numerical Integrator and Computer, also known as the ENIAC, was eight feet high, three feet wide, and 100 feet long (Wiliams, 1997, p. 272). In the 1960s, computers were still large in physical size and housed in large, temperature and dust-controlled rooms (Mandell, 1986, p. 230). These expensive, monolithic creatures of computing power, called mainframe computers, were used by corporations and organizations to perform complex calculations and to exchange information with their personnel.

The design and use of the computer changed dramatically with the invention of the personal computer (Impagliazzo, 2000; Mandell, 1986). Although somewhat limited in its computing capability, the PC or personal computer was introduced in the mid-1970s. Mainframe computing power had been scaled down into a box the size of a small

television set and placed in the hands of the everyday user. By the early 1980s, the development of software programs for the personal computer changed the way people worked. Typewriters were tossed out as word processing computer programs produced documents free of erasure marks. Hand calculators and rulers were idle as computer spreadsheet programs produced budgets and dazzling charts with only a few keystrokes. Personal computers could even be purchased for home use and entertainment.

The invention of the personal computer impacted colleges and universities as well. Computer science faculties were compelled to develop a "computer literacy" course for students who wanted to acquire computer skills, regardless of their major or career objective (Ryder, 1984). The content of this computer science course for non-majors might include material on "a combination of computer appreciation, programming, applications and societal impact," as recommended by the 1978 Association of Computing Machinery (ACM) Curriculum Committee on Computer Science (as cited in Ryder, 1984, p.102). The need to provide computer usage skills to the non-major became increasingly apparent as personal computers in the workplace proliferated. A computer literate student would possess the technical skills to produce, process, and manipulate information in an electronic form. A new literacy had emerged.

Statement of the Problem

The personal computer has been widely used on the job, in schools and in the home for nearly a quarter of a century. Within this period of time, technical advancements such as the Internet and other forms of digital entertainment have attracted new computer users. In 2001, the United States led the world in Internet usage with a

count of some 91 million users (Battey, 2001). Today, American children indulge in many forms of computer-based entertainment, including electronic games, music, and movies, and Internet activities (Wallis, 2006).

After a generation of computer usage, college faculty who teach computer literacy courses report that many students have sophisticated computer skills. As early as 1989, one computer science professor noted that students knew far more than the textbooks used for the course (Myers, 1989). Some computer science faculty believed the course had lost its academic rigor because the course content emphasized application skills over computer concepts (Goldweber, Barr, & Leska, 1994). Edmiston & McClelland (2001) reported that some college faculty did not foresee the need for computer literacy courses by the year 2000, as students would demonstrate accomplished computer skills, acquired, perhaps, by years of training received in the K-12 grades. One university newsletter published results of a survey indicating their freshman students were sufficiently computer literate (University of California, Davis, 1995). The survey asked students about their "computer experience, skills, and comfort level with computers." The report on the results of this survey concluded "...we may assume that high schools and parents have successfully introduced incoming students to the increasing role computers play in society, and that the University must now build on that introduction." Researchers Karsten and Roth (1998), however, could not conclude that early computer experience necessarily resulted in substantial benefit to students at the college level (as cited in Compton, Burkett, & Burkett, 2002, p. 222).

The computer science faculty at community colleges faces a more complex dilemma when evaluating the purpose and need for a "computer literacy" course in their curriculum. The primary task is to evaluate the academic content of the course and assess student computer knowledge and skills. The community college faculty must also consider the academic and societal impact of "computer literacy" courses.

The introduction to computer science or "computer literacy" course at community colleges has a history in supporting an academic program for student achievement and success. At many community colleges, introduction to computer science for non-majors is a core course in the two-year academic program (West Los Angeles College, 2006, Academics). The three-unit course fulfills a critical thinking general education requirement for the Associate's Degree, the only degree conferred by a community college. The course is also a pre-requisite to completing certificate programs in computer science designed to prepare students for immediate employment. Most community colleges offer several sections of this introductory course and draw substantial enrollment.

However, unlike most university students, community college students rely on the institution to acquire computer skills. Ongoing research of the urban community college student document academic and socioeconomic differences between the university and community college student (Transfer and Retention of Urban Community College Students, 2005, p. 1). Based on a national survey by the American Association of Community Colleges, a significant number of students attend a community college to gain computer skills (Phillippe & Valiga, 2000). The report identified specific student

populations that claim computer inexperience. Among these student populations were single parents, the unemployed, and first-generation students or students who are the first in the family to attend college. Over 23% of students in these groups attended college to gain computer literacy. Over one-third of the students 40-years-old and older also reported this purpose for attending college. Similar statistics point to a deficit in student Internet skills and Internet access. The socioeconomic factors that differentiate computer users from non-users, also referred to as the "digital divide," persist at the community college level (de los Santos Jr. & de los Santos, 2000). The need for a computer literacy course accessible to all community college students is profoundly stated here.

The introductory computer science class for non-majors at the community college draws students with a wide range of computer knowledge and experience. One student in the evening class may be working full-time and using computer applications on a daily basis while another student in the day class may be returning to school after years of raising a family, having little to no experience with a computer. The course material assumes no prior computer experience. However, new uses of and improvements in computer technologies increase the demand for "computer literacy" skills and add to the course content of the introductory course. This is the challenge to faculty teaching computer literacy courses in the community college.

This study addressed a current issue of interest to computer science faculty at the community college. The issue is: does the introduction to computer science, computer literacy course, serve its role in preparing students to achieve computer literacy? Do students already know the course content, or if not, do they show increased skill level

after completing the course and thereby show increased knowledge? To assess the claim of knowledge transfer, the study collected data from three student groups. The three student groups were:

a) campus day-- enrolled in the introduction to computer science course during a day course offering, prior to 4:20 p.m.

b) campus evening-- enrolled in the introduction to computer science course during an evening course offering, after 4:20 p.m.

c) online-- enrolled in the introduction to computer science course accessible only by Internet. Student uses personal computer to access course.

The rationale to examine differences between day and evening students is in accordance with community college research practice (Los Angeles Community College District, 2006). A unique characteristic of the community college is its offering of full academic programs to day and evening students. Comparing data from the two student groups might detect differences between the day student, such as a student just out of high school, the unemployed, or of a homemaker, and the evening student, such as a full-time employee or person unable to attend traditional day classes.

The online student group presents a unique opportunity to address pre-course computer literacy skills. Will the online student group possess the computer literacy skills necessary to take an online course? Will they learn anything from taking the course whose purpose is to acquire computer literacy skills?

Another issue of interest is the computer background of students enrolled in the computer literacy course. What prior experience do they have with computers? Is there a difference among the student groups with regard to computer knowledge?

Purpose of the Study

The purpose of the study is to assess the knowledge gained by the community college students enrolled in the introductory science course for non-majors. The curriculum includes the identification of personal computer hardware, use of operating system file management, use of application software such as word processing and spreadsheet programs in a business setting, and Internet user skills. These computer skills are identified by the Association of Computing Machinery (ACM Two-Year College Education Committee, 2004) and are listed in Table 1.

Table 1

Description of Student Performance Objectives

ACM Code	Objective
UCA-01	Demonstrate proficiency in the use of office productivity knowledge work software (word processing, spreadsheet, database, email, web browser and presentation software).
UCA-05	Conduct web-based research; demonstrate proficiency with online documentation and help files.
SHS-05	Describe basic computer software, including operating system (interoperability, standalone, network, and multi-user) and application software.
SHS-06	Perform installation and configuration of system hardware and components.
SHS-07	Perform installation and configuration of operating system and application software.

UCA = Using Computer Applications
SHS = System Hardware and Software
Number indicates level of difficulty within a category.

A self-assessment survey required students to perform a self-rating of these computer literacy skills. An additional skill area, use of multimedia, is now a function of computer operating systems, and was included in the survey. The survey, administered both pre- and post-course, would show the effect, if any, the course had on improving computer skill levels. Significant improvement of skills would highly suggest the sustained need for the introductory course and support its place in the computer science curriculum. The analysis of the data may be used to validate the course content and the course's purpose to develop computer literacy skills.

A second purpose of the study is to identify characteristics of students enrolled in the introductory computer science course for non-majors. Multiple-choice items included in the survey collected student information regarding age, gender, and computer experience. Additional survey questions asked students about attitudes toward online learning. Data collection and analysis of each student group would assist computer science faculty and college administrators in the planning and scheduling of this course.

This study was similar to other computer literacy studies by focusing on a selective group of college level students and assessing computer abilities. The investigators of these studies shared the same purpose, to test the null hypothesis that college students are sufficiently skilled in computer use and do not require instruction in applying computer skills in college studies, job tasks, or personal use. The need for the research studies were also similar, to evaluate abilities and deficiencies in the computer skills identified as critical and vital to the success of students for college level work and for vocational and professional preparation.

There were four significant factors distinguishing this study from other computer literacy studies. This was a research project addressing curriculum concerns of computer science faculty at a community college. The study focused exclusively on computer literacy skills taught and assessed in an introductory computer science course for non-majors at the community college. Computer literacy instruction can take the form of short-term courses, 1-unit courses (Utah State University, 2004). Computer literacy assessment is often administered during freshman orientations (Johnson, Lester & Ferguson, 2001; Gomm, 2004). This study applied a pre- and post-course assessment. The preference for this experimental model allowed the researcher to claim significance of the independent variable, in this case, the course instruction, on the dependent variable, computer skills, with greater confidence. A third distinguishing factor of this study was the collection of data from three distinct student groups. This study strategically examined the diverse community college population by collecting data on three identified student groups, the day, evening, and online student group. The fourth factor, the inclusion of an online student group, allowed the investigators to evaluate whether students choosing online instruction are necessarily more computer literate. The online student group data would supply data to technology educators who ask the question, "Can you teach technology with technology?"

Theoretical Bases and Organization

In this study, students were asked to self-rate their computer skills. This method of evaluation is called self-efficacy, or user confidence in performing a task (Johnson, Lester, & Ferguson, 2001). These investigators reported that student self-efficacy rating

of computer tasks was the strongest predictor of exam scores that tested for computer skills in word processing, file management, spreadsheets, databases, Internet use, and programming (p. 12). Self-efficacy scored above "number of courses completed and computer topics studied" as the strongest of the three predictors of exam scores (p.12). Compton, Burkett, & Burkett (2002) also found that self-efficacy was one of the strongest predictors of computer proficiency. "I know how to use computer programs" is an example of a self-efficacy response (p. 219). Utilization of research scales using self-assessment and self-perceptions of computer ability is acknowledged as a standard method for reliable data collection.

Limitations of the Study

The study was conducted and the results were analyzed with the following confines or limitations:

I. Only one community college participated in the study over a period of one semester.

II. Only one class of each student grouping, campus day, campus evening, and online, was asked to participate in the study.

III. Student survey data was analyzed for only those students giving permission to participate in the research study.

IV. The computer literacy skills surveyed were determined by computer science faculty. Students assessed their computer skills based on self-reporting or self-assessment.

V. There was no intent in this study to correlate survey results with confidential student information such as course test scores or socioeconomic data.

VI. Data collected from surveys did not always meet the requirement for statistical analysis. Reporting of percentages was performed.

Definition of Terms

*source for definition (Mandell, 1986).

*Application program-- A sequence of instructions written to solve a specific user problem.

Association of Computing Machinery (ACM)-- Computing organization dedicated to the advancement of computing and computer science education.

Community college-- A post-secondary school offering a 2-year Associate Degree (A.A.), programs vocational programs, and matriculation to the university.

Community college student-- Student enrolled in a community college. Typically, requirements for enrollment are 18 years of age or high school graduate.

*Computer hardware-- Physical components that make up a computer system.

*Computer literacy-- General knowledge about computers, including technical knowledge about hardware and software, the ability to use computers to solve problems, and awareness of how computers affect society. See also Computer literacy skills.

Computer literacy skills-- Definition of these skills vary with the institution, user group and current state of technology. Skills usually include application program skills in word processing, spreadsheets, knowledge of computer hardware, operating systems, and Internet proficiency.

*Database-- Collection of data that are commonly defined and consistently organized to fill the information needs of a wide variety of users in an organization.

Day student-- A student enrolled in a course offered in morning through late afternoon, prior to 4:20 p.m..

Evening student-- A student enrolled in a course offered in the evening, typically after 4:20 p.m..

Internet-- A network of computers accessible by computer users to retrieve data and information on a variety of subjects.

Information literacy-- The skill to search for information on the Internet using a personal computer. Also refers to the skill to evaluate validity of that information.

Multimedia-- Refers to graphics or pictures and sound that can be seen or heard with an electronic device such as a computer. Includes digital movies and music.

Online-- Method of offering a course that requires student use of a personal computer to access course material on the Internet.

*Operating System (OS)-- A collection of programs used by the computer to manage its operations; provides an interface between the user or application program and the computer hardware.

*Personal computer or (PC)-- A microcomputer; a smaller, low-priced computer used in homes, schools, and businesses; also called a personal computer or home computer.

Presentation program-- A computer application program that uses text, graphic images, and sound, and special effects to convey information.

*Programming-- The writing of step-by-step instructions that tells the computer exactly what to do; of two types, application and system.

Self-Assessment or Self-rating-- To assess or rate one's self based on self-perception or experience. See Self-Efficacy.

Self-Efficacy-- To rate one's confidence at performing a particular task.

Spreadsheet programs-- A computer application program that performs calculations in rows and columns of data.

*Word processing-- The manipulation of text data to achieve a desired output.

CHAPTER II

REVIEW OF THE LITERATURE

University and community college students use computer literacy skills to acquire and use information in their college courses. Yet, there are but a few studies that measure these skills, especially of the university student (Hoffman & Vance, 2003). The literature reveals the challenge to identify the computer skills that define computer literacy (Gomm, 2004; Zesotarski, 2000). Each university or community college seeks to prioritize them and incorporate the skills in a computer literacy course. Currently, most academic institutions recognize a set of core skills. These skills include word processing skills, information literacy skills, and use of the computer operating system. Few studies have documented the advanced computer skills of university students as reported in some literature. In contrast, the community college literature verifies that the academic institution must play a pre-eminent role in providing basic computer literacy skills to a diverse student population that often faces barriers to technology equity.

Computer Literacy Courses

Hoffman and Blake (2003) chronicled the early history of computer literacy courses in college classrooms. In the early 1970s, students learned about mainframe computers. Course content focused on data processing, the principle and theory of processing massive amounts of data, and the hardware and software used to perform it. With the emergence of personal computers in the mid-80s, business and industry began using computer application programs such as word processing and spreadsheet programs.

The prevalence of personal computers and preferred use of computer applications in business and industry pushed the applications course content to the forefront. In a few short years, computer literacy could be equated with possessing skills in "word processing, spreadsheets, business and presentation graphics, and file management" (Hoffman & Blake, 2003, p. 223). At this time, university faculty challenged the applications definition of computer literacy and called for a beefing up the course with more rigorous computing content as a "new generation" of computer literate students were on their doorsteps (Myers, 1989, p.177).

Computer literacy courses have changed to keep up with advancements in the computing world and with the increasing technical proficiency of students. To revitalize the course, Goldweber, Barr and Leska (1994) suggested a dual approach to the course by concentrating on computer concepts and theory in one short-term session followed by an application literacy course that focused on problem-solving utilizing computer application programs. By the late 1990s, Internet infrastructure had been established and Internet use skyrocketed. Hoffman, Blake, McKeon and Leone (2005) proposed that the use of the Internet as an information tool was surpassing the applications model of computer literacy. Information literacy, or the ability to acquire and evaluate information retrieved from the Internet, had been defined. The skills identified with computer literacy were the abilities to "connect to the World Wide Web, send and receive e-mail, participate in synchronous chat, use a search engine, and create word processing documents" (Hoffman & Blake, 2003, p. 222). Other faculty have taken the Internet based model further and offered the computer literacy course online or via the Internet

(Parker, Cheatham & Milling, 2002). Requiring students to use the technology they are in the process of learning was considered a practical method of teaching the subject. Other recent changes to the delivery of computer literacy instruction applied self-paced learning that allowed the student to fulfill requirements by testing out on computer competencies (Edmiston & McClelland, 2001; Utah State University, 2004).

Student Computer Literacy

University and College

A study by Johnson, Lester and Ferguson (2001) surveyed freshman at an agricultural college for self-efficacy or confidence in computer skills, and tested them on knowledge of computer skills. Faculty were concerned that students might not be aware of the growing need for technical skills in the field of agriculture. The computer literacy evaluation was held at a freshman orientation. Based on the test scores, the freshman students had a mean score of about 40% or a below average rating for computer literacy. Skills in word processing, e-mail, Internet use and opening and saving computer files, were considered either average or above average in mastery. Below-average skills included the use of spreadsheets, presentation graphics, databases and computer programming. The researchers concluded that students did not have an adequate level of computer expertise and recommended a required course in computer applications.

Hoffman and Vance (2003) reported that college freshman at their university perceived their computer literacy skill level as "good." Students were asked from whom or where they had learned their skills. The report showed they learned most of their skills at home, especially in learning how to do word processing, Internet searching and email.

The majority of the students had access to a computer and the Internet in the home. Family or friends, more than their teachers, were facilitators in learning computer skills. The researchers recommended that computer literacy instruction promote an even higher level of computer competency.

At one university, many students were first generation college students and did not have access to computers in the home (Edmiston & McClelland, 2001). Some students had no prior computer experience. However, the majority of the university students already had computer literacy skills that were taught in the computer literacy course ten years ago (p. 312).

Walters, Alphonce, Sherman, Burhans, and Kershner (2002) acknowledged the diversity of student computer skills at the university. They also recognized the "apprehension" that students may have in using the computer (p. 209).

Gomm (2004) carried out the most comprehensive study of computer literacy competencies at a university. The purpose of the study was to re-evaluate the specific skill set considered compulsory literacy skills. Specific skills would be considered "remedial" and eliminated from the compulsory skill set if the skill was accomplished by 80% or more of the students. A random sample of incoming freshmen took performance-based tests in six areas identified as required computer competencies. Gomm reported that the majority of the students tested were computer literate based on the university's skill set of computer literacy. Students excelled most in the email, operating systems, document processing, and information resources exam. The highest computer literacy scores were in Internet resources and document processing. Spreadsheets and ethics had

scores lower than 70% or non-competency. Students were referred to tutorials or short-term computer literacy courses to improve computer competencies if necessary.

Community College

The majority of community college students lacks the most basic of computer literacy skills and is at risk because of this deficiency. Technology inaccessibility is cited as a major cause.

Weglarz (2000) reported poor student computer literacy at a community college in the Midwest. Faculty claimed it was often difficult to assign coursework as students were often lacking computer skills to complete them. A survey of faculty and staff members indicated students were unable to perform the most basic skills such as starting and shutting down a computer, using a keyboard, opening and closing a file, editing, saving and printing a document. Internet searching, downloading information, and email skills were also deficient. The use of graphics, spreadsheets and databases was not considered as important for student achievement. However, most of the faculty responding to the survey considered computer skills very important to the success of the student. Recommendations to improve student skills included the creation of a Computer Resource Center at the college and a new course, Introduction to Computing, as a college requirement.

Community college student populations may fall behind technically to their university counterparts due to lack of computer accessibility. Phillippe and Valiga (2000), of the American Association of Community Colleges (AACC), offered glaring statistics of inaccessibility based on a 1999 survey of over 100,000 community college

students. Internet access was not available to many students in all age groups studied. This was true for nearly 60% of students in the age group 60 years of age or over. The cost of owning a computer ranked as one of the top five problems students have while attending college. Some 60% percent of the students surveyed stated the community "college provided a moderate to major contribution to their growth in computer skills" (p. 1). The community college student has little or no outside resource for acquisition of skills and experience with technology.

A report, *A Nation of Learners*, from the Business-Higher Education Forum (2003) cited alarm at the technology inadequacies that define students from a community college, and looked to this institution to improve student preparation for the global workplace. The report also described the disparity of technology access as 59% of university students own computers compared to 39% of community college students (p. 26).

Zeszotarski (2000) examined the role community colleges have in providing the technical skills students must have to broaden and enhance their learning. The suggestions were to include technical skills in non-computing college subjects and to implement a course in computer literacy as a general education requirement. Recommendations were made to make technology opportunities more accessible through technology. Accessibility might be improved through online education, as reported by community college investigators (Petrides, 2005; Smith, 2005).

A study of student computer literacy at the community college is critical to evaluate the need for computer proficiency curriculum. Documentation of student computer competencies is necessary to ensure student computer literacy is achieved.

CHAPTER III

METHODOLOGY

Design of the Investigation

To assess computer literacy skills of the community college student, the study applied a purposive, stratified, pre-course, post-course design. The students selected for the study were enrolled in Introduction to Computers and Their Use, also known as Computer Science 901 (CS 901). This course is described as providing instruction in "computer literacy" (West Los Angeles College, 2006, Computer Science and Information Technology). The pre-course, post-course design allowed for a comparison of computer skills after a semester of computer instruction and computer experience. The effectiveness of the course would be assessed by comparing skill levels from pre- and post-course student data. Increased skill levels would indicate the need for a computer literacy skills course and the validity of the course content.

Collection and analysis of student data by specific student grouping addressed the diverse characteristic of the community college population (Phillippe & Valiga, 2000). The stratified groups or student samples were distinguished by day, evening, or online enrollment. Day or evening enrollment has been a strategic variable in identifying differences among community college students (Los Angeles Community College District, 2006, Student Characteristics). Demographics such as age and socioeconomic factors influence the enrollment choices of many community college students. A distinctive characteristic of this study was the availability of an online student sample.

The data of students enrolled in the course offered exclusively online provided information on this relatively new student group. The stratified design was chosen to strategically collect and analyze data of the three student groups to identify computer literacy group differences.

Sample

The study was conducted at one of the colleges of the Los Angeles Community College District during the spring 2005 semester. The college's demographics include the following statistics (Los Angeles Community College District, 2006, Academics). At last census, the college student enrollment of the campus was approximately eighty-five hundred students. More than 75% of the student population was considered minority, with a predominance of 47% African-American enrollment and 28% Hispanic enrollment. Female students represented 65% percent of the college population and male students 35% percent. Student age groups were equally distributed but slightly higher for the younger age group, ages twenty to twenty-four years of age, compared to the age groupings of twenty-five to thirty-four years of age, and over thirty-five years of age. Student preference for day-only classes is slightly higher, at 38%, compared to 35% for enrollment for evening-only classes. The remaining 26% of students were enrolled in both day and evening classes. A statistic for online course preference has yet to be determined. All online students are enrolled in the college and are therefore included in the demographic data.

The subjects used in this study were enrolled in the computer science department's introductory computer science or computer literacy course, CS 901. To

obtain the stratified student samples, students were selected from one section of a day class offering, one section of evening offering, and from the newly created online course offering. To minimize instructor differences, a day and an evening section taught by the same instructor was selected. The sole online course offering was selected. It was the first time CS 901 was offered online at this campus. Students enrolled in these particular sections of CS 901, we assume, according to personal preference. The college offers several sections of this course during the day and evening and students are usually able to enroll in their section of choice. Only one class section was offered for the first time offering of the CS 901 online. Students enroll in the course, CS 901, for various reasons. Some students enroll to complete the critical thinking requirement of the Associate's Degree (West Los Angeles College, 2006, College Catalog), while others may enroll to complete computer science certificate programs, to upgrade work skills, or for personal interest.

The instructors of the classes participating in the study were tenured, full-time faculty of the computer science-information systems department. Both instructors have served as chairpersons of the department and have been instrumental in the teaching and development of the CS 901 computer literacy course since it was introduced to the college curriculum in 1989. The instructors selected the computer skills for the student survey and authored the questions and responses (M. Levy & C. Titus, personal communication, January 4, 2005).

Treatment

The treatment applied in this study was an introductory computer course, Introduction to Computers and Their Use, also known as Computer Science 901 (CS 901). This course, developed in 1989, has been taught by the computer science department to provide instruction on the concepts of and operational use of the personal computer. Therefore, it was the course selected for the survey of student computer literacy skills. The course has evolved over the years to stay current with technological advancements and workforce demands. The 3-unit course requires laboratory work to complete computer assignments involving computer hardware, computer operating systems, computer applications, Internet use, and use of multimedia. To accompany course lectures, the on campus students were assigned a college textbook, *Discovering Computers 2005* (Shelly, Cashman & Cash, 2005). In addition to the online course material, the online students were assigned the online tutorials provided by the publisher of this textbook. The online students had the choice to complete computer assignments at home or on campus.

Assessment Instrument

The assessment instrument consisted of a 35-question student survey. Twenty-five of the questions asked students to self-rate their knowledge of specific computer skills. Nine survey questions were included to gain information on student demographics and computer experience. One question from the survey asked the student to indicate their choice to participate or not participate in the study.

To assess the effectiveness of the treatment, the computer literacy course, CS 901, students were asked to self-rate their skill level in the areas of computer hardware, operating systems, computer applications, Internet use, and knowledge of computer multimedia. See Appendix A for a list of the computer skill items and the content area it examined. These computer skill items appeared on both the pre- and post-course student survey.

There were five available responses or choices for self-assessment:

a) I don't even know what this means.

b) I've heard of this, but wouldn't know how to begin.

c) I might be able to do this, but I'd need help.

d) I could do this, but I'd need to look up some steps.

e) I do this all the time--could do it in my sleep.

The reason for this untraditional method of assessment was to offer the student a range of choices to describe computer ability and for faculty to assess computer ability. A student asked to provide or select the correct answer in a traditional skill test would represent only choice d or e. The choices follow a linear or incremental development of skill. This concept of self-evaluation of mastery or self-efficacy, as reviewed in Chapter I, Theoretical Bases and Organization, and Chapter II, Literature Review, offers the investigator a research tool used in many previous studies showing high correlation with computer proficiency testing. The computer skills included in the survey are very similar to the skill categories referred to in computer literacy studies.

The assessment instrument was also used to collect empirical data on the background of students enrolled in CS 901. Why were they taking the course and what computer experience did they have? Would demographics factors correlate with any particular student group? See Appendix B for a list of questions included to obtain student profile data.

The inclusion of the online student group provided an opportunity to gain information on the demographic background and computer experience of online learners. The traditional campus students were also surveyed for attitudes toward online learning. See Appendix C for a list of questions regarding online education and the Internet.

Some questions in the survey were not included in data analysis because they were not directly related to the purpose of this study. For instance, one question asked if the student was interested in taking another computer course. The data was collected for the computer science department to plan for future scheduling.

Procedure

The computer literacy skills survey was administered to the students enrolled in three sections of CS 901 during the first two weeks of the spring 2005 semester. Prior to offering the pre-course survey, all students were advised of the purpose of the survey, to assess their computer literacy skills before and after completing the CS 901 course. The students were given assurance of confidentiality of survey results from the instructor until final grades were determined. The students were reminded to respond, "yes" or "no," to the survey question regarding participation in the research study.

Two methods were used to administer the student survey. One method was used for students taking the CS 901 course on campus. A second method was used for the students taking this course exclusively online.

The campus day and evening students completed surveys handed out to them by the researcher during class hours. This task took approximately twenty minutes of class time. The data was collected and tabulated by day or evening student group.

The CS 901 online students received the survey and the same instructions by accessing a link within the online course during the first week of the semester. The student survey for the online students could be completed online by clicking on a button to select a response. Subsequently, the student would click on a submit button to upload the survey responses to the online course delivery provider. The data was accessed by the researcher using the instructor password to tabulate the survey data. The online instructor had password access to the data but did not view it.

The post-course delivery of the computer literacy survey was administered in the classroom or online, as in the pre-course procedure. The on campus students were given an opportunity to take the survey during the last two weeks of the semester and on the day of the final. The online students were given access to the post-course survey on the day of the final by preference of the instructor. The students were offered the question to state their participation or non-participation in the study. The student survey data was collected and tabulated as used in the same pre-course methodology.

Data Analysis Procedures

The responses from the research instrument, a 35-question student survey, administered at the beginning and end of the introductory computer science course, were tabulated for data analysis. The data was separated by pre- or post-course status. The data was then distinguished by student group: campus day student, campus evening student, and online student. The configuration of the data table resulted in six distinct data groups. Table 2 shows the description of the six groups. The N represents all who responded to either a pre-course or a post-course survey, not exclusively students responding to both the pre-course and post-course survey. The purpose was to maximize the collection and breadth of assessment from both pre- and post-course samples. Survey data from students who completed a survey but chose not participate in the research study were excluded from all data analysis.

Table 2

Student Survey Data Samples

	(*n* of students participating in study)	
Student Group	Pre-course	Post-course
Campus - Day Student	20	19
Campus - Evening Student	19	17
Online Student	78	38

A statistical analysis was designed to evaluate self-rated computer skill level among the three student groups. Twenty-five computer skill questions were included in the pre-course survey. The same twenty-five questions were administered in the post-course survey. A statistical difference in self-assessment of computer skill from pre-course to post-course would reject the null hypothesis that the instruction received by the introductory computer science course had no effect on student computer skills. A positive gain in post-course computer skill level might also substantiate the need for the purpose of the course, to provide instruction in "computer literacy."

Weighted Mean

To determine overall computer skill level or "computer literacy," each computer skills question was given a weighted mean. This weighted mean would measure level of computer skill competency on a scale of 1 to 100. The weighted mean was calculated in three steps.

The first step was to assign a value to each of the five choices. Each computer skill question had five possible responses. The five choices, as described in the previous section, Assessment Instrument, rated student skill from the lowest level to the highest level. The lowest skill level, choice a, was assigned the value of one. The highest skill level, choice e, was assigned the value five. In sequence, choice b was assigned the value two, choice c was assigned the value three, and choice d was assigned the value four.

The second step used to calculate the weighted mean of each skill question was to determine the percentage of choice a, choice b, choice c, choice d, and choice e responses. For example, the responses to Question X of the Pre-course, Campus Day

student group, compiled 15% choice a responses, 20% choice b responses, 35% choice c responses, 20% choice d responses, and 10% choice e responses.

In the final step, step 3, the weighted mean of each skill question was derived by multiplying each choice's percentage by its assigned value, one to five. In this example, the weighted mean was calculated by adding the result of 15 x 1, 20 x 2, 35 x 3, 20 x 4, and 10 x 5. The sum, 258, was divided by 5, as there were 5 choices. The weighted mean for Question X of the Pre-course, Campus Day student group, is 58.

The weighted mean was determined for each of the 25 computer skill questions and tabulated by pre-course and post-course status and by student group.

Within Group Comparison

A *t*-test for dependent means was performed on pre-course and post-course data of each of the three student groups. The dependent variable in the *t*-test was the weighted means of the 25 skill questions. The test was performed to determine effectiveness of a computer course on computer skill level.

Between Group Comparison

A second statistical analysis was performed to compare gains in computer skills, if any, among the three student groups. A gain value was determined for each computer skill by looking at the weighted average of a skill question. The gain value was represented by taking the post-course weighted average and subtracting the pre-course weighted average. An *ANOVA* was performed on the gain values of all 25 computer skill questions to test differences among the three student groups. The dependent variable of

the *ANOVA* was the pre-course and post-course difference in the weighted means of all 25 computer skill questions.

Skill Category

A third approach to determine the effect of computer course instruction on self-assessed computer skills, was to categorize the 25 computer skill questions by type of skill, and look at the weighted means of each category. The five types of skill categories were hardware skills, knowledge of operating system skills, software application skills, Internet or information literacy skills, and use of multimedia skills. The weighted mean of each category was determined by summing the weighted mean of each skill question in a particular skill category and dividing by the number of questions in the skill category. For example, the weighted mean for the software application category consisted of nine questions. The weighted mean for the application skill category would be derived by adding the weighted mean of the nine questions and dividing by nine, the number of questions. Weighted mean increase or decrease in each of the five skill categories was examined.

Demographic Data

Data collection in the student surveys included demographic data to reference characteristics of the three student groups. Any differences found among the three groups would reject the null hypothesis, that all students enrolled in the same class, but at different times or mode of delivery, were the same. Analysis would advance the identification of the community college student as a diverse group. Chi square analyses were performed to determine the effect of group classification on student characteristics.

For these statistical analyses, the number of students belonging in each category was the dependent variable. For example, 14 students were male in the day class, 13 were male in the evening class, and 20 were male in the online class. Prior computer experience was also considered demographic data. See Appendix B for the list of survey questions used in this analysis.

Online Learning

To explore student skills and preferences for online learning, all three student groups were queried. The wording of these survey questions were necessarily different for the campus student groups versus the online student group. See Appendix C for a list of survey questions used. The three groups were compared by examining the percentage of each response.

CHAPTER IV

RESULTS AND DISCUSSION

To test the null hypothesis that students enrolled in the "computer literacy" course, CS 901, would not gain knowledge from instruction, data analysis was performed to test for a change in knowledge, increase or decrease, within each of the three students groups studied and between the groups studied. The groups studied were the campus day, campus evening, and online students. The data was obtained from a student survey of self-assessed skill administered to each group both pre- and post-course.

The data used in these analyses were the weighted means of each of the 25 computer skills surveyed. The procedure to calculate the weighted mean of each computer skill was described in Chapter III, Data Analysis Procedures. See Appendix D for the list of the computer skill questions and the weighted mean of each skill by student group and by pre- and post-course measurement.

The statistical analysis to evaluate the benefit of computer course instruction showed significance. The *t*-test of the weighted means of 25 computer skill questions showed that each of the three student groups, post-course self-assessed skill level was significantly higher than the pre-course, self-assessed skill level. See Table 3, Table 4 and Table 5 for pre-course and post-course scores by student group. The mean score reflects the overall computer skill or computer literacy rating of the group.

Table 3

t-test of Computer Skill Level - Campus Day Student Group

	n	*M*	*SD*
Pre-Course	20	68.4	11.9
Post-Course	19	86.8	9.7

$t(24) = -13.0,\ p<.01$

Table 4

t-test of Computer Skill Level - Campus Evening Student Group

	n	*M*	*SD*
Pre-Course	19	69.4	15.5
Post-Course	17	86.8	9.8

$t(24) = -8.94,\ p<.01$

Table 5

t-test of Computer Skill Level - Online Student Group

	n	*M*	*SD*
Pre-Course	78	78.5	15.2
Post-Course	38	89.9	9.8

$t(24) = -7.72,\ p<.01$

The mean values can be viewed as a computer literacy rating on a scale of 1 to 100. When used as a rating measure, all three groups showed some level of competency at the pre-course measurement. The competency level of the campus, day and evening group averaged about 69%, or a score that might be equivalent to a grade of C or passing. The online student group average was 78%, or close to a grade of B, or good competency rating at the pre-course level. One might expect a rating of 50% or chance level at the pre-course level if no prior competency was present.

The student groups were analyzed between groups to find a difference, increase or decrease, in computer skill level. To ascertain an increase or decrease in skill level, a difference score was calculated by subtracting the pre-course computer skill mean from the post-course computer skill mean. See Appendix B for the difference scores. An *ANOVA* was performed on the difference scores. Table 6 shows the mean, standard deviation, and variance of the difference scores for all three student groups. At $F=5.2964$, there was a significant difference as to the effect of student group on gains or decreases in computer competency level.

Table 6

Analysis of Variance of Difference Scores

	Mean	*SD*	*Variance*
Campus Day	18.4	6.94	50.15
Campus Evening	17.4	9.53	94.68
Online	11.46	7.27	55.02
Between			352.823
Within			66.16

$F(2,72) = 6.2964, p < .01$

The positive values of the student group means indicate a gain in computer competency after course instruction for all groups. While the mean was very similar for the campus day and evening groups, the mean of computer competency gain was distinctively smaller for the online group. There was no difference in gain between the campus day and evening group. This result might be expected, as the online pre-course competency level was 10 points or 10% higher than the campus day and evening group. The online pre-course students started at a higher baseline of computer competency and had less skill to acquire from instruction. An interesting result, from the data analysis, shows that all three student groups had very similar post-course, mean competency levels. At the post-course level, all three groups, the means or competency levels were at the range of 86 and 89. On a traditional grading scale of 1 to 100, the average course grade was B or B+. This was a very desirable result and indicated a high level of student

computer literacy from computer instruction. These scores are comparable and superior to the literacy test scores reported in research studies of university students. The online students, showing a higher pre-course competency, did not excel any more than the campus day and evening groups, at the post-course level. The null hypothesis, that students enrolled in the introduction to computer science course do not increase computer competency due to the instruction, is rejected.

An analysis of pre-course post-course skill levels by skill category revealed the depth of skill improvement in all student groups. See Figure 1.

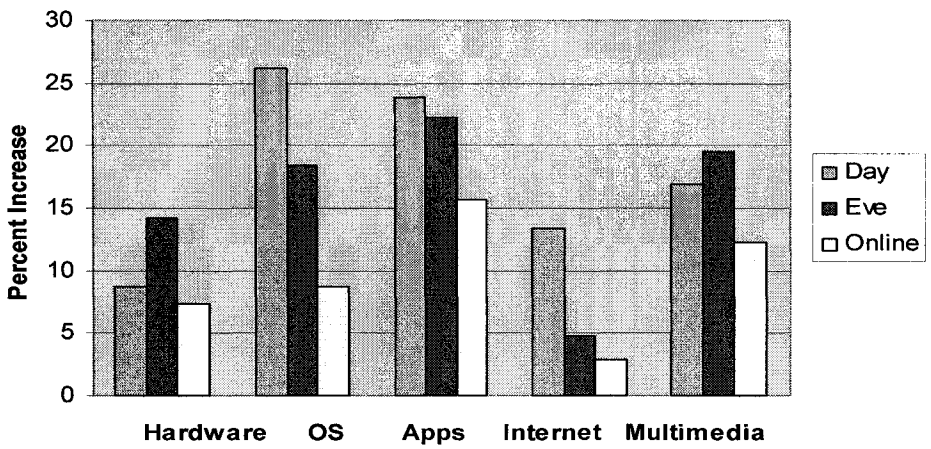

Figure 1. Improvement in computer skills by category.

The five computer skill categories were hardware skills, knowledge of operating system skills, software application skills, Internet or information literacy skills, and multimedia usage skills. Software application skills were very low for all three student groups at pre-course evaluation. However, the most gain was demonstrated in this category by all, including the online group. This analysis would suggest that the need for

software application instruction continues to be necessary in the introductory computer curriculum. The knowledge of operating system skills also showed substantial gain in both campus groups. The online group overall had the highest prior knowledge of these skills indicating confidence in using the computer. The increased gain in multimedia was high, possibly because the skills required were features of the operating system. The overall least gain was in the area of computer hardware. There were little hands on activity in the hardware category.

All three groups showed the most pre-course knowledge in Internet skills and consequently showed the least gain in this category, except for the day group. The online group showed the highest level of Internet skills at pre-course level as might be expected. Within each group, the highest competency rating was demonstrated in the Internet or information literacy category, with competency scores ranging from 93 to 99 percent. This is a desirable result, as Internet or information literacy skills are integral to academic use of digital information in college courses.

The curriculum of the introductory computer science course used as the experimental treatment in this study provided computer skills that advanced computer competency in all five categories.

The second hypothesis posed by the study stated there were no characteristic differences such as demographics, among the three student groups studied, the campus day group, the campus evening group, and the online student group. Chi square data analysis showed in some instances, statistically significant differences. See Table 7.

Table 7

Chi Square Analysis of Demographic Factors by Student Group

Demographic	χ^2	Significance
Age	χ^2 (6,N=117) = 2.081	$p<=.01$
Gender	χ^2 (2,N=117) = 4.882	$p<=.10$
Computer Experience	χ^2 (6,N=116) = 13.663	$p<=.05$
Computer Goal	χ^2 (4,N=117) = 3.633	ns
Computer Literacy	χ^2 (4,N=117) = 1.70	ns

Student age and prior computer experience revealed significant differences among the groups. The age factor was very significant, at $p < .01$. The online student group was overall older in years of age and the day group was the youngest. The evening group showed the most students over the age of 40.

This group had more "first-time (computer) users" and the least number of students who considered the course to be a review of their computer skills. These results corroborate with the *ANOVA* resulting in the day students showing the lowest pre-course computer skill rating. The age statistic seems to support instructor and administrator observation of day enrollment characterized by younger students.

Gender was a factor approaching significance at the $p<.10$ level. The online students were predominantly female in enrollment. This may not be surprising as the female demographic of this college is of the same or similar proportion or 65% female. The campus day and evening CS 901 enrollment was generally 50% male students and

50% female, with the day enrollment slightly higher in male enrollment. It seems enrollment in the CS 901 course has traditionally shown higher male enrollment compared to the predominant female college population. Perhaps the online delivery of instruction was more accessible to female students.

Reason to take the course or computer goal did not show group differences. The majority of each student group took the course to fulfill degree requirements. The second highest reason to take the course was for personal interest. Taking the course for job requirements or training was the least reported factor. The data showed that the majority of the students taking the computer literacy course were on track for following an academic program. However, a good number of students were not pursuing a degree or may have already earned a degree, but enrolled in this course. One purpose may have been to obtain computer literacy skills as has been reported by the community college literature for older students (Faces of the Future, 2000).

There were no group differences with regard to self-assessed, pre-course computer literacy rating. In fact, each student group looked identical as to the distribution of responses rating from not literate, literate, and very literate. Statistically, the day group showed the lowest overall computer literacy rating on the pre-course survey.

None of the students took the course primarily to obtain Internet skills. Pre-course skills were good at 80% for all student groups. By the end of the course, all three student groups showed Internet skills the highest rated category at more than 90% competency.

The inclusion of an online student group in this study provided a comparison of student preferences and skills for online learning. A few observations were very

surprising. The day students, or the younger students, showed the least preference for taking the course online. The younger students, who came of age with Internet technology, had the least desire to take a college course using the Internet. Of the online students, approximately one-third of the students would not consider taking the course on campus. Therefore, the online course attracted this number of students to the college who would not ordinarily take the course at all if not offered online. Nearly 30% of the online students said they learned the computer skills needed to take the course online while taking the course. Most of the day and evening campus students felt they could handle an online course after taking the CS 901 course.

CHAPTER V

SUMMARY, RECOMMENDATIONS, AND CONCLUSIONS

Summary

On today's college campuses, students must be equipped with computer skills to access a range of technology driven student services and to engage in the digital exchange of information required by college courses. The technical proficiency required of student of the 21st century is by no means a cliché. *Campus Technology: Empowering the World of Higher Education*, is a periodical that describes how state-of-the-art digital systems are applied at some campuses to service and educate their students (Villano, 2006; Boettcher, 2006).

The sophisticated use of technology in higher education assumes all students have the necessary computer skills to utilize it. University faculty report their freshman students arrive on campus with requisite computer literacy skills. The students use computer applications, like word processing, to complete an assignment and use the Internet to search for information. The dilemma that computer science faculty claim is, "What is left to teach the student in a computer literacy course?"

In contrast, the community college student does not hold that distinction. Research from community college associations report that many community college students not only lack computer literacy skills, but also attend the community college to acquire them (Phillippe & Valiga, 2000). The socioeconomics of many community college students indicate that access to a computer, especially in the home, is a hardship. Technology groups report the "digital divide" that was considered remedied with the

infusion of computers and technology in K-12 schools, persists as technology becomes old, obsolete, and unused (Center for Media and Community, 2003). The obstacles to computer literacy remain as students graduate or drop out of high school, and enter a world that demands technical literacy.

The purpose of this study was to survey computer skills of students enrolled in CS 901, an introduction to computer science for non-majors course at an urban community college. The class is a 3-unit, computer science course, providing hands-on, computer literacy concepts, including knowledge of computer hardware parts, the computer operating system, and the use of the Internet. The course also provided computer application skills in word processing, spreadsheets, and *PowerPoint*, a presentation program, often utilized in business and in education. The survey consisted of 25 computer tasks appropriate for an introductory course. The survey, developed by the computer science faculty, asked the student to self-assess perceived mastery of a particular skill. The survey was administered at the beginning and the end of the course. The data from the survey pre-course would reveal the computer skill level of students who may have sufficient or little to no computer background. Data from the survey post-course would show skill levels of these same 25 items. Data from the survey would also show the relevance of a computer literacy course at the community college.

Another purpose of the study was to compare the literacy skill level and demographics of three distinct student groups, the day student, the evening student, and the online student. Data were collected and analyzed from the computer literacy course offered during the day, in the evening, and exclusively online. Demographic data were collected to get empirical data on the type of student enrolled in the computer literacy

course. Community colleges have been unique in offering full academic programs at various times to allow for work and family obligations. This methodology would allow the investigators to decipher possible differences in computer literacy status and demographic characteristics. The online version of the CS 901 course provided data on a new student group that is growing in numbers.

Results of the study showed that all three student groups, the day student, the evening student, and the online student, increased computer skill level after completion of the CS 901 course. The day students, who were demographically the youngest group in age, showed the lowest overall computer skill level prior to the course. The online students, the group with the most students of ages 25 to 40, showed the highest overall computer skill level prior to the course. However, all three student groups ended the course with very similar skill level, approximately 86%. In other words, the student with the least literacy caught up and the students with the most literacy pre-course did not top out above the other two student groups.

An analysis of computer skill level by skill category showed that post-course, all three groups showed the most improvement in the area of computer applications and showed the highest skill in Internet literacy. The tasks surveyed in these areas asked the student to apply skills and concepts. For example, in the area of applications, students were asked to rate their ability to create a checkbook using a spreadsheet program. An Internet literacy question asked the students to rate their ability to find information on a particular topic using the Internet. The results showed that students benefit from computer applications training, an area often touted as mundane and no longer needed in a computer literacy course. A high skill level in Internet literacy, approximately 93%, is a

welcome statistic, as Internet use for entertainment has reached a staggering scale among young students (Wallis, 2006).

There were very interesting statistical results observed from the online student group. The enrollment in this course was extremely high, especially in comparison to the campus groups. Online enrollment was over 100 students compared to an initial 45 to 50 for each campus, day or evening section. Although retention was about the same, about 50% for each student group, the first time offering of this course online at the college studied, drew unexpected popularity. The number of students who completed the post-course survey was about the same as the two campus courses combined. Substantially more females took the course online, 70% of the class, compared to the 50% day and 60% evening group. These statistics document the benefits of online education at the community college.

The survey of demographic information showed that the day students, which were the youngest and slightly more male than female in gender, were sorely lacking in computer skills. This group showed the least competency of computer skills prior to taking the course. The day student group also showed the most students who had never used a computer. The results suggest that many students come out of high school lacking computer experience or opportunity.

Demographic data reveal the diverse characteristic of the community college student population (AACC, 2000). The data showed a statistically significant difference in age by group. The student day group was the youngest group. The evening group had the most students 40 years-of-age and over. The online group overall had the most students above 24 years-of-age. Students showed a variety of prior computer experience

from some having never used a computer to some indicating that most of the course might be a review of their computer knowledge. Almost half of the students were taking the course for a degree or certificate purposes while almost a half of the students were taking the course for personal interest. This is like similar reports that older students or students with degrees come to the community college for computer skills (Phillippe & Valiga, 2000).

This study provided a preliminary inquiry to the status of computer literacy skills of community college students and the effectiveness of the computer literacy curriculum. In fact, the computer skills level of the community college students in this study surpassed competency level of the university student in some areas. See Table 8.

Table 8

Comparison of Computer Competencies of University and Community College Day Students

Computer Competency	University	Day Pre-Course	Day Post-Course
Internet Literacy	77	82	95
Operating System	72	69	86
Document Processing	80	63	86
Spreadsheets	68		

Note: Document Processing and Spreadsheets combined is the equivalent of the Applications score shown in the 3rd row of the Day students. A mean score for the University students could be considered 74.

The campus day student group had the lowest pre-course, computer skill scores among the three student groups studied. Their pre-course scores were lower than scores of freshmen at a state university who took a computer literacy assessment test as reported by Gomm (2004). After computer instruction, the campus day student group had very

good to excellent scores in applications, operating systems, and Internet literacy. See Appendix E for computer competency by computer skill category for all three community college student groups.

Recommendations

A few research issues should be examined to evaluate the findings of this study. Specific weaknesses of the research endeavor limit the conclusiveness of the results.

The number of students participating in the study was small for several reasons. Only one class of each student group was selected for the study. There was only one offering of the CS 901 course online. Although few students chose not to participate in the study, the delivery of the survey to the campus day and evening students was dependent on who showed up when the survey was administered both pre- and post-course. No student could take the pre-course survey after the second week of instruction because the survey would not evaluate pre-course skills. Capturing survey data from the online students was a little more controlled since it appears in the online course material. Fewer online students who completed the course submitted a post-course survey, perhaps, because it only became available to them during the final exam. To obtain a more comprehensive picture of pre-course literacy skills, all students who participated in the pre-course survey were included in data analysis. All students who participated in the post-course survey were included in data analysis. Using only pre- and post-course students might have resulted in a higher pre-course skill average, and lessened the statistical significance of post-course averages.

The survey data of self-assessment of computer skills would be strengthened by the inclusion of a test score result from an assessment test or a final exam. Test scores are easily translated into level of mastery. A student indicating total mastery of a computer task might demonstrate that knowledge on a test of that skill. However, the response choices to each skill question covered a range of knowledge rather than absolute mastery of that skill. A student who might not have come up with the correct answer on a test would receive credit for selecting the survey choice, "I could do this (task) with some assistance." For instance, a student might not answer a question by recall, but could come up with the answer by looking it up in a book or by using the computer program to figure out the task. In addition, prior research has reported the reliability of self-efficacy, self-perceived confidence of a task or skill, as predicative of persistence in computer problem solving (Compton, Burkett, & Burkett, 2002).

Conclusions

The null hypothesis that community college students do not benefit from computer literacy instruction is rejected. All three student groups studied, the day campus group, the evening campus group, and the online group, all showed statistically significant improvement in computer skills after completing the course Introduction to Computer Science and Its Use. The most improvement by all three groups was shown in computer applications.

The null hypothesis that all three student groups studied were similar in computer skill proficiency was rejected. The day student group had the lowest pre-course computer literacy rating and statistically differed from the other two student groups. The online

group showed the highest, though non-significant, pre-course rating. However, all three student groups performed equally well at post-course assessment.

An examination of demographic data and computer experience data also showed group differences. The age variable was statistically significant. The day students were the youngest in years of age. The online group was overall the oldest group. The evening group had the most students over the age of 40. The variable, prior computer experience, was also statistically significant. The day group had the most "first-time" computer users. Gender approached statistical significance. The online group was predominantly female in enrollment.

A survey of online learning and the online student group generated useful data. The first time offering of this course online drew considerable enrollment. It was well over twice the enrollment of either day or evening campus class. Two-thirds of the students in the online group would have taken the course on campus if necessary. About 40% of the online students said they acquired the computer skills for online learning while taking the course. The campus day students, the youngest of the three groups, were least likely to take this course online. All of the students who completed the course reported to have sufficient computer skills to take an online course.

Computer educators are urged to take the necessary steps to increase interest in the computing sciences on college campuses (Association of Computer Machinery, 2006). The community colleges, in particular, have the opportunity to prepare students for the computing sciences by providing essential foundational skills as well as enriched course activities. With a liberal enrollment policy and relatively low cost tuition, the community college is the sole resource for many minority, first-generation, and older

students, who have not had access to technology. This study has shown that community college students show remarkable gains in technical expertise and become technically fluent after completing one semester of computer instruction. The positive change in computer literacy skills after course instruction support the continuance of computer literacy curriculum. Computer literacy instruction is also effective in promoting student parity to technology access and opportunity.

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APPENDICES

APPENDIX A

COMPUTER SKILL QUESTIONS

Computer Skill Questions

Each question is assigned a skill category:

(A) application (H) hardware (I) Internet (M) multimedia (OS) operating system

Student selects one response representing level of knowledge of a particular skill.

a. I don't even know what this means.
b. I've heard of this, but wouldn't know how to begin.
c. I might be able to do this, but I'd need help.
d. I could do this, but I'd need to look up some steps.
e. I do this all the time--could do it in my sleep.

1. (H) Turn the computer on.

2. (I) Find a web site given its URL (that is, its www address).

3. (OS) Start a program whose icon appears on the desktop.

4. (OS) Start a program whose icon does not appear on the desktop.

5. (A) Start a word processor and open a document whose complete name is: C:\Accounting Dept\Letters\2004\A Anderson.doc

6. (OS) Create a folder called CS901 in the existing folder named My Documents.

7. (OS) Save a new document in the CS901 folder that is in the My Documents folder.

8. (I) Use the web to get precise driving instructions from your home to West Los Angeles College

9. (I) Use the web to get information about safety issues related to nuclear electric power generation for a term paper you are writing.

10. (A) Create a simple text only document using Microsoft Word.

11. (A) Add a box containing a picture to a text document and allow the text to wrap around the picture (using Microsoft Word).

12. (A) Create a newsletter containing pictures and text arranging the pictures and text in three-column format (using Microsoft Word).

13. (A) Create a three-column list of last name, first name, telephone number and sort in last name sequence using Microsoft Excel.

14. (A) Create a spreadsheet that would function in the same manner as your manual checkbook register using Microsoft Excel and simple arithmetic formulas.

15. (A) Create a spreadsheet that will produce an amortization schedule for a 30 year fixed rate home loan using Microsoft Excel.

16. (M) Download a tune from the web, store it on my disk, and play it.

17. (A) Create a simple series of text only slides using Microsoft PowerPoint.

18. (M) Add music and video to an existing PowerPoint presentation.

19. (M) Burn a CD containing a collection of tunes stored in different folders on my hard drive.

20. (A) Automate an existing PowerPoint Presentation so that it plays continuously.

21. (H) Install a new program on a computer.

22. (OS) Make a complete system backup on a collection of CD's.

23. (OS) Restore a system from the most recent backup.

24. (H) Install a new hard disk drive in a computer.

25. (H) Add memory chips to a computer.

APPENDIX B

DEMOGRAPHIC SURVEY QUESTIONS

Demographic Survey Questions

1. Which of the following best describes your age bracket?

    a) Younger than 18 years
    b) 18-21
    c) 22-40
    d) Over 40

2. What is your gender?

    a) Male
    b) Female

3. What is your reason for taking this course (choose the single best answer)?

    a) for a college degree or certificate
    b) job requirement or career re-training
    c) personal interest

4. My expectation for taking this course is best described as:

    a) I will have my first experience in using a computer.
    b) I will learn a little more about computers and computer programs.
    c) I will review what I already know.

5. Computer literacy skills include knowledge and use of computer hardware and software. I consider myself:

    a) not very computer literate
    b) computer literate
    c) very computer literate

APPENDIX C

ONLINE LEARNING SURVEY QUESTIONS

Online Learning Survey Questions

Pre-Course

1. Would you enroll in an online version of this course if there were no convenient time to take this course? (campus version)

   a) Yes
   b) No

1. Would you enroll in this class on campus if it weren't offered online? (online version)

   a) Yes
   b) No

2. I am most interested in learning about

   a) computer hardware - the parts of the computer and how it works
   b) computer applications - word processing, spreadsheets, etc.
   c) how to use the Internet and email
   d) all of the above

Post-Course

1. What best describes your comfort level to take a course online? (campus version)

   a) I had sufficient computer skills to take an online course prior to taking CS 901.
   b) I did not have the sufficient computer skills to take a course online but believe I do now after completing CS 901.

1. What best describes your online course experience? (online version)

   a) I did not have sufficient computer skills to take this online course.
   b) I did not have sufficient computer skills to take this course online but acquired them during the course.
   c) I had sufficient computer skills prior to taking this online course.

APPENDIX D

COMPUTER SKILL WEIGHTED MEANS

LIST OF COMPUTER SKILL QUESTIONS

Weighted mean of computer skill questions - by student group by pre-course, post-course

	Campus Day Student Group			Campus Evening Student Group			Online Student Group		
Question	Pre	Post	*Difference*	Pre	Post	*Difference*	Pre	Post	*Difference*
1	97.0	99.0	*2.0*	98.0	100.0	*2.0*	100.0	100.0	*0.0*
2	86.0	96.0	*10.0*	91.2	94.0	*2.8*	98.6	100.0	*1.4*
3	85.0	96.8	*11.8*	84.0	96.4	*12.4*	95.2	100.0	*4.8*
4	77.0	90.4	*13.4*	84.0	96.4	*12.4*	95.2	98.4	*3.2*
5	65.0	93.8	*28.8*	78.4	94.0	*15.6*	87.0	97.4	*10.4*
6	67.0	93.6	*26.6*	78.6	96.4	*17.8*	90.2	97.4	*7.2*
7	78.0	97.8	*19.8*	88.2	98.8	*10.6*	97.2	98.4	*1.2*
8	84.0	97.8	*13.8*	88.2	91.6	*3.4*	97.2	99.4	*2.2*
9	77.0	93.4	*16.4*	86.0	94.2	*8.2*	93.2	98.4	*5.2*
10	80.0	97.8	*17.8*	81.4	98.8	*17.4*	92.6	98.4	*5.8*
11	61.0	86.4	*25.4*	68.0	76.2	*8.2*	77.6	91.8	*14.2*
12	59.0	86.0	*27.0*	57.0	87.0	*30.0*	71.8	89.2	*17.4*
13	66.0	88.2	*22.2*	63.6	89.4	*25.8*	74.4	91.6	*17.2*
14	56.0	84.2	*28.2*	55.0	79.6	*24.6*	65.0	82.0	*17.0*
15	50.0	74.8	*24.8*	47.6	74.8	*27.2*	55.2	76.4	*21.2*
16	71.0	88.4	*17.4*	70.0	83.4	*13.4*	79.4	91.4	*12.0*
17	62.0	92.8	*30.8*	51.2	90.6	*39.4*	67.0	93.4	*26.4*
18	58.0	74.6	*16.6*	48.4	77.4	*29.0*	59.0	84.2	*25.2*
19	68.0	84.8	*16.8*	68.0	84.2	*16.2*	75.6	86.8	*11.2*
20	68.0	78.2	*10.2*	68.0	79.6	*11.6*	75.6	87.4	*11.8*
21	68.0	89.0	*21.0*	68.0	89.4	*21.4*	75.6	91.0	*15.4*
22	56.0	74.8	*18.8*	52.0	78.4	*26.4*	66.2	82.6	*16.4*
23	57.2	73.6	*16.4*	54.6	73.6	*19.0*	59.4	77.0	*17.6*
24	60.8	72.6	*11.8*	55.0	85.0	*30.0*	56.8	68.8	*12.0*
25	52.6	65.0	*12.4*	51.0	61.2	*10.2*	56.8	66.8	*10.0*
Mean	68.384	86.792	*18.408*	69.416	86.816	*17.4*	78.472	89.928	*11.456*
SD	11.69436377	9.5227693	*6.9386984*	15.139027	9.62977383	*9.5336037*	14.874825	9.6166323	*7.2675762*

Computer skill questions (A) application (H) hardware (I) Internet (M) multimedia (OS) operating system

1. (H) Turn the computer on.
2. (I) Find a web site given its URL (that is, its www address).
3. (OS) Start a program whose icon appears on the desktop.
4. (OS) Start a program whose icon does not appear on the desktop.
5. (A) Start a word processor and open a document whose complete name is:
   C:\Accounting Dept\Letters\2004\A Anderson.doc
6. (OS) Create a folder called CS901 in the existing folder named My Documents.
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14. (A) Create a spreadsheet that would function in the same manner as your manual checkbook register using Microsoft Excel and simple arithmetic formulas.
15. (A) Create a spreadsheet that will produce an amortization schedule for a 30 year fixed rate home loan using Microsoft Excel.
16. (M) Download a tune from the web, store it on my disk, and play it.
17. (A) Create a simple series of text only slides using Microsoft PowerPoint.
18. (M) Add music and video to an existing PowerPoint presentation.
19. (M) Burn a CD containing a collection of tunes stored in different folders on my hard drive.
20. (A) Automate an existing PowerPoint Presentation so that it plays continuously.
21. (H) Install a new program on a computer.
22. (OS) Make a complete system backup on a collection of CD's.
23. (OS) Restore a system from the most recent backup.
24. (H) Install a new hard disk drive in a computer.
25. (H) Add memory chips to a computer.

APPENDIX E

COMPUTER SKILL WEIGHTED MEANS

BY SKILL CATEGORY

Computer Literacy Skills - by Category by Group by Course Status
Hardware, Operating System, Applications, Internet (information literacy), Use of Multimedia

Category	# Items	Campus Day			Campus Eve			Online		
		pre	post	diff	pre	post	diff	pre	post	diff
Hardware	3	70.1	78.7	8.73	68.0	82.0	14.06	71.2	79.2	7.3
OS	7	69.7	88.0	26.25	72.7	89.9	18.37	82.7	92.1	8.68
Apps	9	63.0	86.8	23.91	63.3	85.5	22.2	74.0	89.7	15.7
Internet	3	82.3	95.7	13.4	88.4	93.2	4.8	96.3	99.2	2.9
Multimedia	3	65.6	82.6	16.9	62.1	81.6	19.5	71.3	87.4	12.3

Note: Calculation of the weighted mean of each skill category determined by adding group weighted mean of each skill question, then dividing by the number of items (questions) in that category.

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