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Self-Assessment and Student Improvement in an Introductory Computer Course
at the Community College-level

A dissertation
presented to
the faculty of the Department of Educational Leadership and Policy Analysis
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Doctor of Education in Educational Leadership

by
Jama Spicer-Sutton
May 2013

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Dr. H. Lee Daniels
Dr. Virginia Foley
Dr. Jasmine Renner

Keywords: computer literacy, computer competency, computer skills

ABSTRACT

Self-Assessment and Student Improvement in an Introductory Computer Course at the Community College-level

by

Jama Spicer-Sutton

The purpose of this study was to determine a student's computer knowledge upon course entry and if there was a difference in college students' improvement scores as measured by the difference in pretest and posttest scores of new or novice users, moderate users, and expert users at the end of a college-level introductory computing class. This study also determined whether there were differences in improvement scores by gender or age group. The results of this study were used to determine whether there was a difference in improvement scores among the 3 campus locations participating in this study.

Four hundred sixty-nine students participated in this study at a community college located in Northeast Tennessee. A survey, pretest, and posttest were administered to students in a college-level introductory computing class. The survey consisted of demographic data that included gender, age category, location, Internet access, educational experience, and the self-rated user category, while the pretest and posttest explored the student's knowledge of computer terminology, hardware, the current operating system, Microsoft Word, Microsoft Excel, and Microsoft PowerPoint.

The data analysis revealed significant differences in pretest scores between educational experience categories. In each instance, the pretest mean for first semester freshmen students was lower than second semester freshmen and sophomores. The study also reported significant differences between the self-rated user categories and pretest scores as well as differences in improvement scores (posttest scores minus pretest scores), which were higher for new or novice users. Of the 3 participating campus locations, students at Location 1 earned higher improvement

scores than did students at Location 2. The results also indicated that there was a significant difference between the types of course delivery and course improvement scores (posttest scores minus pretest scores). The improvement scores for on ground delivery was 5 points higher than the hybrid course delivery. Finally, the gender and age categories as compared to the self-rated user categories revealed no significant differences in the study.

DEDICATION

This study is dedicated to my loving husband and daughter, Rodger and Piper. Your encouragement and support are priceless. Thank you for always listening. I would like to also dedicate this work to my mother, father, aunt, and my sister and best friend, Sherry. Each of you fostered in me the belief that I could climb any mountain.

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CHAPTER 1

INTRODUCTION

Technology, especially the personal computer, has become an integral part of our daily life. About 50 years ago, the world witnessed an explosion of technological advances. The first manned lunar mission required massive technology to accomplish the feat. Some of the technological concepts conceived for the lunar landing project are still used today. Another milestone in technological advancement was the creation of Apple Computers. Steve Jobs and Steve Wozniak designed and produced the first Apple computer. The next generation of the Apple computer, the Apple II series, found market shares in education and also in affordable home computing. In the late 1990s Apple Computers struggled, but re-entered the technology market with their new iMac computer line and then later with the iPod portable digital music players. Then, in 2007 Apple introduced a new operating system for its innovative smartphone line, the iPhone. Apple shortened the operating system name to iOS and this operating system was later used in the various generations of iPad tablet computers. Another technology innovator was International Business Machines (IBM). In the early 1980s IBM introduced its first computer which contained an Intel 8088 processor. Following this release, IBM next introduced a new computer, the IBM PC-AT, which incorporated the newly released 80286 processor for approximately \$4000. The main operating system for the IBM PC-AT was a version of the Disk Operating System (DOS) called PC DOS. This era also produced the 3.5 inch floppy disk drive. During this period, Time Magazine released its new “Man of the Year” cover on January 3, 1983, instead of the typical individual on the cover Time dedicated its cover to the computer, the “Machine of the Year”. The creation of the Internet introduced a new form of military, business, and personal communication. The Internet allowed computers at different

geographical locations to communicate. A commercialized version of the Internet was officially launched for every-day consumers in the 1980s. The Internet was then incorporated into college-level introductory computer science courses. The World Wide Web was a leap forward in technology. Hypertext transfer protocol allowed formatted documents from various geographical locations on the web to be hyperlinked together to enhance information flow.

Earlier versions of the Microsoft Windows operating system were released in the late 1980s with limited commercial success. It was not until the release of Microsoft Windows 3.0 that this software reached a broader market. The creation of a personal computer-based graphical user interface afforded potential users the opportunity to use a computer without prior programming experience. Because of the introduction of these high-tech advancements, new knowledge was needed to understand, create, and process ideas using a computer. Colleges met the challenge for new users' skills by creating computer science courses for the noncomputer science majors, the consumer. Initially, the basic structure of these courses included computing history, social and ethical issues, and problem solving using the computer. Problem solving often resulted in students writing simple programs in a programming language called BASIC to demonstrate this skill. Microsoft co-founders, Paul Allen and Bill Gates, further popularized the language when they rewrote a version of the BASIC language. Other popular components added to a general computer science course were productivity software such as word processing and spreadsheets. Word processing skills necessary for college-level computing included the ability to produce specific types of documents. These document types included discipline-specific or work-related usable documents such as business letters and memos. During the 1980s and early 1990s, WordPerfect was a popular word processing program used in many higher education institutions to teach specific skills such as creating, editing, and formatting documents. Within

the business environment use of the WordPerfect software waned, while Microsoft Word often called MSWord gained in popularity. MSWord was then used to teach basic word processing skills to students. Another productivity program taught in higher education to noncomputer science students was spreadsheets. A spreadsheet allowed an individual to input and calculate values in a grid format of rows and columns. During the 1980s and early 1990s, a business spreadsheet software was Lotus 1-2-3. Lotus 1-2-3 was widely accepted in the public sector because of its relative ease of use. Its popularity also waned, opening the door for Microsoft's new spreadsheet program, Microsoft Excel, which was incorporated into the MSOffice Suite in the late 1980s. This suite contained word processing, spreadsheet, and presentation software. This suite gained market share in the business and commercial sectors. Another concept incorporated into the college-level introductory computer course was the study of the internal components of personal computers that enhanced the student's knowledge of computer terminology. Some computer concepts included the role of an operating system, the types of memory and storage, and knowledge of input and output devices.

In 2003 the computer science curriculum began to change in Tennessee's colleges and universities because of a mandate from the Tennessee Board of Regents (TBR). TBR removed the college-level introductory computing class from the core curriculum. Higher education institutions had to decide how to handle this development. Some institutions mandated the college-level introductory computing course as a degree competency requirement, but it was not included as a part of the general education core requirements. As a result of the TBR mandate and the addition of the competency requirement, a community college changed the objectives of this course to reflect cross-curricular computing needs as determined by the various disciplines.

For instance, first-time freshmen entering the participating community college were required to complete an entry level computing class.

The Computer Competency Requirement at the Participating Community College

In 2003 all degree programs offered at Tennessee colleges and universities were required to be reduced to 60-semester hour programs by TBR. A committee comprised of representatives from each of the TBR institutions was charged with the task of determining the core courses that would be integrated into all degree programs. For many degree programs this meant that courses had to be removed from the existing curriculum. An introductory computer science course was one of the courses removed from this core. At the participating community college an unanswered question was how to mandate college-level computer competency. At the time the curriculum audit was conducted, there was not a college-level computer competency model that met the needs of the participating community college.

The technical programs dean began collecting data to design a computer competency model for the participating institution. The data collection instrument used was a survey that was administered to the division deans (Appendix B). Operating under the premise that a student had completed 30 semester hours of college-level course credit, the division deans in each respective discipline were then asked to rank eight computer skills categories by their level of importance. These computing categories included skills deemed essential at the completion of 30 semester hours of coursework. These categories were:

1. understanding the course management system,
2. understanding the role of an operating system,
3. having a working knowledge of online databases,
4. possessing the ability to use a modern word processing package to create a product,

5. having the ability to use an electronic spreadsheet to produce a product,
6. presenting the ability to use presentation software to create a finished document,
7. exhibiting the ability to access the Internet, and
8. having the understanding of computer concepts and terminology.

The results of the participating division dean's survey revealed two possible methods for satisfying college-level computer competency at the participating community college. The college-level introductory computer course was one method used to prove college-level computer competency, except in those degree programs requiring a specific computer competency. The college-level introductory computing class was redesigned to reflect the skills deemed necessary in the division deans' surveys. An additional requirement for the course mandated that it must be accomplished within the first 30 semester hours completed within a chosen degree field. The second option students might have selected to satisfy college-level computer competency was to undergo the computer competency test-out process, which required students taking and passing the computer competency exam.

The community college provided students with a readiness checklist containing frequently asked questions and hyperlinked resources that allowed them to review the process necessary for skill assessment (Appendix C). First, students completed a computer competency self-assessment. Categories in the self-assessment included Microsoft Word, Microsoft Excel, Microsoft PowerPoint, general use computing questions, and knowledge of Microsoft's current operating system. Hyperlinked tutorials were embedded within the practice questions for student preparation. Students were then given opportunities to register for and complete a computer competency pretest. The desired score for the computer competency pretest was 85 points or higher. The pretest could be taken an unlimited number of times until the student achieved the

designated score. After a minimum score of 85 points was achieved on the pretest, students were then given one opportunity to take the computer competency exam, a test to determine computer knowledge. An exam score of 80% or higher satisfied the college-level competency requirement for each student at the participating community college. If students did not achieve a score of 80% or above, they were required to complete the entry-level computing course.

Statement of the Problem

College-level computing skills are useful tools that serve students throughout their college career. However, many students enter college lacking necessary computing skills. While many students might be proficient in locating information online through search engines, less is known about the use and application of specific types of software often found in business and industry. As a result of this lack of knowledge, all students entering the participating community college must prove computer competency either by taking a competency exam or by the completion of a college-level introductory computing class. Approximately 97% of the students chose to take the introductory class to satisfy this competency requirement. Assessment methods used to evaluate students in the introductory class included hands-on project tutorials, a research paper, and multiple-choice quizzes.

The purpose of this study was to determine a student's computer knowledge upon course entry and if there was a difference in college students' improvement scores as measured by the difference in pretest and posttest scores of new or novice users, moderate users, and expert users at the end of a college-level introductory computing class. This study also determined whether there were differences in improvement scores by gender or age group. The results of this study were used to determine whether there was a difference in improvement scores among the three campus locations participating in this study.

Research Questions

The following research questions guided this study:

1. Are there significant differences in students' pretest scores among the three college experience categories (freshman – 1st semester, freshman – 2nd semester, and sophomore- 1st and 2nd semester) in college-level introductory computing classes?
2. Are there significant differences in students' pretest scores among the five types of self-reported residential Internet access (dial-up, cable, DSL, wireless, and no Internet access) in college-level introductory computing classes?
3. Are there significant differences in students' pretest scores among the three self-rated user categories (new or novice user, moderate user, and expert user) in college-level introductory computing classes?
4. Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the three self-rated categories (new or novice user, moderate user, expert user) in college-level introductory computing classes?
5. Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the three campus locations (Campus Location 1, 2, and 3) in college-level introductory computing classes?
6. Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the three age categories (age 15-19, age 20-28, age 29 and older) as determined by gender in college-level introductory computing classes?
7. Are there significant differences in students' improvement scores among the three self-rated user categories (new or novice user, moderate user, expert user) in regard to the

three age categories (age 15-19, age 20-28, age 29 and older) in college-level introductory computing classes?

8. Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the course delivery types (on ground courses, online courses, and hybrid courses) in college-level introductory computing classes?

Significance of the Study

According to Mendels (1999), one impetus in the adoption of a computer literacy requirement was accreditation. Today, the Southern Association of Colleges and Schools Quality Enhancement Plan contains Policy 3.4.12, a technology use policy that reads, "The institution's use of technology enhances student learning and is appropriate for meeting the objective of its programs" (Southern Association of Colleges and Schools, 2010, pg. 27).

Computing skills of entry level college students can differ greatly. Dettori, Steinbach, and Kalin (2006) reported that students' perceived preparedness was not always realistic. Some higher education institutions require students to prove computer competency. Students can prove computer competency at the participating community college by taking and passing a computer literacy challenge test or by enrolling and successfully completing a college-level introductory computer science class. In 2009 VanLengen noted that while students' technological knowledge has increased, they still lacked specific computer skills. Students taking a college-level introductory computing class demonstrated significant improvement gains and the course added value to the learning experience. In order for the course to remain viable, however, it must continue to be consistent with technological advances of the current job market (VanLengen, 2009).

With rapid advancement of technology, come increased task-specific computing skills. For example, 20 years ago when a student was faced with a lack of information, library research would have been necessary to acquire it, while today a student's first instinct is to "Google It" on the Internet. With ready access to knowledge and online communities, many college students perceive their general computing skills at a higher level than is realized. As a result, the purpose of the study was to understand the relationship between a self-rated user's perceptions in college-level introductory computing classes by the comparison of test scores.

Definitions of Terms

The study presents many terms that are commonly understood. However, some terms require further explanation in order to provide clarity for the reader because they are terms specific to the discipline.

Computer Competency: Basic computer competencies and use the computer and the appropriate software are necessary for all college graduates. The appropriate software mastery for college students includes word processing, spreadsheets, database managers, and Internet search engines (San Antonio College, 2005).

Computer Literacy: Computer literacy is the demonstration of knowledge regarding terminology and concepts required to use computer hardware, software, and operating systems. Additionally, students must demonstrate a competency in using the computer system to accomplish tasks efficiently in the production of usable documents (San Antonio College, 2005).

Computer Literacy Challenge Test: This is a comprehensive computer test that demonstrates a student's basic computing skills (San Antonio College, 2005).

Limitations of the Study

This study was limited to those students who enrolled in the college-level introductory computer class during the study period at the three campus locations of the participating community college. It was further limited by the number of instructors teaching at these locations. Additionally, the third limitation of the study was that it did not include those students who took and passed the Computer Competency Exam.

Organization of the Study

This study is organized into five chapters. Each chapter discusses a major element within the study. Chapter 1 contains an introduction and subsections that describe the background, problem, research questions, and delimitations of the study. Chapter 2 explores the literature that supports the dissertation topic. The review of the literature includes the method used in defining computer literacy and in creating college-level computer competency standards. Additionally, the study addresses the need for assessment to determine student gains in a college-level introductory computing class. Research design and methodology of the dissertation study are presented in Chapter 3. Chapter 3 includes the method of conducting the study, the research questions, data analysis, and the limitations of the design. Chapter 4 consists of the data collected for the study, analysis of the data, and the research hypothesis. Chapter 5 contains a summary of the findings of the study and provides recommendations for practical and future research and a conclusion.

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter provides an overview of computer literacy, perceptions of computer literacy, and various methods of assessing computer literacy and college-level computer competency programs. The literature review was designed to gain a better understanding of the multiple meanings of computer literacy and the way in which these meanings shaped modern college-level computer competency requirements.

Computer Literacy

The term computer literacy assumed different names and meanings since the 1980s. Definitions were influenced by various theories. The National Science Foundation (NSF) hosted a conference in 1980 to discuss the meaning of the term “computer literacy” (Childers, 2003). Burniske (2000) stated that, “To prepare ourselves and our students for new types of literacy, we must be receptive to new definitions of the term itself” (p. 3). Burniske addressed two types of literacy. The first type of literacy was functional literacy. This concept was popularized by the United States Army during World War II. Functional literacy included the lowest functioning level of literacy and rarely required an individual to use problem-solving techniques. Functional literacy focused on teaching the basics of reading and writing. The second literacy type was critical literacy, which often referred to a learned individual with the ability to solve problems. This type of literacy was comprised of students being able to interpret and apply new information presented. Many researchers considered computer literacy a type of critical literacy. To integrate computer literacy the instructor often blended traditional teaching with new technologies. In the classroom teachers are often required to move beyond simply teaching a skill, such as keyboarding, to integrating computer skills within the core curriculum. This

required the teacher to have a combination of a technical skill set and a theory-based skill set. According to Burniske (2000) if we are to achieve literacy-across-the curriculum, formal teacher training was required.

Childers (2003) stated that computer literacy had become a popularly coined term instead of a necessary skill because researchers had redefined the meaning of the term over several decades; the public often held a negative connotation of the word literacy; technology adaptation by youth occurred much more rapidly than ever anticipated; and technology changed so quickly that it required users constantly to play catch-up to remain current in the field. Computer literacy held many different names such as computer competency, computer proficiency, digital literacy, and computer skills. However, Childers asserted that literacy and proficiency were not interchangeable terms. He stated that proficiency dealt with one's ability to memorize information. Computer proficiency consisted of a user's ability to complete a series of proficiencies at varying levels. This series of proficiencies formulated Childers' definition of computer literacy. "Literacy suggests understanding and the ability to adapt and increase that understanding" (Childers, 2003, p. 102).

Chung and Keith (1994) outlined a personal needs approach to computer literacy. Each profession required a diverse set of computing skills. If users were able to meet professional needs, they were deemed computer literate according to this approach. For instance, scientists and historians defined computer literacy differently as it related to their profession (NRC, 1999, p. 17). Chung and Keith (1994) noted that a computer literacy course should consist of three objectives. First, the course must integrate technology across the curriculum, which was consistent with Burniske's (2000) view of literacy, which purported a "literacy-across-the curriculum" program. Second, relevant concepts should be a fundamental part of the course.

Third, a computer literacy course must contribute to the core curriculum. In order to design a computer literacy course that included these three objectives, faculty had to identify the personal needs of the students. Chung and Keith surveyed faculty and staff to determine the most important literacy topics and found that faculty expectations were much broader than those of students. The survey included 20 topics such as the history of computers, computing systems, computer hardware components, operating systems and software, file organization, spreadsheet packages, word processing packages, MS/DOS commands, and database management packages. Of the 20 topics listed in the survey, faculty commonly selected four topics. These topics included programming, using MS/DOS, database and spreadsheet skills, and word processing skills. Their survey illuminated the need for students to understand the relevance of computer skills to other courses in their degree program and their career path. "Faculty and students in all disciplines regarded application knowledge of productivity packages as most important" (Chung & Keith, 1994, p. 57). According to Chung and Keith (1994) computer literacy required more than one course for effective computer literacy. Each subsequent course required the reiteration of basic skills followed by more sophisticated content to achieve computer literacy.

Halaris and Sloan (1985) identified literacy as a continuum with four stages, including computing awareness, computing literacy, computing fluency, and computing expertise. Stage one began with computing awareness, which established a basic understanding of computing vocabulary. It also dealt with the use of a computer and the ethical impact of computers on society. Computing literacy characterized the next stage of the continuum and incorporated the skills in computer awareness supplemented by additional skills. This phase of hands-on computing allowed the participant to experience first-hand such skills as opening and closing of applications and movement within the applications. Another component within the computer

literacy stage was information gathering. The information gatherer must have the ability to locate and process the material. Students used software applications for job-related tasks and general problem-solving techniques. During this stage, Halaris and Sloan (1985) introduced the concept of basic knowledge of computer programming, including the ability to read, write, and edit a simple program. The computer fluency stage built upon the components listed in computing awareness and computer literacy. Next, the participant developed intermediate level computer programs and determined appropriate problem-solving approaches for task-specific scenarios. Computer professionals comprised the highest stage in the continuum, computer expertise. Within the stages of computer literacy, fluency, and expertise, the user understood and exhibited basic computer programming skills such as problem solving; however, the role of computer programming was often debated regarding its part within computer literacy. Halaris and Sloan (1985) remarked, "Since computing is based upon programming and programs, all individuals should understand the concept and process of programming" (p. 324).

Mason and Morrow (2006) divided computer literacy into two components, awareness and competence. Awareness required knowledge of how technology affected the daily life of an individual, while the individual's ability to demonstrate hands-on proficiency determined competence. The authors noted that because of the increased technological advancements in society, a 15-week semester was not enough time to teach both the awareness and the competence components. Therefore, the literacy course was divided into two distinct courses, awareness and competence. The awareness course incorporated topics including the history of computer development, how technology developed, ethics, security (personal and work-related), economic issues such as E-commerce, the World Wide Web and electronic mail, legal issues, networks, communication issues, and the use of computers in varied fields of study. After

meeting these objectives, students would understand how technology affected their daily lives. The second course developed by Mason and Morrow focused on competence. The objectives listed for this course included the use of a personal computer and server application software, basic knowledge of computer hardware, Internet research tools, integration of software applications, the integration of hardware and other tools, and computing mobility. Students who completed both the awareness and competence courses then demonstrated computer literacy (Mason & Morrow, 2006).

Researchers at the Association of Computing Machinery (ACM) in the ES3 Report identified three computing competencies: subject-specific competencies, computer science related competencies, and universal competencies. The universal competencies was focused on the history of computers, computer terminology, societal impact of computers, and problem solving skills as applied to designated topics (as cited in Halaris & Sloan, 1985). Mason and Morrow (2006) defined each of the universal competencies as awareness. Only one listed universal competency, the ability to write a basic computer program, demonstrated computer competence. The competency component was demonstrated by the student's ability to use application software. During the 1970s and 1980s, computing awareness was the center of advancing technological knowledge. At the onset of the 1990s, however, a shift away from computing awareness occurred. This shift focused on computer competency. "A student who is technically proficient but lacks awareness cannot be said to be 'computer literate.' The reverse is also true" (Mason & Morrow, 2006, p. 99).

Goldweber, Bar, and Leska (1994) agreed with Mason and Morrow's belief that computer literacy must be defined by two separate criteria. The first criterion, computer literacy, outlined a student's ability for problem-solving in a selected discipline using a computer system.

The second criteria, application literacy, exposed students to computer application packages. Goldweber et al. (1994) enumerated the modules necessary for a successful computer literacy course. The modules incorporated ethical and social issues such as discussions on security, viruses, ethics, and privacy followed by the next units of study, hardware and software components. The hardware component included stored programs and the way in which computer components interacted, while the software component explained the differences between system software and application software and offered examples of each. The computer user interaction module focused on hands-on training to manipulate files. The user was required to understand the organization of file space regardless of the operating system. The last module deemed necessary for a computer literacy course was the user's ability to solve problems with the aid of application programs. To produce computer literacy, the modules combined to form a foundation upon which to add appropriate application literacy based on the student's field of study. To implement the computer literacy model, Goldweber et al. (1994) designed two one half semester module courses. During the first half of the semester all students enrolled in the computer literacy course. During the second semester students selected domain specific computer application course blocks. Within the second block faculty enhanced the student's problem-solving capabilities by introducing software specific tasks pertinent to their field of study.

According to Ellis, Hase, and Phelps (2005) competency referred to measurable skills that when assessed against computer competency standards tended to be predictable. Unfortunately, the technological knowledge gained in a formal computer class was often outdated within a few months of taking the course. Ellis et al. (2005) differentiated between the concepts of competency and capability. They defined capability as the users' ability to solve a problem by taking appropriate action in known and unknown situations. Capability theorized a

holistic approach, combining personal skills and qualities and integration of knowledge (Ellis et al., 2005).

Weber (2005) termed computer skills as technological literacy that included the concepts of knowledge, ways of thinking and acting, and capabilities. Teachers were encouraged to adapt a holistic awareness of these dimensions. The No Child Left Behind Act (NCLB) mandated that all students must be technologically literate by the completion of eighth grade. However, there was no federal definition provided for the states concerning what constituted a computer literate student (Weber, 2005). Eight of the states in the U.S. adopted either the State Technology Directors Association (SETDA) or the International Society for Technology in Education (ISTE) to define computer literacy for their populace. The State Educational Technology Directors Association (2007) defined technology literacy as:

“Technology literacy is the ability to responsibly use appropriate technology to communicate, solve problems, and access, manage, integrate, evaluate, and create information to improve learning in all subject areas and to acquire lifelong knowledge and skills in the 21st century.” (p. 1)

ISTE NETS-S (2007) proposed six broad categories of technology literacy: creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making; digital citizenship; and technology operations and concepts. In 2007 the State of Tennessee adopted the ISTE NETS-S standards to define computer literacy.

Perceptions of Computer Literacy

Computer skills considered necessary for computer literacy varied according to position. For instance, students assumed computer literacy if they could play games or word process a document, activities important to them, thus producing self-efficacy. Self-efficacy included belief in one's skill for successful task completion. Individuals who reported high levels of self-efficacy tended to face difficult challenges more easily than others. Additionally, individual beliefs affected how persons felt, behaved, and motivated themselves (Bandura, 1997).

According to Margolis and McCabe (2006) self-efficacy was the belief or perception of students that they could successfully complete an assigned task. Students acquired self-efficacy information from four sources: task performance, vicarious experiences, verbal persuasion, and physiological reactions. Task performance helped students identify their ability level when completing an assigned task while vicarious experiences provided an opportunity for a student to watch a modeled task. A modeled task was one in which the skill was not only viewed but explained using direct guidance through the completion of the project. The third source of self-efficacy was verbal persuasion, which resulted from another individual encouraging the student through verbal messages, such as "you can do this task." Teachers must then pinpoint specific portions of a task that contributed to the overall completion of the project. The final source of self-efficacy was the physiological reaction before, during, and after the assigned task. Pajares (2002) purported that with a positive computing attitude, self-efficacy, individuals were more likely to attain the desired goal.

Researchers at the University of Utah conducted student self-efficacy assessments measuring the levels of computer skills using a hands-on Microsoft Excel laboratory exercise (as cited in Bartholomew, Johnson, Ormond, & Mulbery, 2003). The researchers compared the

students' perception of their computer skill level using Microsoft Excel and the actual laboratory exercise score. Results revealed the objective laboratory exercise score was 20 points below the subjective student perception scores. Professors frequently hold different perceptions of their students' computer literacy than do students. If an assignment was successfully completed using a designated software application, a professor might consider the student computer literate. On the other hand, the perception of potentials employers was that college graduates had attained the necessary computer skills to be productive in a work environment. Employers desired graduates with problem-solving skills and the ability to adapt to new situations. Although different, the perceptions of computer literacy held by students, professors, and employers were all valid. Halaris and Sloan (1985) stated that computer literacy was a continuum of four stages: awareness, literacy, fluency, and expertise. However, most employers expected graduates to rank at least in the fluency stage of the continuum (Bartholomew et al., 2003).

Davis (1997) noted that among the highest ranking computer skills was the knowledge of word processing, spreadsheets, and presentation software. Employers expected graduates to be skilled in detailed analysis when using spreadsheet software. In addition, a majority of employers expected graduates to be competent in Internet and online search strategies and electronic mail. Employers stated that the more computer skills a graduate possessed, the more marketable the graduate. In comparison, the University of Utah also conducted a survey of employer perceptions of college graduates. Word processing and spreadsheets ranked as very important computer skills, while database and presentation skills ranked as important computer skills (as cited in Davis, 1997). Davis (1997) also revealed that, after taking a computer literacy course, students appeared confident in their computer skill levels. Over time, however, the students' perception of their computer skill level decreased from the time they began their initial study.

Research based on middle school age students by Jackson et al. (2008) posed questions about gender and race differences in the use of technology. Four hundred sixty-nine students participated with male participants representing approximately half of the population. The study revealed that a higher number of males used the Internet for gaming than did females. However, a higher number of females used the internet for academic intent. Also, cell phones, emails, and instant messaging were more used by females (Jackson et al., 2008).

Zickuhr and Smith (2012), research specialists for the Pew Internet American Life Project, authored a comparison study on the digital differences for gender as well as designated age groups focused on the years 2000 and 2011. In 2000 adult men 18 years and older reported 50% internet usage while internet usage for men increased to 80% in 2011. Women ages 18 years and older demonstrated a lower percentage of internet use for both the 2000 and 2011 demographic surveys. In 2000 women reported internet use at 45% and 2011 resulted in a 76% usage. Zickuhr and Smith (2012) also surveyed four age groups: 18-29, 30- 49, 50-64, and 65+. The age group 18-29 illustrated the highest use of smartphone ownership, mobile internet use, web searches, and computer internet use while the age group 30-49 demonstrated a higher percent use of online activities such as email, e-commerce, and banking online. The 65+ age group overall reported significantly lower usage. In 2000 the 65+ age category reported internet use of 12%, as compared to a 41% use in 2011.

The Social Security Administration hypothesized a doubling of retirement age Americans by 2015. The organization also hypothesized a labor shortage due to a lower birth rate of American families. Consequently, the Social Security Administration predicted that many older Americans would remain in the job market to fill the employment gap and to bolster their retirement income. However, the majority of these older Americans had less exposure to

technology than did the younger generations. Because of the lack of exposure to technology, the older generation held lower perceptions of its value in a high-tech workforce (United States Department of Labor, 1991). A 2008 United States Department of Labor study reported that individuals age 55 and above received an average of 9 hours of training annually while employers provided an average of 37 hours of training annually for workers between the ages of 25 to 34. This study alluded to several reasons for the disparity in training between the two groups. Some suggested reasons for the disparity in training were that older workers had not taken advantage of the training opportunities, no other training was necessary because of their work experience, and doubts in their own abilities to learn the new material. Further, use of computers among Americans age 65 and older was reported at 29% occasional computer use. However, Internet use among this group was on the rise (United States Department of Labor, 2008).

Some considered chronological age a barrier to acquiring technological literacy. Reed, Doty, and May (2005) proposed that, although chronological age did not have a predominant effect on computer skills acquisition, it did influence computer self-efficacy. In order to test the theory, Reed et al. (2005) conducted a study comparing the number of skills learned by older workers to those of younger workers. This study focused on the skills acquired in a given amount of time and the effect of computer self-efficacy on older workers. The results of the study documented that older individuals with stronger beliefs or perceptions about their abilities acquired new computer skills more easily. In an age when a workforce shortage could occur effectively trained older workers could fill the gap with appropriate training and improved perceptions of their viability in a high-tech workforce (Reed et al., 2005).

Technologically savvy individuals have been called digital natives or millennials. Prensky (2001) created the phrase digital native in 2001 to identify those who had access to technology since birth, while Strauss and Howe (2000, p. 432) coined the term millennials to refer to any individual born after 1982. Some characteristics of the millennial generation encompassed the need for collaboration, visual graphics, multitasking, and the immediacy of communication. Millennials responded rapidly to forms of communication that they received. However, they expected an immediate reply in return (Frاند, 2000). Additionally, the millennials expressed self-efficacy in their ability to search for data on the internet (Fallows, 2005; Fields, 2005). As indicated by the Pew Internet & American Life Project (2012), 93% of millennials, ages 18-34, used the internet. The 35-46 age group, Generation X, totaled 89% usage. The largest age category was the Baby Boomer generation, which comprised the 47-65 age group. Internet usage for this group totaled near 77%. When using technology, those individuals with a high self-efficacy embraced changing technologies more readily than users with a low self-efficacy (Ellen, Bearden, & Sharma, 1991).

He and Freeman (2009) conducted a general computer self-efficacy study on college-level business students and the role gender played. The study defined general computer self-efficacy as a combination of gender, computer knowledge, current computing experience, and computer anxiety. Two surveys were administered to a population, 52% female and 48% male. The findings were that females had less computer knowledge and computer experience when compared to males. Also, females demonstrated more anxiety when using a computer than males (He & Freeman, 2009). However, between the years 2000 and 2010, the U.S. Department of Labor documented that women in the computer systems analyst field experienced a 37% growth. Females in other computer related jobs such as computer engineering, computer support, and

database administrators also reported growth (United States Department of Labor, 2002). In 2011 the Bureau of Labor Statistics reported that women comprised 33.9% of the total number computer systems analysts in the United States (Bureau of Labor Statistics, 2011).

Several attitude exams purport to measure attitudes toward technology (Conrad & Munro, 2008). Notably, Loyd and Gressard (1984) created the Computer Attitude Scale (CAS) that measured computer usefulness, computer anxiety, confidence, and liking; and Kay (1989) designed the Computer Attitude Measure (CAM) to measure affective, cognitive, and behavioral attitudes. Conrad and Munro (2008) introduced the Computer Technology Use Scale (CTUS) that differed from the other instruments because it included technology experience as one of its three domains.

In the early 1990s many Americans reported varying degrees of technophobia. Merriam-Webster defined technophobia as the fear or dislike of advanced technology (Technophobia, 2008). Research supported by the Dell Corporation in 1994 suggested that 55% of Americans experienced computer anxiety (Williams, 1994). Orr, Allen, and Poindexter (2001) examined the factors that predicted attitudes toward computers including computer experience, gender, age, personality type, and the computer user's learning style. In the study one group received formal computer training, while the other group received no training. Males tended to exhibit more favorable attitudes toward technology than did females, but age was not a significant factor in computer attitudes.

Orr et al. (2001) used the Computer Attitude Scale designed by Loyd and Gressard in 1984 to determine attitudes of individuals toward computers. The Computer Attitude Scale for the Orr et al. study consisted of 30 items. The Likert-type instrument blended both positive and negative statements that required individual responses. Three topics were included: (1) anxiety

and fear of computers, (2) confidence in the ability to use or learn about computers, and (3) liking of computers". The study found students reported less anxiety after completing a formal computer course. In 2010 Stern defined four course delivery types for formal computer courses: traditional, web-enhanced, online, and hybrid. The traditional course consisted of face-to-face meetings on the campus grounds, while web-enhanced courses employed the traditional on ground teaching approach with supplemental online materials. An online course was defined as a class delivered completely through electronic communication with no on ground class meetings. The fourth course delivery type was hybrid. Hybrid or blended learning combined aspects of online and the best aspects of face-to-face class delivery (Stern, 2010). The last CAS factor used to predict computer attitudes was individual learning styles. The study employed the Kolb experiential learning model. The work of Dewey and Levin provided the basis for Kolb's model. This model contained four stages: concrete experience (do), reflective observation (observe), abstract conceptualization (think), and active experimentation (plan). Four learning styles, assimilators, convergers, accommodators, and divergers, corresponded to the stages. The use of theories is preferred by assimilators, while convergers learned best when given real-world tasks. Accommodators learned through direct experience, though divergers preferred to gather and plan to use the information (Learning Theories Knowledgebase, 2010). Orr et al. (2001) stated that if instructors understood the factors that affected computer attitudes, they could apply appropriate interventions to maximize student potential.

Kay framed the Computer Attitude Measure (CAM) in 1989. Demographic information, affective, behavioral, and cognitive attitudes were identified in the instrument. A 7-point Likert-type scale was used to measure these computer attitudes. Similar studies measured the affective and cognitive attitudes of computer users but failed to incorporate behavioral attitudes.

CAM incorporated a behavioral component within the survey. Examples of behavioral questions included use of a computer on a regular basis, the ability to complete a task on a computer, and experimentation with new software. The findings of the CAM study established a correlation between positive attitudes toward computer use and strong computer skills. This relationship also was dependent upon an internal locus of control of the computer user (Kay, 1989).

The Computer Technology Use Scale (CTUS) allowed Conrad and Munro (2008) to study the relationship between three domains: computer self-efficacy, attitudes toward technology, and technology-related anxiety. Self-efficacy, derived from Bandura's (1997) Social Cognitive Theory, revealed one's belief in his or her ability to complete assigned tasks. In other words, individuals based their actions and motivations on what they believed they could accomplish rather than on their actual capabilities. Attitudes factored into an individual's response to technology. If users with high self-efficacy experienced a negative computer situation, it produced little change in the users. However, if novice users experienced a negative computer experience, it diminished their computing self-efficacy. The last domain of the CTUS was computer anxiety. This domain was defined by the researchers and the focus of CTUS. Reber (1985) defined anxiety as either positive and negative emotional states or a feeling of uneasiness. Therefore, the questions used on the anxiety domain of the CTUS included both positively and negatively worded questions regarding an individual's computer anxiety (Conrad & Munro, 2008).

Saade and Kira (2009) explored the mediating factor of computer self-efficacy between the anxiety of the user and the manner in which that anxiety affected the user's perceived ease of use. Some users experienced negative emotions such as anger, fear, and anxiety before and after the use of technology. Anxiety sometimes affected computer-based learning because of the effect

on user self-efficacy. The belief that one was not good at using a computer prompted fear of computers, which led to avoidance. Negative feelings resulted from the apprehension surrounding computer use by some. McInerney, McInerney, and Sinclair (1994) defined computer anxiety as "apprehension or fear of computer technology accompanied by feelings of nervousness, intimidation and hostility" (p. 28).

According to Prabhu (2008) Project Tomorrow created and administered a survey to determine the views of parents, students, administrators, and teachers on technology education. Over 370,000 individuals participated in the study, of which 320,000 of the population represented were students. When communicating through texting, email, social networking, and instant messaging, 24% of the students rated themselves as advanced technology users. Online and computer gaming and music downloading were also included in the lists of skills offered. Students typically spent eight to 10 hours per week gaming. When asked to create a design for a perfect school, students responded that Web 2.0 technologies must be a part of the curriculum (Prabhu, 2008).

Assessing Computer Literacy

Technology skills assessments have taken many forms. For instance, Martin and Dunsworth (2007) proposed formative assessment of computer literacy at the university level to improve curriculum design of a computer literacy course. This formative assessment included the technological advances of the workplace as well as the technological needs of the student. Class observations, student test scores, student and teacher focus groups, and instructor surveys were tools used to collect the data. Four hundred forty-four students received a Likert-type survey through the Blackboard Course Management System in which 329 students responded. The researchers interviewed five focus groups comprised of 25 students as well as the 11

instructors who delivered the course. Five class observations also aided in data collection. The compiled data formed two categories: 1) what to teach and 2) how to teach it. The findings showed that both instructors and students rated Microsoft Office Skills, particularly Word and PowerPoint, as necessary. Additionally, both groups agreed that in-class activities and hands-on projects were useful approaches when teaching computer literacy. Instructors and students stated that the Internet and the World Wide Web were considered important tools. However, students reported that online quizzes and extended lectures were not helpful, while instructors deemed them valuable teaching tools and a means to measure student learning. Neither students nor instructors considered knowledge of computer hardware (input, processing, storage, and output) as a necessary skill. Instructors submitted that File Management was a needed skill, while students assigned a lower rating to this skill. Recommendations from the study included the need for more in-class and hands-on activities and collaborative activities that provided a group learning atmosphere (Martin & Dunsworth, 2007).

La Barge (2007) used pretest and posttests to assess skills acquisition. Generally, individuals learned from an early age to answer a multiple choice question by eliminating possible answer choices, which sometimes meant guessing the answer if it was not known. LaBarge wanted to remove the guess factor for the pretest and posttests results to reflect true knowledge acquisition. Using the concept introduced by Alliger and Horowitz (1989), which included qualifiers to reduce the skewing of pretest and posttests results, La Barge created a 12-question multiple choice test with the standard four possible answer choices. However, after answering each multiple choice question, the participant also marked one of the two boxes provided: Yes, I know the answer or No, I am guessing. The pretest resulted in a 46% average of correct answers using the traditional method, including guessing. From the secondary responses

based on the author's unique approach, only 31% actually responded that they knew the correct answer. This resulted in 15% of the test takers guessing the correct answer. Correct answers on the posttest averaged 88%. Of that percentage, those who knew the answer averaged 83%, while those who admittedly guessed correctly comprised 5% of the test takers (La Barge, 2007).

The Maricopa County Community College District (2002) defined a pretest as an exam administered upon entry into a course, while a posttest was an exam administered at the exit point of the course. The Maricopa County Community College District itemized advantages and disadvantages of using pretesting and posttesting to assess skill acquisition. First, within a program of study, the pretest and posttest method can measure value-added growth or be used as a basis for comparison. A pretest can be a diagnostic tool to identify an individual's background knowledge of the subject as well as document the prerequisites listed for the course. One disadvantage of pretest and posttest skills acquisition was included the difficulty in determining whether the gains over time were a result of learning or growth. The instructor's desire to cover the posttest material was also a potential disadvantage. In addition, if offered the same pretest and posttest, students could absorb knowledge from the pretest, thereby skewing posttest results (Maricopa County Community College District, 2002).

At California State University, Northridge (CSUN), Lingard, Madison, and Melara (2002) studied the effectiveness of their introductory computer science course. The Chancellor's Office requested that some of the California State University campuses test an assessment tool called Tek.Xam. Tek.Xam contained five modules or tests with a completion time of 1 hour per test examination. CSUN selected its introductory computer science course, CS 100 Computers: Their Impact and Use, for this exam. Four sections, which included 109 student volunteers, participated in the initial assessment using a pretest and posttest. Researchers randomly assigned

students to one of the five modules. Because participation in the study was voluntary, only 51 of the 109 students completed both the pretest and the posttest. Four of the five assessments administered confirmed statistically significant findings. The researchers concluded that the course significantly improved the student's computer skills in some areas. However, they suggested that, although the vendor-neutral Tek.Xam was currently the best assessment tool on the market, it was inappropriate for CSUN's introductory computer science course. CSUN recommended offering a reward to students such as extra credit to increase participation in the study. Additionally, the university developed an exam that specifically targeted the objectives within the introductory computer science course (Lingard et al., 2002). Cengage Learning introduced vendor-specific computer assessment software named Skill Assessment and Measure (SAM). The web-based software focused on computer skills introduced within designated Cengage Learning textbooks. The SAM training and assessment tool covered Microsoft Office 2010, Microsoft Windows, Microsoft Outlook, and Internet Explorer. Institutions that used SAM could tailor the software to meet their institution's needs (Cengage Learning, 2010).

Researchers at the International Society for Technology in Education (ISTE) (2007) created guidelines for technology use. These guidelines formed the National Educational Technology Standards and Performance Indicators for Students (NET-S). NET-S standards were comprised of six major categories. The first category, Creativity and Innovations, required students to use current knowledge to develop new goods. Communication and Collaboration was the next standard, which encouraged various means of digital collaboration and problem solving within project teams. The third category, Research and Information Fluency, focused on the student's ability to organize and evaluate digital data derived from multiple sources. Critical Thinking, Problem Solving, and Decision Making encompassed the fourth category. Students

identified, evaluated, and managed questions for investigation using diverse perspectives. Digital Citizenship, category five, required students to focus on the ethical use of technology and demonstrate a positive attitude toward the technology use. The final category was Technology Operations and Concepts. Students needed a clear understanding of a technology system and be able to select an application that efficiently solves a problem (ISTE, 2007).

The International Technology Education Association (ITEA) (2000) project, entitled Technology for All Americans, designed a different set of technology standards to measure computer literacy. Technology for All Americans incorporated the national standards from other disciplines and the inclusion of technology in those disciplines. The ITEA and its project, Technology for All Americans, published the *Standards for Technological Literacy: Content for the Study of Technology* in April, 2000. The content standards defined two categories, what technologically literate individuals should know about technology and what they should be able to do. The two categories were further subdivided into five major categories. These categories included The Nature of Technology, which concentrated on the understanding of and scope of technology and its relationship to other fields of study. The second category was Technology and Society. This category focused on the historical impact of technology and the cultural impact of technology on society. Design, Abilities for a Technological World, and The Designed World comprised the final three categories. These final three categories concentrated on technological skills related to the study of science and math.

The European Union (EU) and its member States have committed themselves to ensure the continued growth of an European knowledge economy. The first step to ensure this growth was that the EU member states had to assess the level of technology skills. The study found that about 40% of the European population was lacking basic information and communication skills.

One large group identified within this populace was the older working adults from ages 55 to 64. It was further documented that a significant portion of unemployed Europeans lacked basic information and communication skills. In order to improve the lack of information and communication skills for all Europeans especially the older population, the EU member states implemented several initiatives. The Spanish Everybody Online program was designed to introduce the Internet particularly targeting the older population. Basic information and communication literacy coaching programs were introduced to the EU. Two coaching programs introduced in the EU were Maltese myWeb and Cybersoek. Unemployed EU citizens were also taught information and communication literacy. One example of labor market training for the unemployed was the Latvian EQUAL project. The project taught the participants basic computers skills, which included knowledge regarding Internet searches for job resources and the creation of cover letters and curriculum vitae. Technical skills enhancements were also introduced to younger individuals. For instance, Great Britain initiated an after-school computer club for girls. The Computer Club for girls targeted ages 10 to 14 and was developed to interest this group in future technology careers (Junge & Hadjivassiliou, 2007).

Certiport developed a certification program to promote digital literacy entitled the Internet and Computing Core Certification or IC³. The IC³ certification exam consisted of three key components: Computing Fundamentals, Key Applications using Microsoft Office 2007, and Windows Vista. Because the State of Florida on a yearly basis had an estimated 10,000 entering freshmen, Certiport selected Broward Community College (BCC) to pilot the IC³ examination in 2007. The school required entering students to take the IC³ examination to determine their computing skill level. Certiport research suggested an approximate 7% pass rate for this exam. Of the 10,000 incoming students statewide, approximately 15% achieved the desired digital

literacy score of 85. The schools also required a three-credit remediation course for students who were unsuccessful on the IC³ examination (Certiport, 2010a).

Certiport (2010b) and the Educational Testing Service offered an iCritical Thinking Certification that assessed individual digital literacy skills. This certification focused on workers' ability not only to use technology, but also to solve problems and to maneuver in a digital environment. The iCritical Thinking Certification tested seven Information and Communication Technology (ICT) Literacy skills, the ability to define, access, evaluate, manage, integrate, create, and communicate in a digital environment (Certiport, 2010b).

In 1991 the United States Department of Labor created the Secretary's Commission on Achieving Necessary Skills (SCANS) to assess employee workforce preparedness. These performance-based skills comprised the SCANS skill competencies and reflected not only the acquisition of basic thinking skills but technology for an ever-changing workplace. Some SCANS competencies were resources, interpersonal, information, systems, and technology. Using these competencies, an individual must have been able to allocate technology resources, function in a team, acquire the needed data, and monitor the system. Another competency criterion was the workers' ability to identify and solve problems using technology. Workers had to apply a technological solution to a specifically assigned task (United States Department of Labor, 1991).

Institutions' Adoption of Computer Literacy Requirements

Several higher education institutions adopted computer literacy requirements. For example, Liberty University in Lynchburg, Virginia adopted computer literacy requirements because of its desire that all students achieve technological literacy. During the first semester of their freshman year, students must have taken a computer assessment. If students were not

successful, they retook the exam during its first semester. If students had not passed the assessment exam after the second attempt, they were then required to complete a three-credit-hour course, Computer Concepts and Application, INFT 110. The catalog course description follows:

“Computer Applications will introduce the student to the operation and use of computers. Specific applications taught include operating systems, word processing, spreadsheets, and presentation software. In addition, students will learn basic terminology and concepts related to the use of computers in today’s society.” (Liberty University, 2009-2010, pg.158)

The categories targeted for both the computer assessment and INFT 110 were word processing, presentations, spreadsheets, file management, electronic mail, and basic concepts. Word processing, spreadsheets, and presentations were subdivided into individual skills. To complete the word processing skills set successfully, the user planned, created, and edited a document. For the spreadsheet program, the user entered numbers, formulas, and functions and performed what-if analysis. Finally, in the presentation software, the user created a multimedia presentation that included headers, footers, text, pictures, tables, and bulleted lists. MyItLab, vendor-specific software, facilitated the web-based computer assessment. In order for the participant to run the web-based assessment software, an Internet connection was required along with ActiveX, and Adobe Flash player. Multiple Windows operating systems and the web browser, Internet Explorer, supported the MyItLab assessment tool (Liberty University, 2010).

In 2005 San Antonio College (SAC) adopted a computer competency policy. This policy complied with the Southern Association of Colleges and Schools mandate that required demonstration of computer competency by graduates. Therefore, SAC’s computer assessment measured students’ ability to access relevant software to complete an assigned task. Graduates needed a basic understanding of how the computer retrieved and moved the data and the ways in

which data were saved in a computer. Other necessary requirements were a proficiency in storing and retrieving files and formatting files. The school provided computer competency websites as helpful reviews before students took the assessment. However, the materials provided were not comprehensive study materials for the assessment. The monitored SAC Computer Literacy Challenge Test contained two parts. The first, Theory Test #1, included 50 to 75 questions that reflected the students' knowledge of basic computer concepts and terminology. To advance to the second section of the test, students were expected to score at least 70%. The second section of the test, Practical Applications #2, encompassed three areas. Literacy assessment was validated through word processing and spreadsheet applications, while only a basic knowledge was required for databases. Facilitators scored the literacy assessment and provided feedback during an advisement session. During the advisement session, students chose to keep their score and have it added to their transcript or to take an intensive computer course. Three designated computer courses met the computer competency requirement for the college. The student had to earn an overall C in the course to satisfy SAC's computer literacy requirement (San Antonio College, 2005).

Students who attended Mississippi Gulf Coast Community College (MGCCC) demonstrated computer competency skills to receive an Associate of Arts degree. Students completed a three-credit-hour computer course, transferred college-level computer credits from another institution, or were required to pass a computer competency exam. MGCCC defined college-level competency as the ability to manage files, use electronic mail, and locate information on the Internet, as well as, use word processing and spreadsheet software effectively. Students must have demonstrated the use of other basic software applications if applied to a specified task. If students chose the computer competency exam and failed to pass the exam on

the first two attempts, students were required to wait 6 months before the exam was again attempted (Mississippi Gulf Coast Community College, 2009-2010).

In 2010 Cape Fear Community College (CFCC) in North Carolina mandated that students prove computer competency to graduate. The students were presented with two options that satisfied competency requirements. They must have successfully passed the computer competency exam, a 1-hour exam, or have completed a designated college transfer computer course. If students chose the proctored competency exam, it was administered through Blackboard, a course management software application. In preparation for the exam, CFCC provided a computer competency tutorial and a computer competency practice exam for students (Cape Fear Community College, 2010).

Merced College in Merced, California instituted a Computer and Information Literacy competency requirement in 2000. The computer competencies listed in the Merced College Catalog 2010-2011 included competencies identified by assigned alphabet letters: A) Name and describe the typical digital computer components and their functions; B) Describe common computer applications and related social and ethical problems/impact; C) Learn fundamental operation and concepts of word processing, spreadsheet, and database software applications; D) Understand the difference between information and knowledge; E) Understand the links among information centers and the access points available through technology and reference sources; F) Understand the basic structure of electronic databases and the strategies used to access them; and G) Recognize the different levels, types, and formats of information, including but not limited to primary versus secondary, and popular versus scholarly. The course catalog displayed a chart that listed all the courses that satisfied computer competencies A through G. For instance, a student who completed ENGL-01A would have met only one competency, and a student who

completed CPSC-01 would have met six competencies in the grid. However, if the student enrolled in the Learning Resources course, it would meet all required computer competencies. It was the students' responsibility to contact a counselor to determine whether they met all computer competencies before graduation (Merced College, 2010-2011).

Upon graduation at Florida State University (FSU), students must have demonstrated basic computer competency by taking and passing a computer science course. An overall C in the designated course met competency requirements. No computer skills exam was available to FSU students to exempt the designated computer competency course (Florida State University, 2010).

Each higher education institution listed in the study has detailed the need for college-level computing skills. However, requirements for determining computer competency varied from institution to institution.

CHAPTER 3

RESEARCH METHODOLOGY

Within the literature, definitions of computer literacy have varied from author to author. Often, individuals' actual task-specific computer skills and their perceived computer skills do not coincide (Dettori et al., 2006). According to Messineo and DeOllos (2005) higher levels of experience with forms of technology produced more confidence. However, it was suggested that with advanced applications, the confidence level and the exposure level was lacking. Incorrect assumptions are sometimes made by faculty members regarding student preparedness to take the introductory computer science class.

The purpose of this study was to determine a student's computer knowledge upon course entry and if there was a difference in college students' improvement scores as measured by the difference in pretest and posttest scores of new or novice users, moderate users, and expert users at the end of a college-level introductory computing class. This study also determined whether there were differences in improvement scores by gender or age group. The results of this study were used to determine whether there was a difference in improvement scores among the three campus locations participating in this study.

A quantitative research method was used to evaluate the difference in student improvement using pretest scores and posttest scores in a college-level introductory computer class at the participating community college. Chapter 3 presents the research design, population, research instrument, data collection procedures, research hypotheses, and methods.

Research Design

The term computer competency as applied to college students is often defined as having a working knowledge of terminology as it related to computer hardware and software systems.

Students are usually required to have the ability to efficiently produce practical documents (San Antonio College, 2005). The first step in defining what college-level computer competency meant for the participating institution was to survey each administrator of the college to determine the skills needed for graduates to successfully enter the job market. A computer skills survey for deans was created by the Dean of Technical Education and the computer science faculty. Before completing the survey, each division was asked to consider four major points about computer education at the college-level:

1. What tasks should any graduate of a community college be able to complete when using a computer?
2. Your division may have degree programs that require a computer course. These degree programs are more likely to have different competency expectations.
3. It is likely that the college will offer the option of taking a computer competency exam a student may take or an introductory computer course to fulfill computer competency. Either path selected must be completed in the first 30 hours of course work.
4. The exam, the competency course(s), and the introductory procedures ensure college-level computing competency will be developed after the computer competencies have been determined.

Using quantitative research, the present study was focused on student improvement as measured by a pretest scores and posttest scores in a college-level introductory computer course at a participating community college. Twenty-six sections of the introductory computer course were analyzed to determine student improvement. All students enrolled in the target community college must prove that they possessed college-level computing skills. Students offered this

proof either by taking a Computer Competency Exam or by completing an introductory computer course at the designated community college. Approximately 97% of students chose to take the college-level introductory computer course while an average of 3% of students chose to take the computer competency exam. Both computer options were comprised of units on hardware, software, computer terminology, Microsoft Word, Microsoft Excel, and Microsoft PowerPoint. Within the 26 sections of the introductory course, there were approximately 469 students enrolled who volunteered to participate in the study. Typically, students do not enter the introductory course with the same set of computing skills. Often, individuals' computer skills perceptions do not concur with their actual skill level (Dettori et al., 2006). Assessment in the form of pretesting and posttesting offered insights on students' computer skill growth during the semester. The survey provided demographic information and data on students' perceptions of their self-assessed skill level (Appendix A). When students entered the introductory computer course, they completed a pretest to evaluate areas of strengths and weaknesses. After the pretest was administered the course instructor evaluated each student's pretest score. If students scored an 80% or higher on the course pretest, they were provided a test-out option. The course test-out option allowed the student to take a projects-based test. While under supervision, the student would be assigned a specific project for Microsoft Word, Microsoft Excel, and Microsoft PowerPoint. Upon submission, the projects were graded by the head of the Computer Science Department. An overall score for the three projects was assigned and provided to the course instructor by the department head. At that point, the students decided to accept the projects-based course grade as the grade earned for the course or they could decide to continue on in the course as usual.

After receiving permission from the appropriate dean at the participating community college, data were collected by the Computer Science Department. Once permission was granted, access to the data was available by a designee appointed by the division dean through the course management system, Desire to Learn. The data consisted of the pretest scores, posttest scores, and survey results. The improvement score was derived from the posttest score minus the pretest score. The posttest was factored as a part of the course grading scheme and was delivered at the end of the course. All introductory computer course students took the pretest and posttest at three different campus locations. For the purposes of this study and for reasons of confidentiality, each of the three campuses was designated as locations 1, 2, and 3. There were a variety of introductory computer course delivery methods in the semester during the study. The course delivery types included on ground courses, hybrid courses, and online courses. In addition, participants received a demographic survey with the pretest (Appendix A). Students enrolled in the introductory computer course elected to participate in the demographic survey. Variables included in the demographic survey were: gender, age, campus location, higher education experience, residential Internet access, and self-rated of computing skill level. One key demographic variable included participants self-rating their current overall computing skill level. Students selected one of the three categories (Appendix D). Each category listed skill descriptions. These three self-rated categories were new or novice user, moderate user, and expert user.

Research Questions and Null Hypotheses

The study addressed eight primary research questions from the survey responses, as follows:

Research Question 1: Are there significant differences in students' pretest scores among the three college experience categories (freshman – 1st semester, freshman – 2nd

semester, and sophomore- 1st and 2nd semester) in college-level introductory computing classes?

Ho1: There are no significant differences in students' pretest scores among the three college experience categories in college-level introductory computing classes.

Research Question 2: Are there significant differences in students' pretest scores among the five types of self-reported residential Internet access (dial-up, cable, DSL, wireless, and no Internet access) in college-level introductory computing classes?

Ho2: There are no significant differences in students' pretest scores among the five types of self-reported residential internet access in college-level introductory computing classes.

Research Question 3: Are there significant differences in students' pretest scores among the three self-rated user categories (new or novice user, moderate user, and expert user) in college-level introductory computing classes?

Ho3: There are no significant differences in students' pretest scores among the three self-rated user categories in college-level introductory computing classes.

Research Question 4: Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the three self-rated categories (new or novice user, moderate user, expert user) in college-level introductory computing classes?

Ho4: There are no significant differences in students' improvement scores among the three self-rated categories in college-level introductory computing classes.

Research Question 5: Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the three campus locations (Campus Location 1, 2, and 3) in college-level introductory computing classes?

Ho5: There are no significant differences in students' improvement scores among the three campus locations in college-level introductory computing classes.

Research Question 6: Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the three age categories (age 15-19, age 20-28, age 29 and older) as determined by gender in college-level introductory computing classes?

Ho6₁: There is no significant age by gender interaction.

Ho6₂: There are no differences in students' improvement scores among the three age categories in college-level introductory computing classes.

Ho6₃: There is no difference in students' improvement scores between males and females in college-level introductory computing classes.

Research Question 7: Are there significant differences in students' improvement scores among the three self-rated user categories (new or novice user, moderate user, expert user) in regard to the three age categories (age 15-19, age 20-28, age 29 and older) in college-level introductory computing classes?

Ho7₁: There is no significant age by self-rated user category interaction.

Ho7₂: There are no differences in students' improvement scores among the three age categories in college-level introductory computing classes.

Ho7₃: There are no differences in students' improvement scores among the three self-rated user categories in college-level introductory computing classes.

Research Question 8: Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the course delivery types (on ground courses, online courses, and hybrid courses) in college-level introductory computing classes?

Ho8: There are no significant differences in students' improvement scores among the course delivery types in college-level introductory computing classes.

Variables in the Study

This study focused on student improvement in a college-level introductory computing class using a pretest and a posttest at the participating community college. The assessment of the pretests and posttests and the results of these tests were the criterion variables for the study. The independent variables included were: gender, age, campus location, prior higher education experience, residential Internet access, and user's self-rated computer skill level.

Instrumentation

A group of Computer Science instructors at the participating college aided in the development of the pretest and posttest. The questions represented each unit studied throughout the course. Administration of the pretest and posttest were managed through the course management system and consisted of 100 questions. The questions incorporated the chapter units of the course, as follows: (a) Chapters 1-3, operating system; (b) Chapters 1-4, basic word processing; (c) Chapters 1-4, basic spreadsheet chapters; (d) Chapters 1 and 2, basic presentation software. Some enrolled students did not complete the pretest. One factor for the lack of pretest completion was that the student registered for the course after the administration of the pretest. Another factor hindering pretest data collection was student absenteeism during the class period in which the instructor scheduled the pretest.

The student survey instrument contained various demographic questions (Appendix A). The independent variables included were: gender, age, college experience, campus location, residential Internet access, and the user's self-rated computing skill level. The survey questions were comprised of multiple choice situations. One particular survey question regarding the user's self-rated computing skill level was of particular importance to this study. The question required the participants to read descriptions of each of three defined categories (Appendix D). They then selected the category that best described their computing skill level. The three self-rated categories were new or novice user, moderate user, and expert user. Because the demographic survey was optional, some students chose not to participate in this portion of the study or they completed only portions of the survey.

The pretest, posttest, and demographic survey data used in the study were compiled in spreadsheet software. Each student's name was removed from the spreadsheet record and replaced with a number by a designee of the division dean to protect the anonymity of the participants. Students included in the study were those who had taken the pretest and had answered the corresponding demographic survey question for the analysis of the research question. Additionally, students who completed the pretest, the posttest, and had supplied the demographic data for the analysis of the research supplied were incorporated in the study.

Population

Students from 26 sections of the introductory computer science course participated in the study. In each section the instructor administered the pretest, posttest, and survey to those students who had chosen to participate. A total of 469 students participated in the study. Students taking the pretest exam numbered 458. However, there were 426 students eligible to be involved in the in the analysis of the research questions involving the pretest scores and the corresponding

demographic data. Participants included students who took an introductory computer science course instead of the computer competency exam. If students took the computer science course, they were required to pass the course with a score of a D or higher. If students failed the course, they were required to retake the course to prove computer competency. There were 400 students who completed both the pretest and the posttest. Four hundred students were eligible to be included in the analysis of the research questions involving improvement scores and the corresponding demographic data. Other participants in the course included students who took the computer competency exam but were unsuccessful in their attempt to test-out of the course. Before taking the computer competency exam, students were given unlimited attempts to take the computer competency practice test. When students attained a minimum score of 85, participants then had the opportunity to take the computer competency exam one time. Students were required to achieve a minimum score of 80 on the exam. Participants dissatisfied with their competency exam passing score could have also opted to take the introductory computer course. The posttest portion score was factored into the grading scheme of the course. In addition to the pretest and posttest component of the study, participants completed the survey as an optional component. The majority of the students who completed the course participated in the pretest, posttest, and survey portions of the study. However, of the 469 student participants, not all students completed all three components used in the study. Some students completed the pretest and demographic survey and then withdrew from the course, while others opted not to complete the demographic survey. All students enrolled at the end of the course were required to take the posttest.

The participating community college served 10 surrounding counties with three campuses serving diverse populations. Students from three geographically unique campuses participated in

this study. The campus locations in the study included: Location 1, centrally located; Location 2, located furthest southeast of the campuses; and Location 3, located furthest south. Enrollment in the course numbered 469 students. For the analysis of research questions involving pretest scores and demographic data, there were 426 students eligible. For the analysis of research questions focused on pretest scores, posttest scores and survey data, there were 400 students eligible for participation. Because all course sections administered the pretest, posttest, and the survey, there was no skewing of the data by either the selection of a particular introductory computer science course or the time designation that each course was offered.

Data Collection

The online course management system used in the study was Desire to Learn. The online course management system provided one central location for course materials, quizzes, surveys, calendars, and drop boxes for students to submit assignments with no installation of additional software required by the participants. The data provided for the study were collected through the course management system by a designee of the division dean. Twenty-six sections of college-level introductory computing classes at three different campus locations: Location 1, Location 2, and Location 3, participated in the administration of both the pretest and posttest delivered through the course management system. The pretest consisted of 100 multiple choice questions. Instructors for each college-level introductory computing class administered the pretest during the first week of class during the fall semester. The posttest questions mirrored the pretest. This test was delivered during final exam week for the fall semester through the course management. All enrolled students who took the college-level introductory computing class for a grade were required to complete the posttest because it was considered as a part of the course grading scheme.

In addition, a demographic survey was administered electronically along with the pretest. The demographic survey was developed with the assistance of the instructors in the Computer Science Department. Each instructor of the 26 participating course sections explained the purpose of the survey to each class and noted that student participation was optional. As with the pretest and posttest delivery, the demographic survey was administered electronically as part of the class through the course management system. Students logged in to the course management system and entered into their college-level introductory computing class to take the survey located in the Surveys section of the course. If students chose to participate, students were then instructed to complete and submit the demographic survey questions electronically. Data provided by the students in the study were used only for the purposes of this study and the Computer Science Department of the participating community college. Pretest, posttest, and survey data were collected by a designee of the division dean to protect the anonymity of students who chose to participate in the study.

Data Analysis

The components included in this study were a survey, pretest, and a posttest. The analysis of the collected data used standard research strategies. IBM SPSS, a computer software program, was used to analyze the data. Evaluation of the hypotheses for each of the eight research questions used an alpha level of .05, which allowed the researcher to reject the null hypothesis. The tests included both one-way analysis of variances (ANOVA) and two-way ANOVAs. In the study, research questions 1 through 5 and research question 8 were analyzed using a one-way ANOVA to analyze the data, while research questions 6 and 7 were examined using a two-way ANOVA.

Summary

Chapter 3 offered the research design of the study, the population of the study, the research questions, null hypotheses, and the data collection methodology. The study included 26 sections of the introductory computer science course at a community college in Northeast Tennessee. Chapter 4 presents the statistical data analyzed from the sections of the introductory computer science course. Chapter 5 contains the summary of the study and the recommendations for practice and future research.

CHAPTER 4

ANALYSIS OF DATA

Technology, especially the use of computers, has become an essential part of our personal and professional lives. With the availability and use of computers comes an increased need for computing skills. As a result of this need, the participating community college now requires all students to prove college-level computer competency using one of two methods. One method is for students to pass a computer competency exam with a minimum score of 80%. This competency exam is designed to reflect the skills deemed necessary to be successful in the general education curriculum. The exam topics are computer hardware and terminology, the operating system, as well as the designated productivity applications, word processing, spreadsheets, and graphics presentation software. A second method to demonstrate college-level computer competency is for students to successfully complete a college-level introductory computing course with at least a grade of a D within the first 30 semester hours of coursework in a degree program.

The data for this study consisted of pretest scores, posttest scores, and survey results from 469 participants enrolled during the fall semester of 2007. The pretest, posttest, and survey data were collected through Desire 2 Learn from 469 students who chose to participate in the components of the study. Males represented 35% of the population and females represented the remaining 65%. The data included the improvement score that was calculated as the difference between the posttest and the pretest scores. The survey instrument (Appendix A) contained multiple items. The survey questions served as independent variables in the study. Participants were asked to provide data regarding their age group, campus location, and educational experience. Three categories characterized the age of the participants of the study. The age 15-19

category represented 67% of the respondents. The age 20-28 category included 19% of the respondents, and the age 29 and older category totaled 14%. First semester freshmen represented 65% of the population, second semester freshmen represented 19%, and sophomores – first and second semester comprised 19% of the total. Data were collected from three locations. For the purpose of this study, these sites were listed as Location 1 which contained 55% of the participants, Location 2 with 20% of the participants and Location 3 with 25%. Other data collected from the participants included the student's type of residential Internet accessed. Also, students were asked to self-rate their overall computing skill level. Participants were provided three possible computing skill level categories: New or Novice User, Moderate User, and Expert User. A list of specific computing skills was provided for each category. The complete survey used for the present study is located in Appendix A.

Eight research questions and 12 null hypotheses were used to guide this research. The data collected were analyzed using IBM-SPSS statistical software.

Research Questions

Research Question 1

Are there significant differences in students' pretest scores among the three college experience categories (freshman – 1st semester, freshman – 2nd semester, and sophomore- 1st and 2nd semester) in college-level introductory computing classes?

Ho1: There are no significant differences in students' pretest scores among the three college experience categories in college-level introductory computing classes.

A one-way analysis of variance was used to evaluate the relationship between students' pretest scores and the college experience of students enrolled in college-level introductory computing classes. The dependent variable was pretest scores. The independent variable, college

experience, had three levels: first semester freshmen, second semester freshmen, and sophomores – first and second semester. The ANOVA was significant, $F(2, 423) = 11.01$, $p < .001$. The effect size as measured by η^2 was small (.05). That is, 5% of the variance in students' pretest scores was accounted for by college experience.

Because the overall F test was significant, multiple post hoc comparisons were conducted to evaluate pairwise differences in the pretest means of the three groups. The Tukey post hoc test was used because equal variances were assumed, $F(2, 423) = .85$, $p = .430$. The Tukey procedure determined that there was a significant difference between first semester and second semester freshmen ($p < .001$) and between first semester freshmen and sophomores – first and second semester ($p = .020$). In each instance, the pretest mean for first semester freshmen students was lower. The pretest mean for first semester freshmen was over six points lower than the mean for second semester freshmen and over 3.5 points lower than the mean for sophomores – first and second semester. There was no significant difference between second semester freshmen and sophomores – first and second semester ($p = .322$). The 95% confidence intervals for the pairwise mean differences, as well as the pretest means and standard deviations for the types of college experience levels are shown in Table 1. Figure 1 shows the boxplot for the distribution of pretest scores for each level of college experience.

Table 1

Means and Standard Deviations for Pretest Scores with 95% Confidence Intervals by Education Experience

User Category	<i>N</i>	<i>M</i>	<i>SD</i>	1 st sem. freshman	2 nd sem. freshman
1 st sem. freshman	277	52.96	10.24		
2 nd sem. freshman	70	59.16	11.34	-9.55 to -2.84	
Sophomore – 1 st and 2 nd sem.	79	56.63	11.66	-6.87 to -.47	-1.59 to 6.64

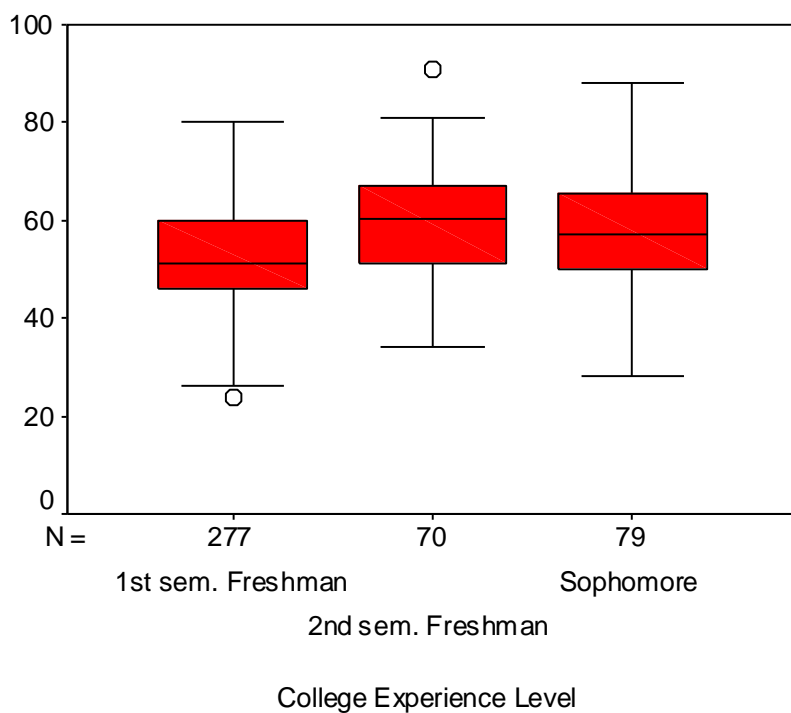


Figure 1. Boxplot for Pretest Scores by College Experience Levels

Note. o = an observation between 1.5 times to 3.0 times the interquartile range

Research Question 2

Are there significant differences in students' pretest scores among the five types of self-reported residential Internet access (dial-up, cable, DSL, wireless, and no Internet access) in college-level introductory computing classes?

Ho2: There are no significant differences in students' pretest scores among the five types of self-reported residential Internet access in college-level introductory computing classes.

A one-way analysis of variance was used to evaluate the mean differences in students' pretest scores among the five types of self-reported residential internet access. The dependent variable was the pretest scores. The independent variable, type of residential internet access, had five levels: dial-up, cable, DSL, wireless, and no internet access. The ANOVA was not significant, $F(4, 421) = 1.48$, $p = .209$. The effect size as measured by η^2 was small (.01). That is, only 1% of the variance in pretest scores was accounted for by the type of internet access. The results indicated that the type of residential internet access did not significantly affect students' pretest scores. The pretest means and standard deviations for the types of residential internet access are shown in Table 2. Figure 2 shows the boxplot for the distribution of pretest scores for each of the types of internet access.

Table 2

Means and Standard Deviations for Pretest Scores by Type of Residential Internet Access

Residential Internet Access	<i>N</i>	<i>M</i>	<i>SD</i>
Dial Up	59	54.86	11.68
Cable	117	54.16	11.24
DSL	88	55.48	10.77
Wireless	119	55.67	10.48
No Internet	43	51.28	10.46
Total	426	54.66	10.95

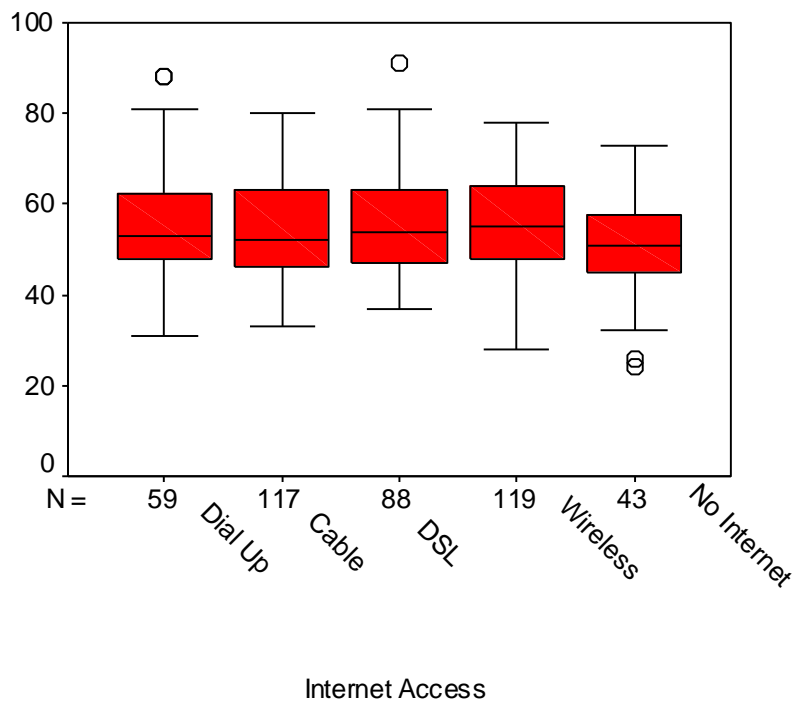


Figure 2. Boxplot for Pretest Scores by Types of Residential Internet Access

Note. o = an observation between 1.5 times to 3.0 times the interquartile range

Research Question 3

Are there significant differences in students' pretest scores among the three self-rated user categories (new or novice user, moderate user, and expert user) in college-level introductory computing classes?

Ho3: There are no significant differences in students' pretest scores among the three self-rated user categories in college-level introductory computing classes.

A one-way analysis of variance was completed to evaluate the relationship between students' pretest scores and the self-rated user category in college-level introductory computing classes. The dependent variable for this ANOVA model was the pretest scores. The independent variable, self-rated user category had three levels: new or novice user, moderate user, and expert user. The ANOVA was significant, $F(2, 422) = 40.74$, $p < .001$. The effect size as measured by η^2 was large (.16). That is, 16% of the variance in pretest scores was accounted for by the self-rated user category.

Because the overall F test was significant, follow-up tests to evaluate the differences among the pairs of pretest means were conducted. The Tukey post hoc test was used because equal variances were assumed, $F(2, 422) = .78$, $p = .459$. The Tukey procedure determined that all pairs of pretest means were significantly different at $p < .001$. In each pair of means evaluated, the lower the self-rated user level had the lower pretest mean. That is, the pretest mean for self-rated new or novice users was over 7.0 points lower than self-rated moderate users and almost 15 points lower than self-rated expert users. The pretest mean for self-rated moderate users was 7.4 points lower than self-rated expert users. The 95% confidence intervals for pairwise differences in pretest means, as well as the pretest means and standard deviations for the self-rated user

categories are shown in Table 3. Figure 3 shows the boxplot for the distribution of pretest scores for each of the self-rated user categories.

Table 3

Means and Standard Deviations for Pretest Scores with 95% Confidence Intervals by Self-Rated User Category

User Category	<i>N</i>	<i>M</i>	<i>SD</i>	New or Novice	Moderate
New or Novice	62	46.79	10.64		
Moderate	274	54.23	9.71	-10.75 to -4.13	
Expert	89	61.63	10.90	-18.73 to -10.95	-10.27 to -4.53

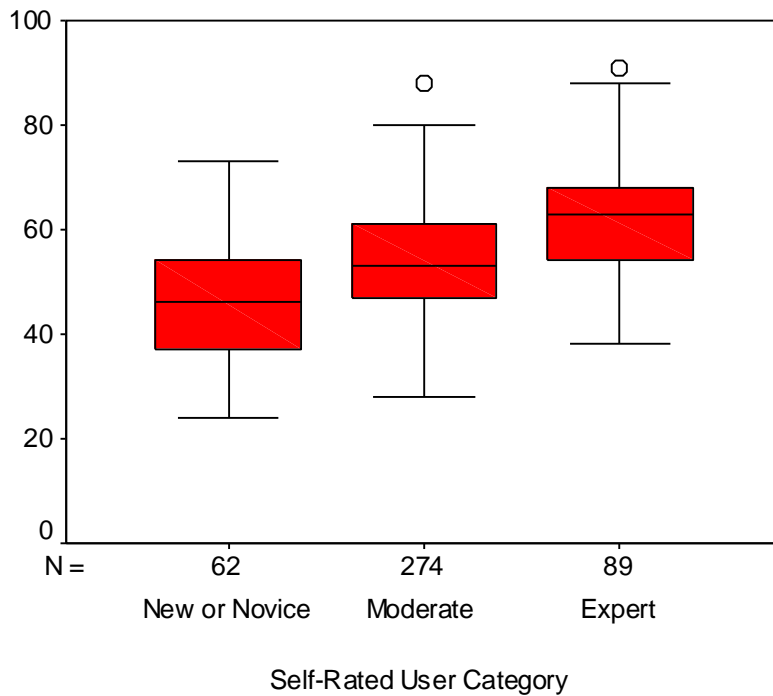


Figure 3. Boxplot for Pretest Scores by Self-Rated User Category

Note. o = an observation between 1.5 times to 3.0 times the interquartile range

Research Question 4

Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the three self-rated categories (new or novice user, moderate user, expert user) in college-level introductory computing classes?

Ho4: There are no significant differences in students' improvement scores among the three self-rated categories in college-level introductory computing classes.

A one-way analysis of variance was completed to evaluate the relationship between students' improvement scores and the self-rated user category in college-level introductory computing classes. The dependent variable was improvement scores. The independent variable, self-rated user category had three levels: new or novice user, moderate user, and expert user. The ANOVA was significant, $F(2, 372) = 15.54, p < .001$. The effect size as measured by η^2 was medium (.08). That is, 8% of the variance in improvement scores was accounted for by self-rated user categories.

Because the overall F test was significant, post hoc multiple comparisons were conducted to evaluate which pair of improvement score means was different. Levene's Test of Equality of Error Variances showed equal variances could not be assumed, $F(2, 372) = 4.33, p = .014$. Therefore, the Dunnett's C post hoc test was used to test pairwise differences. All three pairs of means were significant at the .05 level. Self-rated new or novice users' improvement score mean was 5.6 points higher than self-rated moderate users and 10 points higher than self-rated expert users. Moderate users' mean improvement was 4.5 points higher than expert users. The 95% confidence intervals for the pairwise differences in improvement score means and standard deviations for the self-rated user categories are shown in Table 4. Figure 4 shows the boxplot for the distribution of improvement scores for each of the groups of self-rated user categories.

Table 4

Means and Standard Deviations for Improvement Scores with 95% Confidence Intervals by Self-Rated User Category

User Category	<i>N</i>	<i>M</i>	<i>SD</i>	New or Novice	Moderate
New or Novice	58	29.00	13.11		
Moderate	240	23.40	10.00	1.19 to 10.01	
Expert	77	18.90	9.41	5.23 to 14.98	1.53 to 7.48

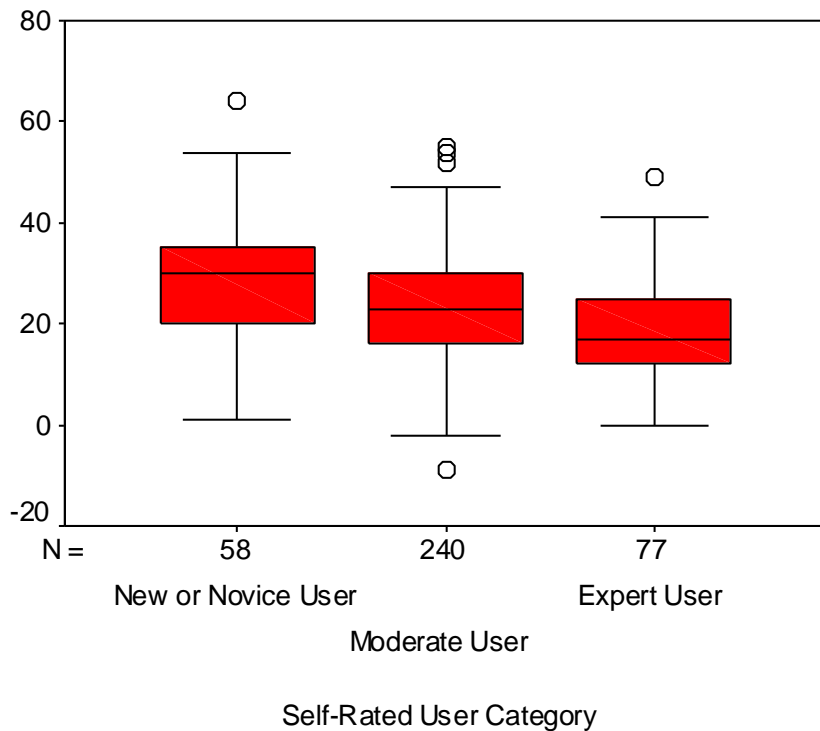


Figure 4. Boxplot for Improvement Scores by Self-Rated User Category

Note. o = an observation between 1.5 times to 3.0 times the interquartile range

Research Question 5

Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the three campus locations (Campus Location 1, 2, and 3) in college-level introductory computing classes?

Ho5: There are no significant differences in students' improvement scores among the three campus locations in college-level introductory computing classes.

A one-way analysis of variance was completed to evaluate the differences in students' improvement scores among the three campus location in college-level introductory computing classes. The dependent variable was improvement scores. The independent variable, campus locations had three levels labeled: Location 1, Location 2, and Location 3. The ANOVA was significant, $F(2, 369) = 3.57$, $p = .029$. The effect size as measured by η^2 was small (.02) indicating that 2% of the variance in improvement scores was accounted for by campus location.

Because the overall F was significant, multiple post hoc comparisons were conducted to determine which pair of means was different. Dunnett's C was used because equal variances were not assumed, $F(2, 369) = 6.03$, $p = .003$. Dunnett's C showed there was a significant difference in improvement score means between Location 1 and Location 2. The improvement mean for Location 1 was 3.1 points higher than the mean for Location 2. No other pairs of means were significantly different. The 95% confidence intervals for the pairwise differences, as well as the improvement score means and standard deviations for the campus locations are shown in Table 5. Figure 5 shows the boxplot for the distribution of improvement scores for each campus location.

Table 5

Means and Standard Deviations for Pretest Scores with 95% Confidence Intervals by Campus Location.

Location	<i>N</i>	<i>M</i>	<i>SD</i>	Location 1	Location 2
Location 1	204	24.69	11.80		
Location 2	74	21.59	8.44	.05 to 6.14	
Location 3	94	21.79	9.83	-.20 to 5.99	-3.56 to 3.18

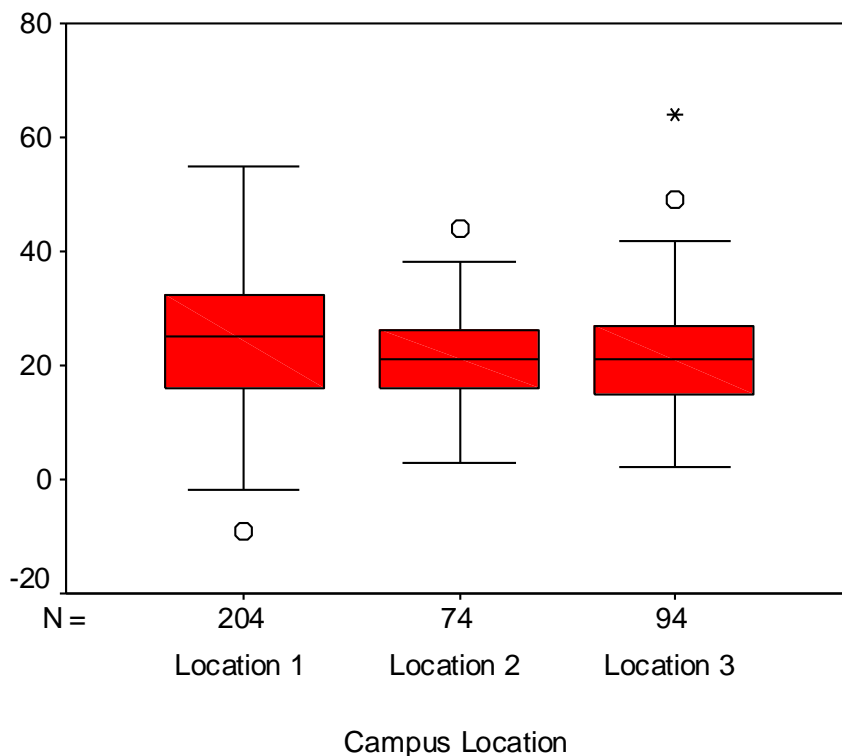


Figure 5. Boxplot for Improvement Scores by Campus Location

Notes. o = an observation between 1.5 times to 3.0 times the interquartile range;
 * = an observation which is more than 3.0 times the interquartile range

Research Question 6

Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the three age categories (age 15-19, age 20-28, age 29 and older) as determined by gender in college-level introductory computing classes?

To answer this research question, a two-way analysis of variance was used. The dependent variable was improvement scores. The two factors (independent variables) were gender and age which had three levels (age 15-19, age 20-28, age 29 and older). The two-way ANOVA evaluated three hypotheses:

Ho₆₁: There is no significant age by gender interaction.

Ho₆₂: There are no differences in students' improvement scores among the three age categories in college-level introductory computing classes.

Ho₆₃: There is no difference in students' improvement scores between males and females in college-level introductory computing classes.

The two-way ANOVA showed there was no significant age by gender interaction, $F(2, 370) = .536, p = .585$. The effect size as measured by η^2 was small ($<.01$) indicating that less than 1% of the variance in improvement scores was accounted for by age by gender interaction. There was no significant difference in the improvement score means among the age categories, $F(2, 370) = 2.966, p = .057$. The effect size as measured by η^2 was small (.02) indicating that 2% of the variance in improvement scores was accounted for by age. Finally, there was no significant difference in improvement score means between male and female students, $F(1, 370) = .489, p = .485$. The effect size as measured by η^2 was small ($<.01$). That is, less than 1% of the variance in improvement scores was accounted for by gender. The means and standard deviation for students' improvement scores by age and gender are shown in Table 6. Figure 6 shows a bar graph for score means by age and gender.

Table 6

Means and Standard Deviations for Improvement Scores by Age and Gender

Age	Gender	<i>N</i>	<i>M</i>	<i>SD</i>
15 – 19	Male	86	23.15	10.23
	Female	167	23.29	10.73
	Age 15 – 19 Total	253	23.25	10.54
20 – 28	Male	31	19.55	7.51
	Female	39	22.67	11.30
	Age 20 – 28 Total	70	21.29	9.86
29 and older	Male	13	26.38	12.92
	Female	40	26.30	12.85
	Age 29 and older Total	53	26.32	12.74
Total	Male	130	22.62	10.08
	Female	246	23.68	11.20
	Total	376	23.31	10.82

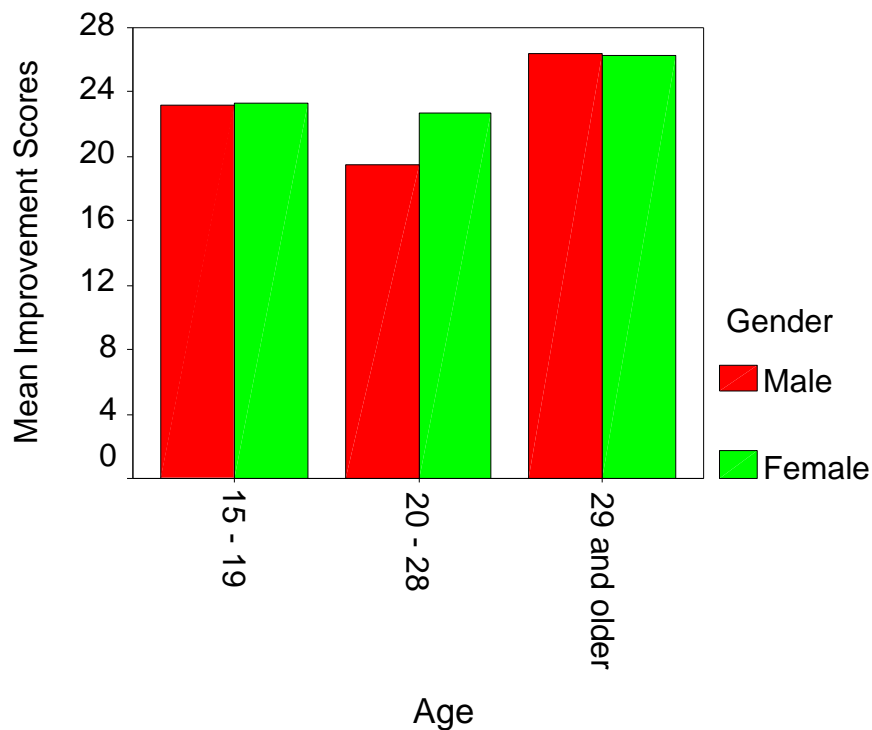


Figure 6: Bar Graph of Improvement Score Means by Age and Gender

Research Question 7

Are there significant differences in students’ improvement scores among the three self-rated user categories (new or novice user, moderate user, expert user) in regard to the three age categories (age 15-19, age 20-28, age 29 and older) in college-level introductory computing classes?

A two-way ANOVA was used to determine if there were differences in students’ improvement score means based on age and self-rated user categories in college-level introductory computing classes. The dependent variable was improvement scores. The two factors (independent variables) were age and self-rated user category. Age had three levels (age

15-19, age 20-28, age 29 and older), while self-rated user category had three levels (new or novice user, moderate user and expert user). The two-way ANOVA tested three hypotheses:

Ho7₁: There is no significant age by self-rated user category interaction.

Ho7₂: There are no differences in students' improvement scores among the three age categories in college-level introductory computing classes.

Ho7₃: There are no differences in students' improvement scores among the three self-rated user categories in college-level introductory computing classes.

The ANOVA showed that there was no significant two-way interaction between age by self-rated user category, $F(4, 366) = .61, p = .653$. The effect size for the interaction term as measured by η^2 was small (.01). The ANOVA also revealed that age categories were not significant, $F(2, 366) = 1.80, p = .167$. The effect size as measured by η^2 was small (.01). That is, 2% of the variance in improvement scores was accounted for by age. However, the self-rated user category was significant, $F(2, 366) = 12.54, p < .001$. The effect size as measured by η^2 was medium (.06) indicating that 6% of the variance in improvement scores was accounted for by the self-rated user category.

Regarding the significance of the self-rated user category, as reported in the discussion of Research Question 4, Dunnett's C showed all three pairs of improvement score means were significant at the .05 level. New or novice users' improvement score mean was over 5 points higher than moderate users and 10 points higher than expert users. Moderate users' mean improvement was 4.5 points higher than expert users.

The improvement score means and standard deviations by age and self-rated user categories are shown in Table 7. Figure 7 shows the bar graph for the distribution of improvement scores by age and self-rated user category.

Table 7

Means and Standard Deviations for Improvement Scores by Age and Self-Rated User Category

Age	Self-Rated User Category	<i>N</i>	<i>M</i>	<i>SD</i>
15 – 19	New or Novice User	21	28.43	13.06
	Moderate User	173	23.88	10.45
	Expert User	59	19.54	8.69
	Age 15 – 19 Total	253	23.25	10.54
20 – 28	New or Novice User	19	25.63	10.69
	Moderate User	36	21.03	8.34
	Expert User	14	16.64	10.69
	Age 20 – 28 Total	69	21.41	9.88
29 and older	New or Novice User	18	33.22	14.93
	Moderate User	31	23.48	9.06
	Expert User	4	17.25	15.86
	Age 29 and older Total	53	26.32	12.74
Total	New or Novice User	58	29.00	13.11
	Moderate User	240	23.40	10.00
	Expert User	77	18.90	9.41
	Total	375	23.34	10.82

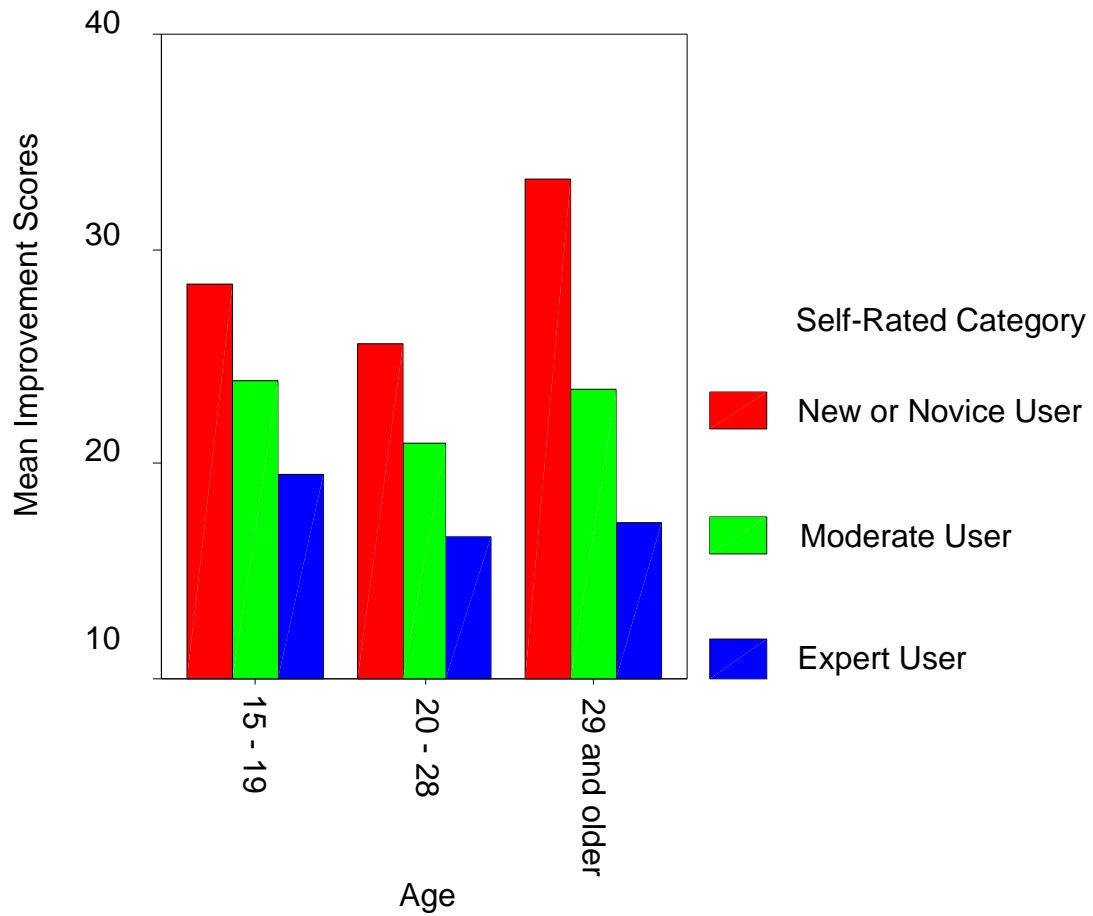


Figure 7: Bar Graph for Improvement Score Means by Age and Self-Rated User Category.

Research Question 8

Are there significant differences in students' improvement scores (posttest scores minus pretest scores) among the course delivery types (on ground courses, online courses, and hybrid courses) in college-level introductory computing classes?

Ho8: There are no significant differences in students' improvement scores among the course delivery types in college-level introductory computing classes.

A one-way analysis of variance was completed to evaluate the relationship between students' improvement scores among the course delivery types in college-level introductory computing classes. The dependent variable was improvement scores. The independent variable, course delivery type had three levels: on-ground, online and hybrid. The ANOVA was significant, $F(2, 397) = 3.36$, $p = .036$. However, the effect size as measured by η^2 was small (.02) indicating that 2% of the variance in improvement scores was accounted for by the course type.

Because the overall F was significant, multiple pairwise comparisons were conducted to determine which pair of means was significant. The Tukey test was used because equal variances were assumed, $F(2, 397) = 1.49$, $p = .226$. The Tukey procedure determined that there was a significant difference in the improvement means between on-ground and hybrid courses ($p = .048$). The improvement score mean for on-ground courses was five points higher than the mean for hybrid courses. However, there was no difference between on-ground and online course ($p = .447$) and no difference between online and hybrid courses ($p = .801$). The 95% confidence intervals for pairwise mean differences, as well as the improvement means and standard deviations for the course delivery types are shown in Table 8. Figure 8 shows the boxplot for the distribution of students' improvement scores for course delivery types.

Table 8

Means and Standard Deviations for Improvement Scores with 95% Confidence Intervals by Course Delivery Type

Course Delivery Type	N	M	SD	On Ground	Online
On-Ground	352	24.14	11.19		
Online	20	21.10	8.69	-2.85 to 8.93	
Hybrid	28	19.07	8.64	.04 to 10.10	-5.47 to 9.53

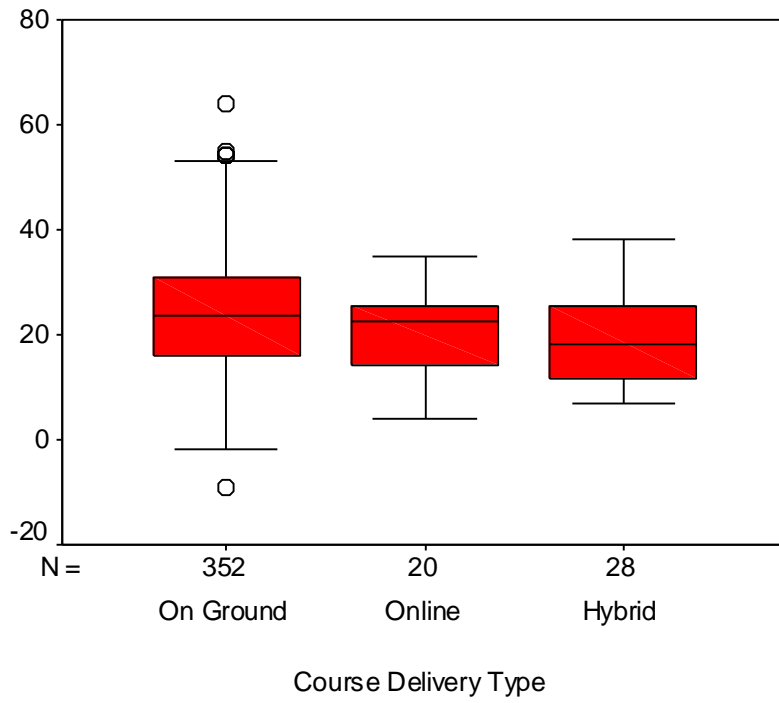


Figure 8: Boxplot for Improvement Scores by Course Type

Note. o = an observation between 1.5 times to 3.0 times the interquartile range

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to determine a student's computer knowledge upon course entry and if there was a difference in college students' improvement scores as measured by the difference in pretest and posttest scores of new or novice users, moderate users, and expert users at the end of a college-level introductory computing class. This study also determined whether there were differences in improvement scores by gender or age group. The results of this study were used to determine whether there was a difference in improvement scores among the three campus locations participating in this study.

Summary

College-level computing skills provide tools for the success of all college students. In the present study, all students enrolled in the participating community college demonstrated computer competency either by taking a computer competency exam or by completing a college-level introductory computing class. Improvement scores (posttest scores minus pretest scores) along with other factors such as age, gender, location, course delivery type, and self-rated computer skill levels were analyzed to determine the possible implications of external factors on student improvement.

Chapters 4 presented eight research questions accompanied by the statistical analysis for each question. Research questions 1 through 5 and research question 8 each discussed one null hypothesis using a one-way analysis of variance. A two-way analysis of variance test was applied to research questions 6 and 7. Each of these two research questions contained three hypotheses. Four hundred sixty-nine students enrolled in a college-level introductory computing class at the participating community college completed the study consisting of a survey, a

pretest, and a posttest. The statistical analysis for the study used a significance level of .05. The voluntary survey compiled demographic data that included location, educational level, Internet access, self-rated skill level, gender, and age. While the pretest was voluntary, the posttest was a required course component and was incorporated into the grading scheme. Findings revealed a significant relationship between the pretest scores and the college experience levels of students while no significant relationship existed between Internet access and students' pretest scores. Both the pretest scores and the self-rated user category revealed significance. Findings also noted a significant difference in improvement scores (posttest scores minus pretest scores) self-rated user levels, campus locations and course delivery types. A comparison of student improvement scores by age and gender reported no significant difference. Additionally, no significant difference was noted in students' improvement scores by age and the self-rated user categories. However, students' improvement scores among the self-rated user categories did reveal significant difference.

Key Findings

The study explored the potential factors affecting students in a college-level introductory computing class. The students' educational experience was the first factor explored. The educational experience demographic data represented three levels: 1st semester freshmen, 2nd semester freshmen, and sophomores – 1st and 2nd semester. Findings indicated that second semester freshmen produced the highest mean pretest score at six points higher than 1st semester freshmen and three points higher than all sophomores. A rationale for this finding could be a student's exposure to computer-intensive general education courses during their first semester freshman term. For example, a typical first semester class schedule would be a combination of composition, history, speech, and psychology courses. Each of these courses featured

assignments and projects that require students to use basic computing skills such as opening, closing, and saving files, producing documents and creating graphics presentations. The data for the same groups of students revealed no significant differences by gender and age. A comparison of college experience to gender and age also revealed no significant differences.

The study asked students to self-rate their level of computing skill by categories including new or novice users, moderate users, and expert users. In comparing students' pretest scores for the self-rated categories, the expert users scored 14 points higher than the new or novice users and 7 points higher than the moderate users. The expert users group demonstrated a high level of confidence regarding the use of computers. In the literature Bandura (1997) stated that one's belief in his or her skills has a strong influence on achievement. However, mean improvement scores (posttest scores minus pretest scores) in a college-level introductory computing course revealed a 34% improvement of new or novice users over expert users and a 19% greater improvement over moderate users. Because students' pretest scores were lower in each of the self-rated user skill levels, most respondents demonstrated significant improvement gains on the posttest exam.

Three geographic locations participated, thus representing an additional factor in the study. The data disclosed a significant difference in students' improvement scores between Location 1 and Location 2. The students' improvement scores for Location 1 (posttest scores minus pretest scores) were higher than those of Location 2. The geographic setting of Location 2 was a rural area, which might have affected Internet access for students, while Location 1 was situated in a more densely populated urban locale. Connected Tennessee's 2010 Residential Technology Assessment (2010a, 2010b) reported that Location 2 had 46% home broadband connectivity while Location 1 had 52% home broadband access.

On-ground, online, and hybrid courses comprised the methods of course delivery available to students. The findings revealed no significant difference between mean students' improvement scores (posttest scores minus pretest scores) in the on-ground and online courses. However, there was a significant difference between improvement scores in the on ground and hybrid courses. Mean improvement scores for on-ground courses were 21% higher than hybrid courses and 13% higher than online courses. One potential reason for this disparity could be that instructors clarify class concepts and assignments for on-ground courses with just-in-time teaching, while online and hybrid courses might require several communications to explain an instruction or assignment.

1. Research question 1 asked whether differences existed in students' pretest scores among three college experience categories: 1st semester – freshman, 2nd semester – freshman, and sophomores – 1st and 2nd semester in college-level introductory computing classes. Findings revealed a significant relationship between the students' pretest scores and the college experience level of students. A post hoc test determined the specific differences in relationships. When compared, first semester freshmen scored more than six points lower than second semester freshmen on the pretest while first semester freshmen recorded only three points lower than first and second semester sophomore students scored on the pretest. Of the three groups, the data showed that second semester freshmen earned the highest pretest scores. The participating community college required all enrolled students to take a computer competency exam or complete a college-level computer competency course within their first 30 semester hours of coursework. The pretest was administered during the first week of class. The average pretest score for all participants was 54.36% with 77% of the respondents ranging in age from 15-28.

2. The study compared in survey question 9 the pretest scores of participating students to their five identified types of residential Internet access specified in college-level computing classes. The five types of residential Internet access were dial-up, cable, DSL, wireless, or no Internet access. Of these Internet access types, dial-up connections offered relatively slow download speeds and used a telephone network to transfer data (Russell, 2012), while cable, digital subscriber line (DSL), and wireless connectivity employed broadband, which provided more efficient access (Ianello, 2012). A one-way analysis of variance revealed that Internet access did not affect students' pretest scores. However, in 2008 Horrigan reported for the Pew Internet & American Life Project that an average of 51% of Americans, rural, suburban, and urban inhabitants, had broadband Internet access connections in their home. In 2010 Smith reported for the Pew Internet & American Life Project that this number had increased to 63%. Modest broadband access growth was indicated in 2010 at 3%. The results of the statistical tests in the current study indicated that the type of residential Internet access did not significantly affect students' pretest scores.
3. In research question 3, a one-way analysis of variance evaluated the relationship between students' pretest scores and the self-rated user category in college-level introductory computing classes, with the pretest means indicating a significant difference. A follow-up test determined the relationship between the groups. The new or novice user's pretest score was over 14 points lower than the expert user's group, while the moderate user's pretest score was over six points lower than the expert user's group. Upon comparison of the new or novice user's pretest score to the expert user's group, it was noted that the

expert user's group was 24% higher than the new or novice user's group and 12% higher than the self-rated moderate user.

4. An Analysis of Variance (ANOVA) test determined significance in research question 4 with a post hoc instrument testing pairwise differences. Significant differences in students' improvement scores (posttest scores minus pretest scores) were evident among the self-rated user categories in college-level computing classes. Student improvement was noted in all user categories. The self-rated new or novice users demonstrated an improvement score mean higher than the self-rated moderate users and scored more than ten points higher than the self-rated expert user's category. When compared, the self-rated moderate users scored over four points higher than the self-rated expert users. In the literature, La Barge (2007) and the Maricopa County Community College District (2002) advocated the use of pretesting and posttesting to determine an individual's skill attainment. The Maricopa County Community College District (2002) listed advantages and disadvantages for assessing skills using pretest and posttest methodology. Among the advantages, the researchers indicated that the acquired data could provide the student's current subject-specific knowledge level when planning lessons. Potential disadvantages included the student recalling pretest information while taking the posttest, thus skewing the posttest results. In addition, pretest and posttests concentrated solely on the measure of progress and not on learning outcomes assessments.
5. A one-way analysis of variance evaluated the difference in students' improvement scores among the three campus locations in the college-level introductory computing classes. Findings noted significance, which required multiple post hoc comparisons. The data revealed that the mean improvement score for Location 1 was over three points higher

than was the mean for Location 2. The rural setting of Location 2 coupled with limited Internet access could account for this difference. In 2008 Horrigan noted in the *Home Broadband Adoption* report that American rural home broadband access comprised only 25% of the population in 2006 while 38% reported American rural home broadband access in 2008. Connected Tennessee (2010a) reported 46% of the population of Location 2 subscribed to home broadband service, which was 12% lower than the national average. On the other hand, research question 2 results noted that residential Internet access had no effect on the pretest scores of students in a college-level introductory college computing class. Location 2 accounted for about 20% of the total respondents in the study. No other pairs of means were significantly different.

6. Research question 6 compared three age categories, as well as gender in college-level introductory computing classes. When compared, the students' improvement scores among the three age categories noted that there was no significant difference. The largest age group included those 15-19, comprising 253 respondents or 67% of the total (N=376) participants. A comparison of student improvement scores between males and females also revealed no significant difference. In 2011, the Pew Internet and American Life Project compiled a trend data report that suggested similarity between genders in Internet use. The data revealed that boys, aged 12-17, reported a 96% Internet usage, as compared to girls of the same age group at 95%. Internet use for both adult males and females was 81% (Pew Internet and American Life Project, 2011a, 2011b).
7. Research question 7 had three hypotheses. The first hypothesis noted no significant difference between age by self-rated user category interaction. Additionally, the second hypothesis indicated no significance in students' improvement scores among the three

age categories in college-level introductory computing classes. However, the third hypothesis revealed differences in student improvement scores among the three self-rated user categories in the college-level introductory computing classes. All three pairs of improvement scores were significant. The self-rated new or novice user category showed a marked improvement compared to the moderate and expert users group. As indicated in the literature, Margolis and McCabe (2006) posited that students acquired self-efficacy information through how a task is performed, demonstration and verbal persuasion. No significant interaction existed by age within the self-rated user category.

8. Research question 8 examined improvement scores among the course delivery types through multiple pairwise assessments. When compared, improvement scores for on-ground courses were higher than were those for hybrid courses. Other pair associations between online and hybrid courses and on-ground and online courses resulted in no significant differences. Chen and Jones (2007) analyzed traditional learning and blended learning. Blended learning was defined as a course delivered primarily through online access with a few traditional on ground class sessions. In this study, students reported a positive learning experience in both delivery types. On-ground students, also deemed traditional learners, perceived a greater level of instructional clarity, while blended students perceived greater analytical skills at the conclusion of the course.

Conclusions

College-level computing skills are a necessary tool for students to navigate through their years in higher education and in to their professional lives. Unfortunately, students do not enter college with the same computing skill set. In 2003 a college-level introductory computing class was removed from the core curriculum requirements. However, because of the lack of a

consistent computing skill set among students, a participating community college required students to prove their college-level computing skills. College-level computing skills were defined as having an understanding of computing terminology, computing hardware, and word processing, spreadsheet, and graphics presentation skills. Students chose to meet the computer competency requirement by taking a computer competency exam or by completing a college-level introductory computing class. The study specifically addressed those students choosing to take the college-level introductory computing class. The data used in the study included pretest scores and improvement scores (posttest scores minus pretest scores) as well as survey data in college-level introductory computing classes. The data revealed that students' perception of their computing skill level was not reflected in their pretest score. However, computing skills improvement scores were noted throughout all self-rated user types with new or novice users representing the most dramatic improvement. When compared to hybrid students, on-ground students revealed an improvement score that was on average five points higher. The data did not reveal any significance among age and gender groups. Campus locations indicated lower improvement scores at Location 2 than recorded for Location 1.

Demonstration of college-level computing skills is necessary to the success of a college student. Therefore, the college-level introductory computing course must reflect current technology to remain a valid competency requirement for students.

Recommendations for Practice

Advanced, detailed knowledge of course delivery methods would provide additional information for students before they registered for a course. The institution would benefit from the creation of an online table of delivery types. This would provide better understanding when registering for courses, thus improving a student's success rate in the course. The participating

community college should continue to standardize course requirements for all sections of the college-level introductory computing class to ensure quality for students. Each college-level introductory computing class should continue to administer an exit survey to elicit student feedback.

For new or novice users, the college-level introductory computing class should provide a video library embedded in D2L. Some introductory video topics should include opening and closing a file, saving a file to different storage locations, and downloading and extracting a file from the course management system. Students could also be directed to free resources that are available online to increase a student's initial computing skill level. In 2011, Microsoft established the Microsoft Digital Literacy Program. This program is comprised of a series of videos that teach standard literacy skills. The Standard Skills Curriculum includes computer basics, the Internet, an introduction to productivity software, security, and leading a digital lifestyle to build computing self-efficacy (Microsoft Digital Literacy, 2011). As indicated in the literature, Orr et al. (2001) stated that instructors could apply interventions if they had better understanding of the computer attitudes of their students.

The purchase and use of web conferencing software in a college-level introductory computing class would facilitate more immediate feedback for online and hybrid students while providing student engagement data for the instructor.

The participating college should develop course learning modules for the college-level introductory computing class to tailor student learning. These course learning modules could incorporate a flipped classroom methodology. A flipped classroom could provide teacher created class lectures which could be published online. These module-specific class lecture videos could then be viewed by students in preparation for the next class meeting. Class time

could then be devoted to hands-on learning projects within the course modules that would allow more opportunities for student individualized learning. Additionally, these course learning modules should be units of study that students could complete within a specified time period at their own pace under instructor guidance. For students to move forward to the next module, they would have to attain a predetermined minimum module score. For self-rated expert users, this would provide an alternative to traditional classroom instruction.

Recommendations for Future Research

Because technology changes occur rapidly, researchers should conduct a similar study each year to determine the most current course model. The data retrieved would provide pretest scores for students enrolled in the college-level introductory computing class. A rise in the average pretest scores on specific modules, for instance, might indicate a need to change the module or increase the skill set within the module. Student-driven feedback and industry needs would be other indicators when determining course redesign needs. Another recommendation is to study the outcomes of a modular-driven college-level introductory computing class. After developing and implementing a completely modular-driven computing class, researchers should conduct a comparison study between on-ground traditional computing classes and on-ground modular-based classes to determine differences in student growth. A qualitative study is also recommended to explore reasons why pretest scores for second semester freshman in the college experience category were higher than both first semester freshman and sophomores. Additionally, the on-ground, online, and hybrid course delivery types could benefit from further research. A qualitative study could also explore the reasons for lower improvement scores for hybrid course delivery types as opposed to improvement scores for online and on-ground

courses. An additional recommendation for further study is to determine the motivation of students when selecting a specific course delivery type such as on ground, online, and hybrid.

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APPENDICES

APPENDIX A: Pretest Survey

Pretest Survey

1 What is your gender?

Question options:

- Male
- Female

2 Select your age from the ranges listed.

Question options:

- Age 15-19
- Age 20-28
- Age 29-39
- Age 40-50
- Age 51 and higher

3 Which group best describes your ethnicity?

Question options:

- African-American
- Caucasian
- Asian
- Hispanic
- Other

4 Which participating community college site do you attend? (the majority of the time)

Question options:

- Location 1
- Location 2
- Location 3
- Location 4

5 What college grade level BEST represents your educational experience?

Question options:

- Freshman - 1st semester
(1-15 college credits)
- Freshman - 2nd semester
(16-30 college credits)
- Sophomore - 1st semester
(31-45 college credits)
- Sophomore - 2nd semester
(46-60 college credits)

6 Have you attended the participating community college in the past? (prior to 1 year ago)

Question options:

- Yes
- No

7 While attending the participating community college, what is your current major?

Question options:

- Computer Science
- Health Programs
- Humanities
- Behavioral Social Science
- Mathematics
- Education
- Natural Science
- Public Safety
- Other

8 Are you planning to pursue a four-year degree?

Question options:

- Yes
- No

9 What type of Internet access do you have at your current residence?

Question options:

- Dial-up

- Cable
- DSL
- Satellite
- Fiber
- Wireless
- None

10 Read each answer choice carefully. Then select the answer that **BEST** represents your current overall computing skill level.

- NEW USER**
may or may not be able to turn on a computer
- NOVICE USER**
can turn on a computer
experience some anxiety about using a computer
Internet - can accomplish basic Internet browsing; can type in web addresses and move from one website to another
Email - can read and send a basic email.
- MODERATE USER**
some computing experience
Internet - successfully browse the Internet
Email - can read, send, reply and print an email
MSWord - can type/print and save a basic Word document
MSExcel - little or not experience
MSPowerPoint - little or no experience
- EXPERT USER**
Internet - successfully browse and locate specific information on the Internet using search operators.
Email - read, create and send email; can open and attach files to an email.
Basic Computer Functions - open/save files, create folder to organize files
MSWord - can type, format, print, and save a document; create labels/envelope
MSExcel - can create a basic spreadsheet which includes the use of formulas and functions; can create charts and graphs
MSPowerPoint - create a multi-slide presentation with graphics and charts.

11 Do you own and play a gaming system? (Playstation, XBox, etc.)

Question options:

- Yes
- No

12 How many hours per week do you spend gaming?

Question options:

- Do not play a gaming system
- 1-5 hours per week
- 6-10 hours per week

- 11-15 hours per week
- 16-20 hours per week
- More than 20 hours per week

13 Did you have an introductory computer course while in high school? (*keyboarding does not qualify as an introductory computer course*)

Question options:

- Yes
- No

14 Where did you learn the majority of your current computer skills?

Question options:

- At work
- Self-taught
- Friends
- At school
- Other

APPENDIX B: Academic Dean's Survey

Academic Deans: Please fill out this survey and return it to me as soon as possible. I need this information to begin developing the competency test and procedures prior to the approval of our 60 hour programs.

**Thanks,
Michael Helmick**

Instructions

When pondering the issue of computer competency please consider:

- What should any graduate of Walters State be able to do with a computer?
- Your division may have concentrations that require a computer course. Such a course is likely to have more specific competency expectations.
- It is likely that the college will offer the option of taking a computer competency exam or taking a computer course for every student in a concentration not requiring a computer course. This option would be offered after a student has taken 30 semester hours.
- The exam, the competency course(s), and procedures will be developed after the competencies have been determined.

Bearing all of the above in mind: Please mark the competencies below that you feel a student who has completed 30 hours of college-level credit should have mastered. Keep in mind competencies are to apply to all students in all majors.

Computer Competency Survey

1. Understanding of how to access and use WebCT. At the end of the course the student should be able to:

- Login to the WebCT system
- Send and receive e-mail in WebCT
- Send an e-mail attachment
- Post and read messages in a discussion forum
- Use the WebCT Chat room
- Access and take an online test.
- Access and navigate through a Course Content module
- Access class assignments and submit an assignment via the Digital Drop box
- Access student tool to view their grades and course activity
- Utilize help feature & Walters State Helpdesk

2. An understanding of the role of Microsoft Windows/operating systems. At the end of the course, the student should be able to:

- Describe the role of Microsoft Windows/operating systems
- Work with menus
- Start and exit an application
- Demonstrate an understanding of files, folders (directories), subfolders and paths
- Create, save, open, and print a document
- Open, resize, and scroll a window
- Format and copy to storage media (diskettes, CD's Zip Disk)
- Copy a group of files
- Navigate the local computer and network resources.
- Delete a file
- Switch between applications
- Arrange icons
- Maximize, minimize and resize a window

3. Demonstrate a working knowledge of the use of the online databases in the WSCC Library

- Access and search the WSCC online databases for research information
- Use the online card catalog to find a book in the WSCC library
- Find and check out an e-book
- Complete Inter-Library Loan Request

4. The ability to use a modern word processing package to produce finished documents commonly found in the work place or associated with college level course work. At the end of the course, the student should be able to:

- Demonstrate saving and retrieving a document
- Create a document
- Understand the use of word wrap
- Enter text into a document
- Import and scale graphics
- Format documents using: Font, font styles, and font size of text
- Format documents using: Margins, tabs, indents, and columns
- Format documents using: Templates
- Edit documents using: Inserting and deleting, moving, copying, and replacing text
- Edit documents using: Searching for text
- Edit documents using: Spelling and grammar checkers and Thesaurus
- Manipulate text in multiple documents
- Demonstrate headers/footers, page numbering, and footnotes
- Create, edit, and format tables
- Creating and understanding the difference between page and section breaks

7. The ability to access and use the Internet. At the end of the course, the student should be able to:

- Define the Internet and its relationship to the World Wide Web
- Access the World Wide Web
- Create and remove bookmarks
- Save and print Web pages.
- Copy and paste from Web pages using the Clipboard
- Search the Web using a variety of search engines
- Retrieve files from the Internet (upload and download)
- Using e-mail

8. Understanding of computer concepts and terminology sufficient to read and understand commercial publications related to the topic. At the end of the course the student should be able to:

- Define the four operations of the information processing cycle.
 - Identify types of computers and their application
 - Differentiate system and application software.
 - Define CPU and primary storage.
 - Define bits, bytes, and words as it relates to the storage of data.
 - Define binary and ASCII.
 - Identify the components of a computer and explain their use.
 - Differentiate storage and memory
 - Describe multimedia and virtual reality.
 - Identify different types of display devices.
 - Define and discuss a local area networking (LAN).
 - Describe the various operating systems, the differences in their capabilities.
 - Discuss utility programs and their functions.
 - Describe security risks that can threaten a computer system.
 - Describe computer viruses and steps to prevent them.
 - Discuss ethical and privacy issues relating to the information age
-
- Demonstrate the use of STAR_NET to register for classes, access transcripts, access grade reports, and other student services functions

APPENDIX C: Computer Competency FAQs

Computer Competency FAQs

1. What is computer competency?
 - a. Computer competency is a process whereby a student demonstrates his or her ability to perform college level basic computing work. This process includes the successful completion of a Computer Competency Exam or the completion of a specified computer course.
2. What is a “specified computer course”?
 - a. Some majors specify a computer course as part of the area of emphasis. If your major is not one of these, then the specified computer course for your major is CPSC 1100, Using Information Technology.
3. What will the Computer Competency Exam cover?
 - a. In order to prove basic computer competency at WSCC, a student must demonstrate proficiency in Microsoft Word, Excel, and PowerPoint. Additionally, a student must demonstrate knowledge in computer use terminology, hardware selection, and simple maintenance functions.
4. Who is eligible to take the Computer Competency Exam?
 - a. Only those students who will be using the 2004-2005 or later catalog as their catalog of record are eligible to consider using the Computer Competency Exam as means of meeting the WSCC computer competency requirement. Students who use older catalogs as their catalog of record will abide by the course requirements in their chosen catalog.
5. If I decide to take the Computer Competency Exam, at what point in my college career do I have to have the exam completed?
 - a. The Computer Competency Exam must be completed by the student prior to the student registering for the next semester after the student has attempted 30 or more college level (non-behavioral/developmental) hours. For example: If you take 16 hours in the fall 2004 semester and register for 16 hours for the spring 2005 semester, you will have to complete the Computer Competency Exam before attempting to register for the summer or fall 2005 term. If you do not complete the Computer Competency Exam prior to attempting to register for the semester after you reach 30 or more hours of college level coursework, you will have to register for CPSC 1100 immediately after you register for any behavioral/developmental course work.
6. What is the cost of the Computer Competency Exam?
 - a. There is no cost to the student for taking the Computer Competency Exam or Pre-test.
7. What is the difference between taking the Computer Competency Exam and taking a computer course?
 - a. A person who completes CPSC 1100, the basic computer course at WSCC, will be prepared to perform computer tasks that are more complex than what the Computer Competency Exam will test. Successful completion of CPSC 1100 early in a student’s college career prepares him

- or her to use the computer to write papers, calculate arithmetically using spreadsheets, research topics, and present information in a variety of formats. All of the skills acquired in CPSC 1100 will help the student to not only perform at a higher level at WSCC, but to also be better prepared to enter the local workforce
8. Do I get any course credit for taking the Computer Competency Exam?
 - a. No course credit is given for the Computer Competency Exam and no grade is assigned for taking the exam.
 9. What is the process for taking the Computer Competency Exam?
 - a. There are several steps involved in taking the Computer Competency Exam. They are as follows:
 1. Access the www.ws.edu web site
 2. Click on the icon for computer competency and read the information
 3. Take the self assessment
 4. Sign up for and take the pre-test
 5. Pass the pre-test with a score of 85 or higher
 6. Sign up for the competency exam
 7. Pass the competency exam with a score of 80 or higher
 8. Once the exam is successfully completed, the Student Records Office will place the appropriate designation on the student's transcript.
 10. How do I know if I am ready to take the Computer Competency Exam?
 - a. Taking the self assessment quiz is the first thing to do. The self-assessment quiz is available at www.ws.edu by clicking on the icon for Computer Competency. If you perform satisfactorily on the self-assessment quiz, then sign up for and take the pre-test. You may take the pre-test as many times as you wish, but you will have to register for each attempt. Passing on the pre-test is a score of 85 or higher. If you take the pre-test and attain a score of at least 85, you should do well enough on the Computer Competency Exam to receive computer competency credit.
 11. What happens if I fail the exam?
 - a. If a student makes less than an 80 on their one attempt at the Computer Competency Exam, they will be required to complete CPSC 1100. The standard time frame mentioned above will apply.
 12. What is the Computer Competency Exam like?

- a. The Computer Competency Exam is a skills-based test. This means you will be asked to perform certain operations using Microsoft software products. In demonstrating a proficiency in using Microsoft Word for example, you will be expected to manipulate a document and perform certain functions like bolding text, cut and paste, and changing margins. The test also covers Microsoft Excel and Power Point as well as general questions on computer operation.
13. Where do I find information on the Computer Competency Exam and process?
 - a. Go to the www.ws.edu web site and click on the icon for Computer Competency. Follow the links to find the information you need.
14. Where do I go if I have problems or additional questions about the computer competency exam?
 - a. Contact the Technical Education division at 423-585-2644 or via email at computercompetency@ws.edu
15. Does everyone have to take the Computer Competency Exam or take CPSC 1100?
 - a. Though everyone must prove computer competency, some majors have students take a specific course for their major. A student should work with their advisor to determine if the computer course CPSC 1100 is acceptable or if another course is required for their major. Advisors will also be able to inform students if taking the Computer Competency Exam is a viable option.
16. I took a computer course at another college; will this course meet the computer competency requirement at Walters State?
 - a. Transferability of coursework is determined by the Student Records Office at Walters State. In order to meet the computer competency requirement, a transfer course must have covered the same material that is covered in CPSC 1100.
17. I am already a student at WSCC, I have taken a computer course previously, and I want to change to the 2004 – 2005 catalog. Will the computer course I have already taken count for the computer competency requirement?
 - a. A determination will need to be made as to whether or not the course you have taken is sufficient to meet the new computer competency requirement. If you have taken CPSC 1100 at WSCC within the last seven (7) years, you may use this course to meet your computer competency. Courses taken prior to 1996, or courses taken to satisfy the computer competency in another major, will have to be reviewed on an individual basis.
18. I am in a major that does not require a computer course, but it does require several hours of electives, can I take CPSC 1100 and count it as an elective, and fulfill the computer competency with the same course?
 - a. Yes. You may use CPSC 1100 to fulfill the computer competency, and if your advisor permits, you may also use the same course as an elective for the area of emphasis in your major.
19. Can I take any other course, besides CPSC 1100, to fulfill my computer competency requirement?

- a. Certain programs of study do require computer courses other than CPSC 1100 to fulfill the computer competency requirement. However, if your major does not specifically require a different course, then CPSC 1100 is required to fulfill the computer competency requirement.

Back to [Computer Competency Home](#)

Self-Rated User Categories - Pretest Survey

10. Read each answer choice carefully. Then select the answer that **BEST** represents your current overall computing skill level.

NEW USER

may or may not be able to turn on a computer

NOVICE USER

can turn on a computer

experience some anxiety about using a computer

Internet - can accomplish basic Internet browsing; can type in web addresses and move from one website to another

Email - can read and send a basic email.

MODERATE USER

some computing experience

Internet - successfully browse the Internet

Email - can read, send, reply and print an email

MSWord - can type/print and save a basic Word document

MSExcel - little or not experience

MSPowerPoint - little or no experience

EXPERT USER

Internet - successfully browse and locate specific information on the Internet using search operators.

Email - read, create and send email; can open and attach files to an email.

Basic Computer Functions - open/save files, create folder to organize files

MSWord - can type, format, print, and save a document; create labels/envelope

MSExcel - can create a basic spreadsheet which includes the use of formulas and functions; can create charts and graphs

MSPowerPoint - create a multi-slide presentation with graphics and charts.

APPENDIX E: ETSU IRB Approval Letter



East Tennessee State University
Office for the Protection of Human Research Subjects • Box 70565 • Johnson City, Tennessee 37614-1707
Phone: (423) 439-6053 Fax: (423) 439-6060

June 7, 2012

Jama Spicer-Sutton

Dear Ms. Spicer-Sutton,

Thank you for recently submitting information regarding your proposed project "Self-Assessment and Student Improvement in an Introductory Computer Course at the Community College Level".

I have reviewed the information, which includes a completed Form 129.

The determination is that this proposed activity as described meets neither the FDA nor the DHHS definition of research involving human subjects. Therefore, it does not fall under the purview of the ETSU IRB.

IRB review and approval by East Tennessee State University is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are human subject research in which the organization is engaged, please submit a new request to the IRB for a determination.

Thank you for your commitment to excellence.

Sincerely,
Chris Ayres
Chair, ETSUIRB



Accredited Since December 2005

VITA

JAMA SPICER-SUTTON

Personal Data: Date of Birth: December 2, 1963
 Place of Birth: Knoxville, Tennessee
 Marital Status: Married

Education: B.A. History, Carson-Newman College, Jefferson City, Tennessee, 1986

 Elementary Teaching Certification, Warner University,
 Lake Wales, Florida State University & University of Florida,
 Lakeland, Florida, 1990

 M.S. Instructional Technology Specialist - Computers, Appalachian State
 University, Boone, North Carolina, 1998

 Ed.S. Administration Supervision, Lincoln Memorial University,
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 Ed.D Educational Leadership, East Tennessee State University,
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Professional
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 Elementary Education Teacher, Monroe Avenue Elementary,
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 Director, Special Academic Projects, Walters State Community College,
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