THE CORRELATION BETWEEN STUDENT DEMOGRAPHICS AND STUDENT ATTITUDE TOWARD COMPUTER-ASSISTED INSTRUCTION

by

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ABSTRACT

Computers are and have transformed nearly every aspect of contemporary society, and are becoming a common tool for integrating classroom instruction. This quantitative correlation study sought to determine the relationship between student's computer experience and their attitudes toward computer-assisted instruction (CAI). The population consisted of 220 high school student attending Department of Defense Dependent Schools (DoDDS) located outside of the United States. The results revealed no strong correlation between the mean scores of computer experience and attitudes toward CAI instruments. While the differences between male and female attitudes were not statistically significant, the results revealed a correlation between computer experience and a positive perception toward CAI. Recommended future studies include conducting similar research within other high school educational environments.

DEDICATION

I want to dedicate this project to my number one fans and the love of my life, my husband Eric B. Smith and my son Xavier T. Walthall-Jackson, who were patient and understanding through this educational journey.

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I thank God for the woman that I am and will become. I am blessed beyond measure. I would like to thank my husband and son for being patient, supportive and committed to ensuring I am successful in this educational journey. I was not cognizant about the numerous individuals who have made such a significant difference throughout this process. My best friends (Shatera Kennedy and Allen D. Bennett), colleagues and family members contributed encouragement, questions, constructive feedback, patient and understanding. These individuals have enriched my writing and educational experiences by pushing me beyond my threshold of infinity boundaries of becoming a better leader in my profession.

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CHAPTER 1: INTRODUCTION

Computers have transformed nearly every enterprise to which they are applied. This is no less true in education, where computers are becoming a common tool for integrating classroom instruction and improving students' skills. J. A. Kulik (1983) reported, "Most programs of computer-assisted instruction evaluated in the past have produced positive effects on student learning and attitudes" (p. 6). Courses for establishing and applying computer-assisted instruction (CAI) should also be supported. According to Ruffin (2000),

> Kearsley and Hillelsohn (1984) reported an extraordinary increase in the use of computers for training applications. This is due largely to the advances in technology and the growing identification that computer assisted instruction (CAI) is proving to be a good remedy for tight budgets, and the demand for improved training productivity. Research reports that as CAI becomes more widely accepted as a training approach, issues such as cost and the management of self-learning are becoming significant topics in the education and training community. (p. 25)

This chapter discusses the purpose, the nature, and the significance of the study because developing students' computer-related attitudes and attitudes toward learning with computers might be the key to exploiting CAI learning practices. Implementing CAI practices is important because the computer evolution and revolution has produced both positive and negative effects. The positive effects of the advancing technologies include the increase in computing capacity that has developed increasingly sophisticated software. Sophisticated software has helped to make computers a more valuable tool for

CAI. Computer-assisted instruction may be an efficient approach to meeting the teaching and training needs of United States Army Europe (USAREUR) and United States Air Force Europe (USAFE) Department of Defense Dependent School (DoDDS) students, but no study has been conducted in Europe concerning students' attitude toward CAI**.**

Background

Applying computers in higher education has increased over the past 10 years (Zeszotarski, 2000). Computer-based applications such as spreadsheets, statistics, word processing, and graphics have found a way into all subject areas. The accessibility of these applications has brought about dramatic changes in educational settings (Zeszotarski).

As computer applications become more common in schools, educational organizations are able to prepare new generations of students for effective participation in an increasingly technologically oriented society (Hardy, 1998). The core curriculums of many colleges and universities include computer literacy as a mandatory requirement for graduation. Young (2000) listed several educational institutions that had begun mandatory computer literacy programs for all students. Labbo (2006) reported that students need to have "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (p. 5). Some educational reports have addressed computers and computer technology issues and have called for an increase in computer literacy exhibited by students. Zeszotarski (2000) noted,

> Computer technology permeates most aspects of our lives. The ability to use computer technology and to evaluate electronic information has become a basic

> skill for . . . college students in both academic and occupational programs. . . . The definition of computer literacy, to include information literacy, delineates issues surrounding student access to new technologies, describes courses that include instruction in computer-related skills, summarizes efforts at including computer literacy among general education requirements and addresses the faculty role in computer-related skills. (p. 4)

Efforts to promote students' computer literacy may require new planning and integration strategies, which may change teachers' traditional roles and expectations in the classroom. These efforts may also require an understanding of students' attitudes toward computers.

Statement of the Problem

Little research is available that investigates both demographic variables and computer-related experiences as predictors of attitudes toward CAI in a military service environment is evidence the need exists. Computer-assisted instruction deserves inquiry because it taps into the existing gaps in the organized body of knowledge on CAI. The existing gaps in CAI research include the lack of studies aimed at determining the most significant demographic variables that explain attitudes toward CAI. In addition, the lack of research is a problem because such research may assist in improving key development at vital stages of CAI. Identifying if a positive correlation exits between the students' demographics and the students' attitude toward CAI will better aid the "design, development, and delivery of more appropriate learning materials for adult learners" (Milheim, 1993, p. 7). These improvements may help enable educators to implement CAI to solve the problems associated with individualizing instruction to better educate a diverse population. Quantitative methods were used to examine if a positive correlation exists between student demographics (level of education, race, gender, and age) and student attitude toward CAI in the USAREUR and USAFE DoDDS system.

Waugh and Currier (1986) noted, “One of the directions for computer based education (CBE) research is in the area of student characteristics” (p. 14). Examples of student characteristics include demographics such as the students’ mathematics aptitude, level of education, socioeconomic status, race, gender, age, computer science experience, frequency of computer usage, and attitudes toward computers. Milheim (1993) posited, “An important starting point for organizing the content of adult-based instruction should be related to past experiences and knowledge of the adults involved in the learning” (p. 3). Examples of related experience include frequency of computer usage for work, education, and recreation. Student experience with specific software must be explored to capture the content. Jackson (2001) noted, “The question of why and which types of software particularly encourage cooperativeness should be examined in detail” (p. 224).

Examining the students’ experiences with software directly supports suggestions by Waugh and Currier (1986), who indicated a definite need exists for research concerning the instructional design and appeal of CBE materials. Waugh and Currier also explained “this relationship has received very little attention and requires further research if we are to establish how to most effectively individualize instruction” (p. 14). J. A. Kulik and Kulik (1999) supported the need to examine CAI research in the area of student characteristics and addressed the difficulty associated with not examining those characteristics by explaining, “We need to know whether previous conclusions about CBI [computer-based instruction] have changed with the development of new software in recent years" (p. 77).

Purpose of the Study

The purpose of the study was to analyze student attitudes toward CAI using a descriptive survey methodology. The goal was to assess the perceptions or attitudes of junior and senior high school students enrolled in the USAREUR and USAFE DoDDS system. The population for the quantitative study consisted of 220 high school students of USAREUR and USAFE DoDDS with varied computer-related experiences. Approximately 1,536 students attend grades 9 through 12 in USAREUR and USAFE DoDDS and constituted the total population for this study. The study targeted only juniors and seniors in high school resulting in a target population of approximately 678 students. All students enrolled in Algebra, Geometry, Physics, Chemistry, Computer Science, or English were invited to participate in the study. The students were from different socioeconomic backgrounds and different geographic locations around the world.

The students were not randomly selected because the sample consisted of volunteers from a specific population and reflected a selection bias. The only degree of randomization was the students who attended school on the day the CAI survey was administered (see Appendix C and Appendix E). The entire student body was asked to participate in the survey. Students are required to be U.S. citizens to attend the USAREUR and USAFE DoDDSs. The representation from different geographic locations and different socioeconomic backgrounds was evenly distributed among the demographic variables of interest through the randomization that brings the students to the school. Most of the students were from households with middle-class to upper-middle-class incomes.

Forty-eight percent of the 220 participants were minorities. The minority population consisted of African Americans, Hispanic Americans, Native Americans, Asian Americans, and females. The student population consisted of both male and female Caucasian American, Hispanic Americans, Asian Americans, Native Americans, and African Americans.

Significance of the Study

Computer technology has become ubiquitous in Western society (Dockstader, 1999). Most jobs require some use of computers and computer applications. One factor that determines the successful implementation of CAI is users' attitudes toward computers. Little is known about attitudes toward computers in the academic community of the USAREUR and USAFE DoDDS system, although Dockstader noted many studies have been conducted on computer attitudes among groups in the United States and other Western industrialized countries.

As computer technology reaches global proportions, countries around the world also realize the potential benefits of computer technology for education and have begun to equip the schools with computers and to develop computer literacy programs (World Bank, 1995). The USAREUR and USAFE DoDDS are no exception in embracing the trend. Considerably fewer such investigations exist in USAREUR and USAFE due to the limited studies conducted in overseas military communities. The investigation of students in the USAREUR and USAFE DoDDS system may contribute to the body of knowledge related to individuals' attitudes toward computers, particularly students' attitudes.

Computer-related attitudes among students in the USAREUR and USAFE DoDDS system may provide knowledge that can assist educational leaders such as superintendents, administrators, teachers and parents, in finding ways to improve instructional strategies. The study contributes useful knowledge to educational leadership that may facilitate decisions concerning the best allocation of educational resources because both the school districts and the military commanders responsible for each DoDDS in the specific district are concerned. The responsibility of the education leaders and military commanders is different from a nonmilitary school district in which the district facilitates decisions through the superintendent and the state. The study of students' attitudes toward computers also may aid in identifying negative attitudes, which will then facilitate determining appropriate learning measures to build positive attitudes in each individual.

The study of students' attitudes toward computers adds to the existing body of knowledge on the relationship between student demographics and the spectrum of students' computer-related attitudes toward the CAI process of self-directed learning. The new knowledge will make a contribution by facilitating the production of better processes, products, and services that facilitate self-directedness in student learning. The results from this applied research may help educational leaders better prepare students on a global scale for the requirements to become more computer literate and experienced.

The efficient achievement of computer literacy is best attained from work that results from an amalgamation of key philosophical perspectives (Lim, 2002). From a cognitive psychological perspective, this research explores the fit between computer systems and students. Computer-assisted instruction methods place the psychological responsibility of learning more on the student rather than having the learning environment teacher-center, which often has the teacher control and facilitate the learning. From an occupational psychologist's or a training practitioner's perspective, the study addresses CAI effectiveness and the possibility that CAI can be incorporated into a specific organizational environment. The study also explores alternative computer configurations from a computer scientist's or engineer's perspective. The computer configuration that best meets organizational and individual needs produces positive changes in student attitudes.

Nature of the Study

Computer technology has transformed education. Each person responds differently to computer technology, this is reflected in different attitudes toward computers. Some students welcome the presence of computers in the classroom and quickly become acquainted with them. Others are uncomfortable and resist with using computers unless necessary (Wilson, Majsterek, & Simmons, 1996). Lim (2002) reported college students generally had positive attitudes toward computers. Morrison and Lowther (2002) reported learning how to use computers might be an unpleasant experience for some people. Much research has been conducted regarding children and computers, but research on using computers with young adults in nontraditional settings is inadequate. Milheim (1993) maintained while the use of computers for instructional purposes has immense potential, the majority of research has concentrated primarily on the use of this technology with traditional students in traditional, formalized educational settings such as public schools, colleges, and universities. Milheim added that although many of these studies contained some material concerning the use of instructional computing with adults, the primary focus was generally on younger learners and the related research generally contained strategies appropriate to younger people. Milheim posited, “With so much concentration on younger students, it is somewhat difficult to obtain information specifically focused on utilization of CAI with adults within traditional educational settings, or in less formal environments” (p. 2).

No scholarly journals have presented the results of student attitudes toward CAI in a military environment. Studies related to student attitudes toward CAI are essential to investigate to better explain the findings in the study. Quantitative research was appropriate because the relationship between student demographics and students’ attitudes toward computer delivery systems is a mainstream issue found in the work of many investigators. The study clarifies the relationship between demographic characteristics of students in a military service academic environment and the students’ computer-related attitudes and attitudes toward CAI through a quantitative method study.

The goal of the study was to produce more efficient learning systems that are better individualized to USAREUR and USAFE students. More efficient learning systems can be created, according to Milheim (1993), from vital inputs during the design, development, and delivery of CAI. The information received from implementing CAI may assist educational leaders in finding ways to improve instructional methods. The study contributes knowledge that helps to improve decision making about the allocation of educational resources.

Research Questions

To assess the relationship between student attitudes and student demographics, students’ attitudes toward computers were assessed to determine if correlations exist between students' attitudes and students' demographic characteristics. The research questions for the study were as follows:

Research Question 1: What is the correlation between student scores on the BCCAS, ATCAI, mathematics aptitude, average daily exposure to computers, computer experience, and math placement assessment?

Research Question 2: What are the differences in ATCAI scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement and computer knowledge (CS/CP) assessment?

Research Question 3: What are the differences in BCCAS scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement, and computer knowledge (CS/CP) assessment?

Hypotheses

Hypothesis 1: There will be no correlation between student mean scores on the BCCAS, ATCAI, mathematics aptitude, average daily exposure to computers, computer experience, and math placement assessment?

Hypothesis 2: There will be no difference when the ATCAI scores of students are compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra and geometry/trigonometry placement, and computer knowledge (CS/CP) assessment?

Hypothesis 3: There will be no difference in the BCCAS scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement, and computer knowledge (CS/CP) assessment?

Conceptual Framework

The need to improve student academics has been the center of education for centuries. Several strategies have been created to improve student academics. For instance, educational specialists, superintendents, administrators and lawmakers have enhanced school environments and have strengthened curricula, teaching practices, and educator policies anticipating an improvement in students' academic level (Wilson et al., 1996). The theoretical framework of the study starts with the premise that CAI is student centered and seeks to solve the problems associated with the individualization of instructional methods. Student profiling aided in making it possible for all students to benefit adequately from CAI.

Many differences were recognized between this study and other existing studies. Specifically, no existing studies have surveyed students of USAREUR and USAFE DoDDSs or any other American military service school in Europe. Within this context are important environmental factors that were controlled for in the study. For example, the military has its own distinct culture that is profoundly different from a typical school campus culture.

Cultural differences exist in the USAREUR and USAFE DoDDS military environment. In comparison to a typical high school campus, the students in a military environment often relocate. The student typically relocate every 2 to 4 years due to the parent or guardians' military mobility assignment or the parent or guardian is mobilized for deployment making USAREUR and USAFE DoDDS students uniquely different..

According to Lowe (2001), computer technology was broadly discovered in the educational arena in the 1980s. Integrating computer technology in the classroom has been considered to be the solution for every educational issue. Educational institutions have since exhausted an abundance of monetary resources for preserving, installing and improving computer technology with the purpose of enhancing student academics (Lowe). State and national governments, along with educational institutions, have introduced and integrated computers into schools. "An estimated 4.4 million computers were installed in America's classrooms in 2000" (Tzuriel & Shamir, 2002, p. 21). During the 1990s, schools progressively more depended on computer technology for best teaching practices. Computer-assisted instruction enhances students' academics by allowing the learners to experience a variety of cooperative knowledge-based and informative instructions (Tzuriel & Shamir). Computer-assisted instruction provides students with direct comment and responses, continuous assistance and training by providing the student access to immediate research and existing information.

Computer-assisted instruction includes administrators, teachers and students in the development of promoting schools exhilarating and thought provoking areas in which to learn and to work (Middleton & Murray, 1999). Students are thereby engaged in stimulating and challenging projects that integrate intellectual knowledge with realistic activities (Middleton & Murray). Computer-assisted instruction also trains students for constructive effort, learning, and liable citizens in the 21st century (Sherry, Billig, Jesse, & Watson-Acosta, 2001).

Increases in computing capacity have helped tremendously to bring about more sophisticated hardware and software that make the computer a much more valuable tool for CAI. Computer evolution allows CAI to be customized to better meet the needs of a more diverse population. Milheim (1993) posited the evolution of computers is particularly important given the increasing use of CAI and the importance of continuing education for adults. Milheim claimed, “During the last decade microcomputers have become increasingly viable alternatives for the delivery of instruction for learners in a variety of settings” (p. 2). The author added, “The use of this instructional medium has become particularly appropriate during the last few years with increased computer speed and memory, the use of graphical user interfaces and the use of multimedia in a variety of forms” (Milheim, p. 2).

Definition of Terms

Individuals in search of understanding the collection of expressions and terms used by educators and researchers, such as CAI, CBE, CBI, computer-enriched instruction (CEI), and computer-managed instruction (CMI), can easily become confused. Each technological expression used in the study was defined either by a reference to a previously published definition (for standard vocabulary with the usual meaning) or by a specific, explicit definition that emerges before the term was used. The following operational definitions were used in the study:

Attitude: Attitude is “a fairly stable opinion regarding a person, object, or activity, containing a cognitive element (perception and beliefs) and an emotional element (positive or negative feelings)” (Piotrowski & Irons-George, 2003, p. 21).

Computer-assisted instruction (CAI): J. A. Kulik (1983) described CAI as follows:

> A generic term that includes several forms. Most forms often included in typologies are drill and practice, tutorial and dialogue systems. In force concepts that were introduced in the classroom . . . [W]ith tutorial, the computer not only reinforces concepts but also introduces them. . . . [T]he dialogue is the most sophisticated of these forms. It presents lessons and practice instruction, the student is allowed to ask sequence of instruction is controlled by the learner's response. These three approaches can be collectively termed as computer-assisted instruction. (p. 41)

Computer attitudes: Computer attitudes consist of four elements as measured by the Computer Attitude Scale (CAS): computer anxiety, computer confidence, liking of computers, and perceptions of the usefulness of computers (Loyd & Loyd, 1985).

Meta-analysis: According to Jenks and Springer (2003), meta-analysis is "a relatively recent innovation, also known as research synthesis or research integration, that allows a researcher to systematically and statistically combine the findings of several previous studies" (p. 2).

Student achievement: Student achievement is student performance on standardized norm-referenced mathematics, language arts, and reading tests. For this study, SAT and ACT math scores were the units of measurement and comparison (F. Brown, 2000).

Traditional instruction: Traditional instruction refers to conventional classroom language arts, mathematics, or reading instruction delivered by a classroom teacher using textbooks, audio-visual aids, manipulative aids, or other available teaching aids (Chang, 2000).

Assumptions of the Study

The investigation was subjected to the following assumptions. The study assumed the respondents would honestly report his or her computer-related attitudes and attitudes toward CAI and the instruments would elicit the desired responses. The study also assumed the definition of race used by society would sustain enough meaning to communicate the intent as a demographic variable. The study further assumed the respondents would honestly report his or her race to the best of their ability, considering the respondents might not know if he or she are mixed race.

Limitations of the Study

This study investigated attitudes toward computers held by students attending USAREUR and USAFE DoDDSs. The study used the Bath County Computer Attitude Scale (BCCAS) developed by Bear, Richards, and Lancaster (1987) to measure student attitudes toward computers. Several limitations of the study exist. The study included male and female students of USAREUR and USAFE DoDDSs. The students were not randomly selected because the sample consisted of volunteers from a specific population and reflected a selection bias. Students' attitudes toward computers were assessed only via the BCCAS (Bear et al.) and were not measured with any other instrument.

Delimitations of the Study

The following were delimitations of the study. First, the study was delimited to the student population in USAEUR and USAFE DoDDSs. Second, CAI was the only technology examined in the study.

Summary

This chapter described the problem and presented the research questions, the need for the study, and the conceptual framework used in the study. The problem statement discussed the existing body of contemporary research on computer attitudes and the justification for conducting the study on a different population and in a different context. The section on the need for the study discussed the study's importance in providing feedback to designers, developers, and deliverers of CAI. In particular, an understanding of the relation between students' attitudes and students' demographic characteristics was expected to improve individualization of CAI and lead to more efficient learning.

CHAPTER 2: LITERATURE REVIEW

Sufficient evidence exists that indicates technology is no longer a promise for the future but is an element of the present. The effects of technology have brought about both quantitative and qualitative changes in the lives of many individuals. “There was a time when computers were a luxury item for American schools, but that time has clearly passed” (Cotton, 2001, p. 1). Computer-assisted instruction has been a topic discussed in the education environment for many years, although few studies published since 2001 have investigated how CAI improves learning.

The purpose of the study was to analyze student attitudes toward CAI using a descriptive survey methodology. The goal was to assess the perceptions or attitudes of junior and senior high school students enrolled in the USAREUR and USAFE DoDDS system. The population for the quantitative study consisted of 220 high school students of USAREUR and USAFE DoDDS with varied computer-related experiences. Approximately 1, 536 students attend grades 9 through 12 in USAREUR and USAFE DoDDS and constituted the total population for this study. The study targeted only juniors and seniors in high school resulting in a target population of approximately 668 students. All of the students enrolled in Algebra, Geometry, Physics, Chemistry, Computer Science, or English were invited to participate in the study. The students were from different socioeconomic backgrounds and different geographic locations around the world.

Overview

Computer technology can have an effect on the efficiency and productivity of education. The contention that CAI is a constructive method of instruction in the education setting is well documented by many researchers. Bangert and Kulik (1982); K. G. Brown (2001); Christmann and Badgett (2000); Dalton (1986); J. A. Kulik, Kulik and Bangert-Drowns (1985); C. C. Kulik and Kulik (1991); Lowe (2001); Ragosta, Holland and Jamison (1982); and Ruffin (2000) illustrated that perceptively designed computer software can provide numerous, enthusiastically "linked representations in ways that are impossible with immobile, inert media such as books and chalkboards" (Dalton, p. 22). In addition, the aforementioned researchers reported that CAI is cost-effective and produces a more positive student attitude than conventional instruction. Cotton (2001) concluded, "Equal amounts of time of CAI reinforcement and the more-expensive one-to-one tutoring produced equal achievement effects" (p. 9). This broad discovery materialized from analyses of the impact of CAI on student attitude toward computers and the use of computers in education. However, CAI does not have the same effect on all populations. Dalton explained,

> Although CAI may be used to effectively improve a student's attitude toward computers, if used in a manner where low academic achieving students feel demeaned and or isolated because of their additional needs, CAI can have deleterious effects on the learner's attitude. (p. 21)

Other research has shown CAI can enhance a low-ability student's attitude and achievement spectrum. "Computers appear to be a strong motivational device for students identified as educationally disadvantaged and they broaden the scope of the scientific content that can be included in the curriculum" (Wilson, 1988, p. 56).

Improving students' computer-related attitudes and attitudes toward learning through the use of computers might be the key to maximizing the CAI learning process.

Although computers have decreased in cost and in size, the power and usage has increased over the past few decades (Cotton, 2001). The reduction in the costs of computer-related technologies makes the use of these technologies very affordable for USAREUR and USAFE DoDDSs and many other U. S. Department of Defense organizations. This study used quantitative methods to examine if a positive correlation existed between student descriptive variables and student attitudes toward CAI in the USAREUR and USAFE DoDDS system. Before reviewing research that attempts to answer the question of the relationship between demographics and attitudes toward CAI, the definitions of CAI terminology and the psychological construct of attitude were examined.

Examination of the Terminology of Computer-Assisted Instruction

The Association for Education Communication and Technology defined CAI as a technique of instructional strategy in which the computer teaches the student (as cited in Jenks & Springer, 2003, p. 1). According to Cotton (2001), “The terminology in the area is open to dispute” (p. 1). A difference of opinion about the terminology exists because individuals seeking logic of the selection of expressions used by educators and researchers, including CAI, CBE, CBI, CEI, and CMI, can easily become confused. Kulik and Kulik (1991) defined CAI by comparing many closely related computerized systems. The following clarifications of terms are amalgamation of those presented by Cotton (2001) and represent commonly accepted definitions of the terms:

Computer-based education (CBE) and computer-based instruction (CBI) are the most wide-ranging terms and can refer to practically any kind of computer use in educational settings, including drill and practice, tutorials, simulations, instructional management, enhancement exercises, indoctrination, database development, writing using word processors, and other applications. These terms may refer to either stand-alone computer learning activities or computer activities that reinforce material introduced and taught by teachers. (Cotton, 2001, p. 1)

> Computer-assisted instruction (CAI) is a more narrow term and most often refers to drill-and-practice, tutorial, or simulation activities offered either by themselves or as enhancements to traditional, teacher-directed instruction. (Cotton, 2001, p. 1)
>
> Computer-managed instruction (CMI) can refer either to the use of computers by school staff to organize student data and make instructional decisions or to complete activities in which the computer evaluates students' test performance, guides them to appropriate instructional resources, and keeps records of their progress. (Cotton, 2001, p. 1)
>
> Computer-enriched instruction (CEI) is defined as learning activities in which computers (1) generate data at the students' request to illustrate relationships in models of social or physical reality, (2) execute programs developed by the students, or (3) provide general enrichment in relatively unstructured exercises designed to stimulate and motivate students. (Cotton, 2001, p. 1).

According to Ruffin (2000), comparing and contrasting the definitions of CBE, CBI, CMI, CEI, and CAI show the lines between these activities are not distinctly drawn and the definitions are dependent upon the system's interpretation of the capacity in which the computer is being used.

Examination of the Terminology of Attitude

How attitude, whether positive or negative, influence behavior varies in interpretation of the definition. In general, the definition of attitude is regarded as a preparation or readiness for response. Ruffin (2000) noted, “Shaw and Wright (1967) list several definitions of this psychological construct of personality called attitude” (p. 21). The definition of attitude is specifically different from the definitions of concept, belief, and motive. The term attitude can generally be defined as “a person’s positive or negative evaluation of an object or thought” (Piotrowski & Irons-George, 2003, p. 191). In a more practical understanding, attitude is defined as an optimistic or pessimistic emotion or mental state of readiness learned and organized through experiences that apply specific influences on a person’s response to people, objects, and situations (Lim, 2002, p. 398).

Ruffin (2000, p. 9) reported on Shaw and Wright’s (1967) description of attitude as “an enduring predisposition to behave in a consistent way toward a given class of objects.” Shaw and Wright also reported that an attitude is “an enduring system of positive or negative evaluations, emotional feelings, and pro or con action tendencies with respect to a social object” (as cited in Ruffin, p. 9). Organized learning is viewed as a social object. Akock, Garment, and Sadava (2001) described attitude as “the mental or neutral state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual’s response to all situations to which it is related” (as cited in Daniel, 2005, p. 9). The element of experience in this definition provides a significant responsibility in the study because the strong influence of experience may help explain student responses and the array of behaviors that students display toward CAI. Shaw and

Wright also noted attitude is a drive-producing response that elicits motives and gives rise to overt behaviors (as cited in Ruffin).

Shaw and Wright (1967) described attitude as being based upon evaluative concepts regarding characteristics of the referent object and as giving rise to motivated behavior (as cited in Ruffin, 2000). Characteristic of the referent object indicates how attitudes can predict behaviors. Characteristic of the referent object is important and may be used to determine if a participant will choose to use or not to use a certain type of learning device based on some attitude toward the device (p. 6).

Various definitions of the term attitude available in the literature share common characteristics. For example, according to Beckers and Schmidt (2001), attitudes consist of three elements: (a) emotions or affects; (b) cognitions, beliefs, and opinions; and (c) tendency to act (p. 43). Morrison and Lowther (2002) reported attitudes are learned and are not inherent (p. 55). Attitudes are generally not transient; rather, they tend to be enduring and consistent.

According to Evanshen (2001), attitude is the "sum total of a man's inclinations and feelings, prejudice or bias, preconceived notions, ideas, fears, threats, and convictions about any specified topic" (p. 2). Thurstone (1967, as cited in Ruffin, 2001) cautioned using opinion as an index of attitude carries some uncertainty with it and is modifiable depending on those situations in which expressing one's opinion may not be received well. Thurstone further suggested, "A man's action is a safer index of his attitude than what he says" (as cited in Ruffin, p. 12). In determining attitude with an attitude scale or some other instrument intended to measure attitude toward computers, participants may be intentionally shielding his or her true attitude or some other environmental distractions may influence the participants to believe something more and might not naturally exist.

Research assisting in developing an understanding about attitude toward computers is important and can facilitate computer-based learning (Chin, 2001). Modern psychology has emphasized the role of individuals' attitude and anxiety are considered factors affecting individuals' performance (Beckers & Schmidt, 2001). The research on students' attitudes toward computers has indicated attitudes have an impact on the use of computers as professional tools in the workplace or as instructional tools in the classroom. Morrison and Lowther (2002) reported that if positive attitudes toward computers increased, students would master computer-related skills more easily. Lim (2002) found some students developed a degree of anxiety and yielded a negative influence on the learning process. Hong (2002) noted that emotions associated with anxiety, liking, and fear affected computer use.

A Theory Concerning Attitude Toward Computers

To more adequately determine if a relationship exists between student demographics (aptitude, race, computer-related experience, gender, and age) and student attitude toward CAI, the findings of many studies were synthesized. Synthesization is necessary because existing studies do not use a model where independent variables achieve a balance between inputs from the field of psychology and computer science. A different combination of independent variables was also needed to better achieve the needed balance. Age, race, gender, and aptitude in mathematics, average daily experience with computers, and experience in computer science were used to form the model to explain the construct of attitude toward CAI. Bandura's (1997) model of reciprocal determinism provides an explanation of the differences found in the study.

Self-assurance

Self-assurance is essential to success in any branch of learning. Not every individual is aware of the meaning of self-assurance, where self-assurance comes from, and how self-assurance can be improved. Bandura (1997) created an inclusive theory with regard to (a) individuals' self-assurance in diverse environments, (b) how self-assurance develops, and (c) how self-assurance influences behavioral results such as determination and effort.

The most important idea of Bandura's (1997) theory is *reciprocal determinism*. In reciprocal determinism, learning is the creation of the interaction of "personal, behavioral, and environmental factors" (Brophy, 1999, p. 136). Figure 1 shows the relationship between the three variables.

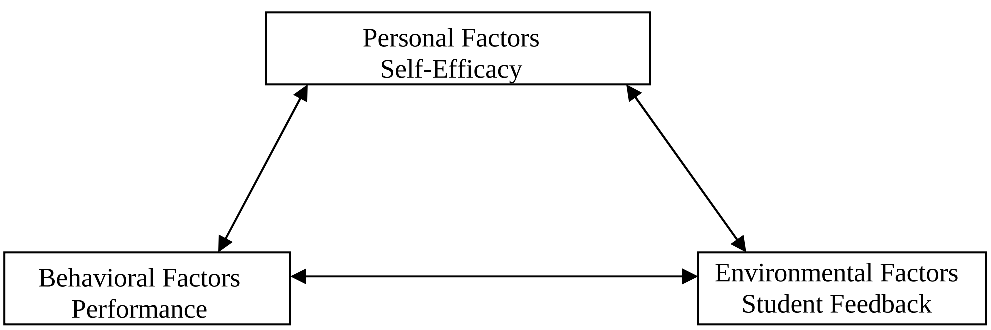

Figure 1. Bandura's model of reciprocal determinism.

The personal factor variable is related to the other variables in the reciprocal determinism model and incorporates beliefs and attitudes that have an effect on learning (Brophy, 1999). The behavioral factor variable includes an individual's response to a particular situation; for example, a student could respond with anger or with increased effort in response to receiving a poor test score. The environmental factor variable includes external influences from parents, teachers, and peers (Brophy).

In the reciprocal determinism model, an individual's behaviors and explanation of environmental signals will be affected by personal factors such as individual attitudes (Brophy, 1999). An approach in which personal factors relate to behaviors and environment signals is through mediating a reaction in which events are interpreted cognitively before a response. For example, poor performance on a test may produce nervousness in one student and increased effort in another because the students interpret the same event (a poor test grade) differently. This concept is relevant to students' attitudes toward computers.

In Bandura's (1997) model, personal factors play a very important role in both behavior and to interpret environmental signals. Two personal factors that have prevailing effects on behavior are outcome expectancy and self-efficacy. Outcome expectancy is "the perceived relationship between performing a task successfully and receiving a specific outcome as a consequence of that performance" (F. Brown, p. 119). Self-efficacy is "the degree to which an individual possesses confidence in his or her ability to achieve a goal" (F. Brown, 2000, p. 118). Many behavioral outcomes link to self-efficacy.

Self-efficacy Theory

Bandura (1997) noted, "Perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (as cited in Hodges, 2005, p. 3). Self-efficacy identifies an individual's life experiences, thoughts, feelings, and behaviors. Through the individual's characteristics, self-efficacy has four major processes: cognitive, motivational, and affective and selection processes (Hodges). "A strong sense of efficacy enhances human accomplishment and personal well-being in many ways. People with high assurance in their capabilities approach difficult tasks as challenges to be mastered rather than as threats to be avoided" (Bandura, as cited in Hodges, p. 4). Such a viewpoint promotes natural interest and profound passion in activities.

In contrast, individuals who are not confident about his or her abilities withdraw or avoid complicated activities and interpret the complicated activities as personal threats. Such individuals have low ambition and inadequate dedication to the goals they opt to pursue. "When faced with difficult tasks, they dwell on their personal deficiencies, on the obstacles they will encounter, and all kinds of adverse outcomes rather than concentrate on how to perform successfully" (Hodges, 2005, p. 3). The self-efficacy concept has a broad range of psychological implications and can provide a theoretical framework to account for the way computer attitudes can affect computer usage (F. Brown, 2000).

Impact of Technology on Learning

Instructional technology has influenced education in numerous ways. Although education has certainly affected the world optimistically, instructional technology has continued to be intangible to numerous individuals. Instructional technology is connecting this practicality disparity by involving as many individuals as desire to partake in learning (Hofmann, 2002). According to Hofmann, educational potential have become available to learners who in the past did not have opportunities to advance because of limitations as family, location, time, and money. Instructional technology is also effecting the method students make decisions on when, where and how to learn

(Ling et al., 2001). The use of prevailing technologies has improved distance learning (Hofmann). Due to these technological advances, Gee (2003) acknowledged the complexity in differentiating between conventional and distance education environments. "Online learning is considered the backbone of continuing education and is enabling educators to reach populations that would be otherwise inaccessible" (Gee, p. 32). The Internet has also extended possibilities for developing resources to improve conventional classroom teaching.

Possibilities exist for accessing current content, such as resources on the web, which can be recognized more rapidly and more easily than discovering information in textbooks. Educators can make decisions regarding the type of technologies to incorporate into the classroom circumstances from the abundance of information available, such as DVD-ROMs, CD-ROM, multimedia application, application software, communications applications and laserdiscs (Shelly, Cashman, Gunter, & Gunter, 2004). Individuals who promote technology amalgamation in the education field believe technology will better prepare students to efficiently contribute in the 21st century work environment and improve learning (Hopson, Simms, & Knezek, 2002).

Educators are challenged with finding ways to apply technology to improve and augment the student's learning surroundings (Barker, 2000). Educators should work to increase prosperous classroom settings that promote vigorous learning and thought provoking skills, such as analytical reasoning, flexible thinking, reflection and ingenuity (Hopson et al., 2002). Organizations of higher learning are developing joint ventures and developing virtual universities to cultivate resource sharing in the learning environment. Some resource sharing is achieved through course sharing. "Course sharing is a process that uses technology to share course resources, for example an instructor, to geographically disbursed learners to create economies of scale" (Jackson, 2001, p. 217). With essential schemes in place, such as structured quantities of information on the web-based libraries, electronic books, internet, and schools prepared to assist the learning process, knowledge can be communally efficient regardless of distance, locality, and time (Lee, Baek, & Spinner, 2002). Technology has become a vital component of advanced education, allowing students to receive information visually and quickly (Smith, 2002). Joined by an augmented use of web-based instructions, resources such as electronic textbooks and instructional technology are gradually making a path into the advanced education system (Ahern & El-Hindi, 2000). Resources such as web-based texts provide readers a sense of connecting into the real world, face-to-face collaboration by interactive programs (Ahern & El-Hindi).

Learning Styles and Computers

To determine the computer-related attitudes of the students in DoDDSs, this study examines research that has compiled findings on the attitudes of students in a similar learning style context. No research reports from scholarly journals present the results of student attitude toward CAI in a European-based U.S. military service environment. Closely related studies were examined and generalized by the findings to this study while controlling for the differences such as the rigid militaristic environment.

Learning style is the way an individual learner reacts to the learning environment (Coley, Cradler, & Engel, 1997). Three dimensions of learning exist: information processing, affective style, and physiological style. Information processing or cognitive styles represent the "learner's typical mode of perceiving, thinking, problem solving, and remembering" (Boyd & Murphrey, 2004, p. 1). Affective style relates to personality and is associated with attention, emotion, and valuing. Physiological style relates to the physical environment, gender, and other personal characteristics (Kolb, 1984).

Learning styles have also influenced performance in CAI environments. "Learning style appears to have a more noticeable impact on computer attitude" (Ester, 1995, p. 129). Ester posited that individuals whose learning styles incorporate active experimentation should be "expected to develop fewer negative feelings toward using computer based technology" (p. 131).

Davidson and Savenye (1992) investigated how learning style affects performance while using computer applications and proposed that some learning styles might be more effective in certain contexts. The study by Davidson and Savenye included 68 participants enrolled in two sections of a computer application course for College of Education students at the University of Texas. Davidson and Savenye did not control for or test for gender differences and did not report the genders of the participants, but they did note the majority were female elementary education majors. To conduct the study, the researchers administered Gregorc's Learning Style Inventory to each participant at the beginning of a course. Davidson and Savenye concluded learners with high abstract sequential ability demonstrated advanced performance on computer applications skills. According to the investigators, the relationships of learner characteristics such as gender on performance in computer applications require further research.

Bostrom, Olfman, and Sein (1990) found a significant disparity between abstract lecture participants and abstract CAI participants. The participants were assigned to treatment groups based on college grade point average and learning styles. The researchers grouped the students into the two above mentioned categories of Gregorc's Learning Style Inventory. According to Martin (2002), Gregorc's Learning Style Inventory describes four basic learning styles: Concrete sequential, abstract sequential, abstract random, and concrete random. Bostrom et al. (1990) explained that concrete sequential learners analyze the society with the senses in a tangible, unbiased approach. Experiences are approached in a chronological and naive behavior. Concrete sequential learners' thought processes are rational, intuitive, and purposeful and the learners strive for precision and are detail oriented. Abstract sequential learners analyze the society in a theoretical affable manner with views and signs used to symbolize realism. Categorization is in order and two-dimensional. The abstract sequential learner's thoughts are initiated with a general foundation and diverge into elements in a tree-like manner. The thought processes are logical, methodical, correlative, and rapid. Attention is focused on comprehension, notions, and thoughts. Abstract random learners analyze society with emotions and feeling. Categorization is nonlinear and multidimensional, and life experiences are holistic. The abstract random learner's thought processes are centered on emotions that make abstract random learners good at establishing a connection with people. Abstract random learners are sensitive, analytical, and apprehensive. Attention is focused on relationships, memories, and emotional attachments. Artistic benefits are creative and are usually articulated through art and music. Concrete random learners analyze society in a tangible manner by using instincts. Categorization occurs in three-dimensional configuration, meaning events take place in a linear sequence and can be changed by outside variables. The concrete random learner's thought processes are intuitive, natural, and spontaneous. Concrete random individuals focus attention on relevancy, technique, and procedure.

Computer-assisted instruction can be used as an instructional method to promote active learning (having students involved in the material presented). Proponents of active learning believe students not only maintain more information but also demonstrate a greater understanding of the material when they are actively processing information by reconstructing the information in personally meaningful ways.

Meta-Analytic Study of Computer-Assisted Instruction

Jenks and Springer (2003) noted, "The 1980s and 1990s usually encouraged the effectiveness of CAI in formal education environments" (p. 2). Jenks and Springer also explained, "Meta-analyses indicated that CAI is usually valuable in education environments for a broad range of student ages" (p. 2) and determined CAI has good capability to improve student academic scores in precollege courses. The outcome of the meta-analysis indicated the typical effect of CAI was to improve student academics by approximately 0.4 standard deviations.

Snowman (1995) further supported CAI at the high school level. The results of Snowman's study revealed positive effects of CBE on high school learners. In the study, the average student in a computer science courses scored in the 60th percentile on the final assessment, whereas the average student in a conventional course scored in the 50th percentile. As cited in Jenks and Springer (2003), Fletcher-Flinn and Gravatt (1995) investigated studies on CAI from 1987 to 1992 and concluded an inclusive positive effect existed for every grade levels for CAI versus conventional classroom environments. Integrated in the meta-analysis were numerous reports in that the same instructor taught both the conventional form and CAI classes. Fletcher-Flinn and Gravatt examined the outcomes of these reports and revealed no major inconsistencies between CAI and conventional instruction (as cited in Jenks & Springer, 2003). Additionally, Fletcher-Flinn and Gravatt revealed how the analyses using pencil and paper equal of the CAI, no major achievement inconsistencies exited between the control groups and the behavior.

Another study cited in Jenks and Springer (2003) was Christmann and Badgett's (2000) study comparing the achievement levels of college students who had courses that used conventional teaching methods with those of college students who had courses when CAI was implemented as an enhancement tool to conventional teaching methods. The students exposed to CAI and the conventional teaching method increased his or her achievement levels more than those students not exposed to CAI. Christmann and Badgett gathered data from 26 studies and determined student academic achievement advanced from the 50th percentile to the 55th percentile when the average student was exposed to CAI (p. 99).

Lowe (2001) explored numerous other meta-analyses from the 1980s and the 1990s and discovered that each of the reviewed meta-analyses revealed an irrelevant positive effect size for CBE over traditional instruction. Conversely, Lowe noted research indicated that when the same instructor delivered CBE and conventional instruction, the CBE benefit decreased to inconsequential levels. Further, models and tutorials as enhancement tools to traditional teaching methods appeared to be the most valuable instruments for learning.

Although meta-analysts have unfailingly discovered that CBI tends to have an explicit effect on standardized test performance, no one has identified if all varieties of

CBI augment student achievement in all types of settings. Computer-assisted instruction appears to be more appropriate in circumstances where teachers' subject matter knowledge and experiences are inadequate. Efforts to ascertain more vastly developed interactive and open-ended technology will involve imperative professional development opportunities and many other technology resources before they can benefit students.

Dependent Variables of Computer-Assisted Instruction

Computer technology is constantly changing and affecting the world by providing a more rapid and powerful process of accessing a wide range of information at a moment's notice. According to Cotton (2001), "Many administrators, teachers, parents, government officials, and researchers have expressed concerns about the educational efficacy of using computer technology in schools" (p. 1). An abundance of research was conducted during the 1970s, 1980s, and early 1990s on the impact of computer use on student attitude, achievement, and other variables such as self-paced learning (Cotton). The goal of this study was to identify students' attitudes and determine if a positive correlation exists between student demographics and student attitudes toward CAI. The measurement of attitude is from the BCCAS and the modified Attitude Toward Any Practice Scale (ATAP; Bear et al., 1987). The instruments chart the spectrum of computer-related attitudes such as anxiety, apprehension, resistance, avoidance, and confidence of the student. The attitudes are associated with the dependent variables of the study. Creswell (2002) explained, "Depending on the cause, the dependent variable is the object of study or investigation" (p. 141). In a more practical understanding, the dependent variable is the effect or outcome of another variable.

No scholarly journals have presented the results of student attitude toward CAI in a military environment. Different related studies were also investigated to be able to better explain the findings of the study. Lawton and Gerschner (1982) reported a mixture of results on the attitudes toward computers and computerized instruction and noted, “There is very little agreement on attitudes toward computerized instruction” (p. 48). Lawton and Gerschner also reported, “Few researchers are willing to guarantee that students would prefer to learn with computers” (p. 48). According to Ruffin (2000), “These results may reflect the fact that Lawton and Gerschner’s (1982) study is relatively old” (p. 25). Ruffin continued, “The advances in technology have changed many of the hardware features that created many of the problems associated with the findings” (p. 25). This signifies that the more proficient a computer program is, the more suitable the program will be to individual students. Wilson (1988) demonstrated that “thoughtfully designed computer software can present multiple, dynamically linked representations in ways that are impossible with static, inert media such as books and chalkboards” (p. 52).

Lawton and Gerschner (1982) also used a research design that was qualitative. Lawton and Gerschner suggested that the research design and framework would be difficult to make scientific comparisons between studies. No mention was made in the study about effect size or the importance in across-study comparisons. Nor did Lawton and Gerschner mention any other reputable meta-analytic method for making comparisons across studies. Based on the limitations that originated from the research design, Lawton and Gerschner did not provide conclusive results.

Three meta-analysis studies (Christmann & Badgett, 2003; Blok, Oostdam, Otter, & Overmaat, 2002; J. A. Kulik & Kulik, 1999) discovered CAI having a positive effect on students' academics. For instance, J. A. Kulik and Kulik (1999) investigated 254 controlled assessment studies and discovered that "81% of students who participated in CAI had better test scores than students who did not participate. The normal effect range was 0.30 standard deviations higher in presentation for CAI students than for students in the control group" (p. 78). The effect range was identified as "the difference between the mean scores of the two groups divided by the standard deviation of the control group" (J. A. Kulik & Kulik, 1999, p. 78). The outcomes reflected a vital augment of student academic accomplishment. Christmann and Badgett's (2003) meta-analysis investigated 68 studies relating to the efficiency of CAI with elementary students and discovered that "students who attained CAI received higher academic achievement than did those students who attained only conventional instruction" (p. 91). A meta-analysis by Blok et al. investigated the efficiency of 42 analyses of CAI curriculums with beginning reading instruction. The outcome reflected that CAI had an insignificant but positive influence on beginning readers. Bayraktar's (2001) meta-analysis examined the impact of CAI on student academic in science education and discovered the average student progressed from the 50th percentile to the 62nd percentile in science with the aid of CAI.

Boling, Martin, and Martin (2002) as well as Traynor (2003) supported the results of the meta-analyses in which CAI improved student academic. For instance, Boling et al. discovered CAI had a significant effect on student academic. The outcomes indicated CAI functioned as an encouraging intermediate that improved good instruction. Boling et al. concluded by suggesting transferring students from conventional contingent activities to autonomous learning is produced by conflicting use of computers in the classroom.

Accelerated Math (AM; Boling et al., 2002) is one commonly used math-based in CAI curriculum. Accelerated Math is an "Enhancement to regular mathematics instruction in general education classes, and students using it consistently demonstrated significantly higher math achievement gains than students in the same math programs who did not receive the AM enhancement" (Boling et al., p. 82). When AM is implemented and integrated with classroom instructions, research revealed students having a positive academic experience (Ysseldyke, Spicuzza, Kosciolek, & Boys, 2003; Ysseldyke & Tardrew, 2002). Ysseldyke and Tardrew further examined the impact of AM on student math performance during a 6-week summer school program in an urban school. The outcome of the 6-week program revealed how students using AM has an average gain of 5.75 normal curve equivalent items on the Northwest Achievement Levels Test, a district math assessment. Ysseldyke and Tardrew performed a national research that investigated the use of AM improved academic results for students in Grades 3–10 in 67 classrooms in 47 schools in 24 states. Students using AM in grade 3-6 had a normal curve equivalent gain difference of 10.75 over the students who did not use AM.

The advantages of implementing CAI consist of the need to study technology, the transfer of students from comprehension and knowledge into relevance and exploration and the growth of student computer literacy by affecting numerous computer skills as part of the learning process (Dockstander, 1999). Computer-assisted instruction brings several prospective benefits as a teaching and learning medium, including independent and self-paced learning, the implementation of numerous senses, and the capability to embody content in an array of media. Computer-assisted instruction also has a philosophical change on students' attitudes toward computer use and classes (C. C. Kulik & Kulik, 1991) and increases motivation by providing a framework for the learner who is challenging and stimulates curiosity (Traynor, 2003). Traynor also found that intrinsically motivating CAI activities carry other important advantages such as personal gratification, thought-provoking challenges, relevance, and promotion of a positive perspective on lifelong learning.

Independent Variables of Computer-Assisted Instruction

Although a number of previous studies and meta-analyses have primarily focused on the comparative efficacy of CAI versus conventional instruction, relatively fewer inquiries have explored how various teaching methods or system designs of CAI influence student learning outcomes in the classroom. Numerous studies have investigated the association of computer anxiety to various demographic variables, such as age gender, and teaching field or academic major (Yang, Mohamed, & Beyerbach, 1999), although the outcomes of most studies have been contradictory (Maurer, 1994). An overview of several studies since 1996 have explored and assessed the independent variables of this study is presented and examines if a positive correlation exists between student demographics (science aptitude, race, computer-related experience, age, and gender) and student attitude toward CAI. According to Creswell (2002), the independent variable is "a variable that is not affected by another variable with which it is compared" (p. 139). Creswell explained how the independent variable is "the cause variable or the one that identifies forces or conditions that act on something else" (p. 141). Independent variable is an influential changeable element in an experiment or studies whose occurrence or degree decides the change in the dependent variable.

A quantitative ex post facto study by Snelbecker, Bhote-Eduljee, and Aiken (1992) has many similarities to this study. The similarities are that the study used previous experience and aptitudes as independent variables. Snelbecker et al. also used attitude as an independent variable as a predictor of success for the participants. The population studied was teachers, but they may be viewed as students because in this situation they served as learners. The study began with the hypothesis that "it is necessary for the instructors to learn more about computers; some people are going to have a more difficult time than others when attempting to learn about computers" (Snelbecker et al., p. 2).

Snelbecker et al. (1992) hypothesized that "gender, math background, or previous experience with computers will indicate who will and will not be successful" (p. 2). Subsequently, the study examined the extent to which a participant's "demographic characteristics, previous experience, aptitudes, and attitudes may be indicative of probable success in learning about computers" (Snelbecker et al., p. 2). The first research question of the study was the following:

> Which attributes collectively account for variations in achievement as measured by course projects, course exams and overall course grades? There is no indication, in this study, about the level of standardization in the course materials. There is no indication, in this study, about the standardization of instruction between instructors. There is no indication that there was any control in the study for differences in instructors or instruction. (Snelbecker et al., p. 4)

The second research question of the study was as follows: "What portion of the collection variance in achievement is accounted for by the respective collective predictors" (Snelbecker, 1992, p. 4). The answer to this question required proper operationalization of the predictors in the conceptual model. The answer also required an instrument that adequately measured the predictors in the model and a design that controlled the extraneous variables affecting measures of the dependent variable (Snelbecker et al., p. 4).

The following was the third research question of Snelbecker et al.'s (1992) study: "To what extent are predictors of one type of achievement evident as predictors as other types of achievement within a given course" (p. 4)? This question asked if success in computer science courses would lead to success with computers or if past experiences with computers led to success with computers. The question was answerable in the study if the design of the study provided sufficient control that would allow the researchers to conclude the treatment caused the change in the measures of the dependent variable and not the result of the effect of some extraneous variable (Snelbecker et al., p. 4).

The fourth research question of Snelbecker et al.'s (1992) study was as follows: "To what extent are predictors for one course likely to be predictive of achievement in other courses" (p. 4)? The question, which asked about the reliability of the predictors, associated with the significance of the predictor in the model. The answer to this question directly related to the question of how much of the variance in the measures of the dependent variable can be accounted for by a single predictor or some combination of predictors (Snelbecker et al., p. 4).

The fifth research question of Snelbecker et al.'s (1992) study was the following: To what extent are there similarities and differences in the pattern of predictors for the high school vs. elementary school teachers" (p. 4)? This question was concerned with the reliability and the generalizability of the predictor variables to larger populations. If the predictor variables were the same for the elementary schools and the high schools, then the researchers might conclude the predictor variables were generalizable to other elementary schools and high schools. This question would answer if the predictor variables are valid enough to generalize the findings of this study to instructors of colleges and universities (Snelbecker et al., p. 4).

The number of research questions in Snelbecker et al.'s (1992) study is a disadvantage and a weakness in the design that prevented the researchers from gaining the needed depth on a few of the questions. The advantage to the number of questions is that the majority of the questions focused on different dimensions of the dependent variable. The questions were directly linked to the criterion variables. Adequate answers to the first two research questions would have been sufficient for a meaningful study and could have eliminated the need to answer the last three research questions. The inability to limit the scope of the research questions and defines the conceptual framework created weaknesses in the framework and the research design (Snelbecker et al., p. 4).

The criterion variables of Snelbecker et al.'s (1992) study consisted of project grades, exam grades, and overall course grades. The course grade variable was a simple average of project grades and exam grades. The high school group had 12 criterion objectives and the elementary school group had 15 criterion objectives (Snelbecker et al., p. 5).

Snelbecker et al. (1992) did not communicated which specific types, in which ranking order, or in which graduated amounts of computer experience are desirable to be considered successful. Snelbecker et al. should communicate, with range and magnitude, the characteristics of these experiences. If a certain type of experience is important, then the experience should be noted. If the type of experience is computer programming, then the experience should be noted if a hierarchy exists among the computer programming languages that would represent the best experience or if some combination of computer programming languages exists that would represent the best experience. These unanswered questions are weaknesses in the design of the study (Snelbecker et al.).

Snelbecker et al. (1992) did collect self-reported information on computer-related experiences and interest variables in the form of written response from the participants. Participant responses included typing speed in number of words per minute, if they have taken any computer-related classes, and level of class achievement (if any). Other self-reported responses included the level of participation in computer games, use of packaged programs, experienced at writing computer programs, operated a mainframe, repaired computers, sold computers, designed computer hardware, or managed computer personnel systems. Self-reported items submitted by the participants were proficiency with computer programs, specifically statistical package word processing, graphics, music, accounting/finance, engineering/architectural, and medical. Finally, the self-reported information submitted was undergraduate majors (math or nonmath) and undergraduate grade point average.

The responses from Snelbecker et al.'s (1992) study make it clear that the type of experiences and the order of the experiences serve as the best predictors of success. A fundamental problem rests with operationalizing the computer-related experience. The poor operational definition of the experience variable led to a weak conceptual model and conceptual framework. A research question asking in what capacity the participant should have to be considered experienced with computers requires CBI with subscales that would identify more specifically the domain and the range of experiences required as predictors of success. The lack of necessary subscales makes it impossible for the study to adequately explain the variance in measures of the dependent variable.

The lack of a valid and reliable instrument to adequately measure a participant's experience level in Snelbecker et al. (1992) led to the inability to adequately measure the experience variable and resulted in a very weak research design. Together the design inherently produced results with inadequate levels of internal validity. The decrease in internal validity led also to a decrease in external validity for the study.

Snelbecker et al. (1992) derived information from two National Science Foundation-funded programs designed to retrain experienced teachers to become K-12 computer science teachers. Selection bias could have occurred because the instructors were "deliberately selected based on computer experience criteria" (Snelbecker et al., p. 4). The criteria were that about "half had little or no experience with computers" (Snelbecker et al., p. 4). No indication exists about what the depth or the breath of that computer-related experience should be. Snelbecker et al. also reported the selection criteria included that "half of these subjects have diverse backgrounds and that they have diverse personal characteristics" (p. 4).

Because no random selection or random assignment exists, the extraneous variables, the confounding variables, and the intervening variables are not likely to be evenly distributed among the population (Snelbecker et al., 1992). If the distribution is uneven, the distribution is not known on what basis a correlation might exist between a student's attitude and a student's computer experiences because CBI was not implemented with any degree of sameness among the population on any of the variables of interest. Having the degree of sameness among the population is a prerequisite if Snelbecker et al. were to make any conclusions about the effect or relationship of the independent variable of interest to measures of the dependent variable. This weakness decreases both the internal and the external validity of the study.

Snelbecker et al. (1992) reported data were collected in various manners. They reported all participants completed two CBIs and a series of questionnaires constructed by the authors. The report failed to include a description of the CBIs or the questionnaires. The researchers did not describe the number of items on the scale or the questionnaire or whether the CBIs or questionnaire were 5-point Likert-type scales or continuous scales. The researchers also failed to mention the alpha reliability coefficient and did not mention for what and for whom specifically the instruments were designed or the various population that have used the instruments to verify the suitability for use in this context (Snelbecker et al.). The Snelbecker et al. study revealed how important the independent variables such as computer experiences can be to this study to adequately explain the variance in measures of the dependent variable.

The results of many studies were merged to effectively determine if a relationship exists between student demographics (science aptitude, race, computer-related experience, gender, and age) and student attitude toward CAI. This study needed to be integrated with other similar studies because the existing studies do not use a model in which independent variables achieve a balance between inputs from the field of psychology and computer science. A different amalgamation of independent variables was also selected to better achieve the needed balance. Age, race, gender, aptitude in science, average daily experience with computers, and experience in computer science were used to form the model to explain the construct of attitude toward CAI.

Computer Attitude and Gender

Females have been involved with computer technology since the beginning. According to Traynor (2003), some of the most prominent women in computer science include Lady Ada Byron, the first computer programmer, and Admiral Grace Hopper, the creator of the first compiler. Females represent a significantly lower percentage of computer users than do males. An impartiality relating to the low level of female participation and practice in the area of technology has existed for some time (Traynor). Hence, gender differences are taken into consideration in the study of computer use. An abundance of research on gender and computers has focused on inequity in education at every level (Traynor).

Efforts have been made to decrease the disparities between males and females in mastering and using technology in general and computers in particular. Fifty/Fifty by 2020, an idea proposed by Dr. Anita Borg at the 1995 National Science Foundation conference, consulting engineer with Digital Equipment Corporation, aims at producing an equal number of male and female graduates in science and engineering by the year 2020 (Bayrakter, 2001). Although females represent a significantly lower percentage of computer users than do males, the disparities are fading. More females are joining technology and computer clubs, attending computer camps, and building web sites designed specifically for females (Bayrakter).

Literature concerning attitudes toward computers has indicated not only gender differences connected with computer usage, but also definite differences with regard to performance and computer-oriented tasks (Kadijevich, 2000). Studies of the relationship between gender and computer attitudes have produced mixed results. Some researchers have reported that male computer users were more confident, more prone to like using computers and less anxious than females (Bayrakter, 2001; Kadijevich; Lim, 2002). Other studies reported no significant difference in computer attitude exists between females and males (Varank, Tozoglu, & Demirbilek, 2001). Part of the reason for the inconsistency in the research might be the studies' designs. Studies that control for one variable, such as the computer experience of respondents, tended to show no major difference in attitude between the genders. In some cases, however, no significant differences were found even when the variable was not controlled (McKinnon, Nolan, & Sinclair, 2000). The study of gender as a factor affecting computer-related practices offers an important opportunity to study the impact of computers on cultures.

Researchers have researched the ascendancy of males in computer use and ownership (Miura & Hess, 1987). Other researchers have investigated the correlation between gender and computer attitude and explained that males have more encouraging attitudes toward computers (McKinnon et al., 2000). Christmann and Badgett (2003) discovered males have a higher level of computer literacy than females, although gender discrepancies in computer literacy were shown to decrease with increased computer experience (weekly usage, years of use, etc.). The gender typecasting of computer use as a sphere of influence but did not change female students' attitude toward computers (Francis & Katz, 1996). Studies of gender dissimilarity in computer literacy have also revealed mixed outcomes. Many studies tend to exemplify equivalent performance by male students in comparison to female students, whereas other studies tend to substantiate equivalent performance by gender or even higher performance by female students.

A study by Hess and Miura (1983) was reviewed to capture findings that explore more related variables pertaining to computer attitude and gender. Hess and Miura investigated the relationship between the demographic variables of gender and socioeconomic status and computer learning. The variable socioeconomic status in Hess and Miura’s study is comparable to economic position in this study because the members of the population under study are DoDDS students of military and government employee members. The military and government employee members of the DoDDS student population receive housing, meals, and medical and dental benefits. Receiving these benefits communicates the DoDDS military community standard of living and economic position.

Hess and Miura (1983) used a conceptual framework based on the assumption how disparities in computer literacy have a theoretical and a social importance. “The social significance follows from economic and educational opportunities open to students who have computer knowledge” (p. 3). Hess and Miura alleged the variations in the trend to obtain programming abilities may be likely to increase gender and socioethnic disparities that exist in the workforce and warned, “The new technologies may threaten gains in educational and career opportunities for women and minorities that have been achieved at great efforts in the past two decades” (p. 4).

The purpose of Hess and Miura’s (1983) quantitative ex post facto study was to identify students who voluntarily seek to acquire computer knowledge and programming expertise. The study identified socioeconomic differences and gender in student enrollment in computer courses during the summer and normal semester classes offered throughout the United States. Hess and Miura examined gender differences by age, social background of students, and selected characteristics of classes provided by the schools.

Hess and Miura (1983) sent out questionnaires to directors of summer camps and classes that offered training in programming for microcomputers. The data were gathered by questionnaire with follow-up by phone with the directors. The camps were identified by listings in microcomputer and educational computing journals. Twenty-three directors of summer programs were contacted by phone. Some of the difficulties associated with the approach they used included incorrect and inappropriate procedures used in the selection of the students.

The directors, who served a total population of 5,533 students in approximately 132 instructional groups, “provided data on enrollment and socioeconomic characteristics of students, type of sponsorship of programs (private, public schools, universities), level of difficulty of programming classes, cost, and residential versus day use” (Hess & Miura, 1983, p. 5). The camps were located in various parts of the United States, and approximately half were in western states. The instrument was a one-page questionnaire that asked for enrollment by age, grade, gender, socioeconomic status, and ethnic origin. The three levels for socioeconomic status were low income, middle income, and upper income. The five classes of ethnicity were Caucasian, Black, Hispanic, Asian, and Native American.

Hess and Miura (1983) did not mention the validity or reliably of the instrument or for whom the instrument was best suited. The study did not mention any cases where the instrument was used in other populations. One of the weaknesses of the study is the manner in which the instrument was used. Hess and Miura relied on the directors to report information on the students, including the students' social background. The directors were not informed about the social background of the students. The unreliability of the source of information greatly decreased the internal validity of the study. The contribution of the independent variable to the measure of the dependent variable is unreliable. The study did not identify the criterion variable.

Hess and Miura (1983) reported, "Analysis of gender and SES enrollment was designed to answer questions about gender and SES differences for the total group" (p. 6). The authors added an additional dimension to the study, which were the data used to determine if the magnitude of gender differences varied by the age of the student, level of difficulty of the programming courses, cost of the residential character of the camp, and type of sponsorship. The authors also reported the dissimilarities between scopes of males and females and socioeconomic statuses were so large that statistical tests were not required to establish significance of the results.

In a study involving 222 students in Grades 8 through 10, Levin and Gordon (1989) attempted to recognize the impact of computer experience and gender on attitudes toward computers and discovered past experience with computers had a more positive effect on the participants' attitudes than did gender (as cited in Leite, 2000). Levin and Gordon explained that because males have more experience with computers and have a more positive attitude than females. Ogozalek (1989) studied 212 computer science students to decide the attitudes of the students toward computers and concluded, "Women seem to be full of contradictions and confusion in their attitudes toward computers" (as cited in Leite, p. 8).

At the higher educational level, Popovich, Hyde, and Zakrajsek (1987, as cited in Leite, 2000) conducted a study with undergraduate students and determined female students demonstrated a better apathetic response to computers than did male students. Popovich et al. also concluded the more time exposed to the number of college-level computer courses taken and using a computer fluctuated significantly between male and female students. Popovich et al. explained "Evidence of the association of computers with males is found in a number of areas, including advertising for computers, computers software and role models such as teachers” (as cited in Leite, p.9).

Some researchers revealed how insignificant discrepancies exist between female and male students’ attitudes toward computers. Morris (1989, as cited in Leite, 2002) conducted an investigation in which he examined the relationships of gender, education, age, and family remuneration to attitudes toward computers. The outcome revealed that family remuneration and gender did not have an effect on the participants’ attitudes toward computers. However, education and age were shown to be significantly related.

Loyd, Loyd, and Gressard (1987, as cited in Leite, 2000) examined 356 students to establish the results of gender and math anxiety on computer attitudes. Loyd et al. explained the relationship between computer attitudes and gender was “generally low and not statistically significant” (Loyd et al., as cited in Leite, p. 1). Previous studies conducted by Loyd et al. reported that students’ attitudes toward computers were extensively changed by computer experience and not by gender (as cited in Leite).

Experience and Attitude Toward Computers

Shashaani (1995) designed a study to examine the extent to which experience with and attitudes toward mathematics differ for males and females. Shashaani was also concerned with the association between math attitudes and computer attitudes of adolescents. Shashaani found gender differences in math experience and attitudes toward math and reported males completed more math courses than females. Females were less interested and confidence in math than males (Shashaani).

Shashaani (1995) showed, using Pearson correlations, that math experiences and attitudes were positively correlated. The study also showed how math liking and math confidence are positively associated with computer interest and computer confidence. The study also documented the positive correlation to computer liking and computer interest and other computer-related attitudes justifying the data associated with mathematics (Shashaani).

The population of Shashaani's (1995) study was 1,730 9th- and 12th-grade students from five suburban public schools in Pittsburgh. The ratio of boys to girls and of 9th graders to 12th graders was approximately equal. The schools selection was based on an attempt to obtain a fair representation of different geographical locations and different socioeconomic backgrounds. The population was predominantly White. Although Shashaani's report mentioned the research took a survey approach, the report did not mention the survey name or its validity and reliability measures.

Shashaani (1995) employed a survey that assessed the mathematics background of the participants. The mathematics experience was assessed by the number of college preparatory courses taken. The courses included were Calculus, Precalculus, Algebra I, Algebra II, Plane Geometry, Solid Geometry, and Trigonometry. The survey also accessed the students' attitude toward mathematics, including liking and confidence. Shashaani noted the alpha reliability coefficient was .76 and described the scale as being a 5-point Likert-type scale. A separate attitude scale was used from previous research but was not mentioned by name and the alpha reliability coefficient was not mentioned. The various attitudes measured included computer interest, computer confidence, and computer stereotyping. Demographic data such as student age, gender, grade, race, and socioeconomic background were gathered (Shashaani).

Shashaani (1995) used various statistical techniques such as chi square, multivariate analysis of variance (MANOVA), and Pearson correlations. Chi square was used to evaluate differences by gender and grade with relation to the number of math courses taken. MANOVA was used to measure gender differences in computer science and math. Pearson correlations were used to determine associations between math attitude and math background and between computer attitude and math attitude (Shashaani).

Shashaani (1995) showed using chi-square that a significant difference existed in gender and grade with relation to the number of math courses taken. Shashaani also showed, using MANOVA, a significant effect for gender on math liking and math confidence. The MANOVA showed that males liked math more than females and that males had more math confidence than females. The MANOVA also showed females had less confidence in their own individual abilities in math (Shashaani).

Shashaani (1995) determined using Pearson correlations that the associations between math attitude and math background and between computer attitude and math attitude showed positive correlations between the number of college preparatory courses taken and math liking. Pearson correlations also showed the effect of math experience on math confidence was higher for females than for males (Shashaani).

Shashaani (1995) showed, using MANOVA, a significant effect for gender on three attitude subscales. On computer interest, computer confidence, and computer stereotype, a significant effect existed for gender. Males scored higher for computer interest and computer confidence. The Pearson correlations showed mathematics was significant on all three subscales. The result was consistent for males and females (Shashaani).

The study charts the spectrum of computer-related attitudes such as anxiety, apprehension, resistance, avoidance, liking, stereotype, useful, easy, interest, and confidence and seeks to find relationships between demographics and computer-related attitudes. The variables of experience and how the variables affect computer-related attitudes and attitudes toward CAI are not clear in the literature. The exact type or capacity of experience is not well documented. Shashaani's (1995) study presented very strong findings that indicate adequate levels of experience in mathematics are very strong indicators for positive attitudes toward computers. Shashaani's study revealed the presence of key experiences stimulates certain corresponding positive computer-related attitudes from students. Although people who exhibit negative attitudes avoid contact with computer systems, people who exhibit positive attitudes maximize the amount of time they spend operating computer systems. Researchers must continue to identify ways to maximize the positive attitudes.

Shashaani (1995) wrote, "If having more mathematical skills leads to more positive attitudes toward mathematics, which in turn leads to more positive attitudes toward computers, then the crucial question is how to attract more females to enroll in math courses" (p. 36). Shashaani's research showed the problem is social rather than biological (p. 36). For example, if the designers, developers, and deliverers of CAI could tailor math courses to the individual and the individual could have a better attitude about the delivery system and the course content; attracting more females to enroll in math courses and improve students' attitude towards computers would create a win-win situation.

As described above, computer experience is another factor examined for its predictive value in determining attitudes toward computers among students (Lim, 2002). Other studies have revealed how computer experience had a positive effect on computer attitudes (Bayrakter, 2001; Kadijevich, 2000). McKinnon et al. (2000) specified that people with more experience working and studying with computers had more positive attitudes than those with little or no experiences with computers. Exposure to computers is inevitable. Computers are in homes, workplaces, and schools. Computers are being integrated into classroom instruction and are improving students' skills, and basic computer literacy has become a necessity for all (Bayrakter).

Taking computer classes leads to an increase in computer experience. Students who have taken more computer courses reported having more favorable attitudes toward computers than those who had taken fewer courses (Chin, 2001). Taghavi (2001) compared college students' attitudes toward computers before and after a computer literacy class by time of class, gender, age, prior computer experience, access to a home or work computer, and collegiate classification. The result of the study indicated highly positive changes in the overall attitudes of students toward computers, with participants feeling better acquainted with computer technology after the course.

Students' Attitudes Toward Computers

Students' attitudes toward computers are major factors in the adoption and successful use of computer technology, influencing the students' use of computers and career paths (West, 1999). Different factors affect students' attitudes toward computers. For example, Bernard (1997) indicated teachers' attitudes might affect how students interact with computers.

As discussed previously, students' computer-related attitudes relate directly to prior experience with and use of computers. Students who are knowledgeable about and experienced with computers have a more positive attitude toward the possible use of computers in education. Generally student make positive statements about computers and some students tend to be far less positive about the experiences of using computer technology (Taghavi, 2001).

Another important factor in students' development of positive attitudes toward computers may be the integration of computers across the curriculum. The success of an integrated computer curriculum could be examined by comparing changes in students' computer-related attitudes with changes in academic outcomes. There has been an evolving concern about the effect of pessimistic attitudes toward computers on individuals' motivation and performance. Sufficient evidence exists that computer anxiety reduces computer-related performance and inversely relates to individuals' attitudes toward computers (Varank et al., 2001). Bernard (1997) posited components that affect computer use include such constructs as anxiety, liking, and fear. Bernard revealed that computer anxiety and pessimistic attitudes toward computers affected student performance. King and Bond (1996) indicated negative attitudes might lead to the exclusion of different groups from opportunities to use computers and might even limit the students' chances of locating employment.

Because computers can be used for a wide range of responsibilities in many different settings, computer curricula should reflect particular working environments. Integrating CAI in the classroom curriculum will accommodate all learning levels because CAI moves at the students' pace and typically does not progress further until the students have mastered the skill. Students should use microcomputers in classrooms in ways that are efficient, practical, applicable, and useful for an array of outcomes.

Summary

Through a synthesis of relevant CAI research findings, research revealed CAI offers superior advantages for learning when used in conjunction with classroom instruction. Because a unified concept of CAI is not presented in the literature, any subdivisions of CBI such as CMI, CEI, CBT, and CAI have roles that are very similar. The similarity leads to unclear definitions among researchers. Unclear lines of distinction indicate the lack of a unified CAI concept.

The lack of a unified concept leads to a situation where CAI means many different things to different researchers. The lack of a unified concept of CAI creates a situation in which different researchers take extremely different methodological approaches to answer the research questions. Another observation is the methodological framework being used by researchers renders results that are limited to the disciplinary perspective. The range of expertise required for the adequate assessment of CAI includes the synthesis of expertise from many disciplines, which proves to be a major weakness in the research findings from CAI.

To address the weakness presented in this study, higher quality CAI research should incorporate an amalgamation of perspectives. First, CAI research should, from an occupational psychologist's or a training practitioner's perspective, address CAI effectiveness and the possibilities that CAI can be assimilated within a particular organizational context. CAI research should also address, from a cognitive psychologist's perspective, the sophistication of dialogue between tutors and students. Finally, adequate CAI research addresses, from the computer scientist's or engineer's perspective, various alternate computer configurations.

The literature review charted the spectrum of computer-related attitudes, including anxiety, apprehension, resistance, avoidance, caution, appreciation, and confidence in using computers as a learning tool. The review showed that CAI has a significantly positive effect on student learning. Chapter 3 discusses the methodology chosen for data collection and describes techniques to build two access databases and a web interface to receive the data.

CHAPTER 3: METHOD

The purpose of the study was to analyze student attitudes toward CAI using a descriptive survey methodology. The goal was to assess the perceptions or attitudes of junior and senior high school students enrolled in the USAREUR and USAFE DoDDS system. The population for the quantitative study included students enrolled in USAREUR and USAFE DoDDS. Each student was taking classes in the content areas of Algebra, Geometry, Physics, Chemistry, Computer Science, or English. Students were from different socioeconomic backgrounds and different geographic locations around the world.

Preparation for the data included building two Microsoft Access databases and a web interface to receive the data. Several databases were constructed based on entities from the questionnaires and surveys. The research had built-in flexibility to provide the participants the option of completing the questionnaires and surveys online or paper document in a classroom setting that was analyzed by using the Statistical Analysis System 9.1.3 (SAS, 2006).

Chapter 3 describes the study group, the instruments, and the procedures used to analyze and synthesize the collected data to answer the following research questions:

Research Question 1: What is the correlation between student scores on the BCCAS, ATCAI, mathematics aptitude, average daily exposure to computers, computer experience, and math placement assessment?

Research Question 2: What are the differences in ATCAI scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement and computer knowledge (CS/CP) assessment?

Research Question 3: What are the differences in BCCAS scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement, and computer knowledge (CS/CP) assessment?

Research Design and Methodology

The relationship between students' demographics and the students' attitude toward CAI is important because of its link to the existing body of contemporary research on student attitudes toward CAI. A quantitative methodology was used to examine if a positive correlation exists between student demographics (level of education, race, gender, and age) and student attitude toward CAI in the USAREUR and USAFE DoDDS system as measured by the BCCAS and the ATCAI.

The goal of the study was to determine students' attitudes to produce more efficient learning systems for each student. According to Milheim (1993), inputs during the design, development, and delivery of CAI can influence the effectiveness of the learning experience. The information received from implementing CAI may assist educational leaders in finding ways to improve instructional methods. The goal of the study may contribute to the knowledge to improve decision making about the allocation of educational resources.

Quantitative research was appropriate for the study because the relationship between students' demographics and students' attitudes toward computer delivery systems is a mainstream issue found in the work of many investigators. In an effort to examine the relationship between demographic variables and attitudes toward CAI, mathematics aptitude scores, race, gender, age, computer science courses, frequency of computer usage, and attitude toward computers served as the independent variables. Dependent variables used in the study were two measures of attitude the BCCAS (see Appendix E) and the ATCAI (see Appendix G).

Another goal of the study was to identify students' attitudes and determine if a positive correlation exists between students' demographics and attitudes toward CAI. Using responses to the ATCAI and BCCAS, allowed the research to determine if a relationship between students' attitudes toward computers and student descriptor variables. The results revealed the levels of computer interest and levels of confidence the students have experienced using computers. The research also examined the differences in age group, daily computer use, math placement assessment, computer knowledge, and gender on the ATCAI and BCCAS scores.

Survey Procedures

Permission was granted to use the premises and participants (see Appendix A) and the letter of collaboration among institutions (see Appendix B). The researcher ensured the confidentiality of the student responses on the surveys. The students were surveyed at the same time at the same location. Consent forms and questionnaires were administered only by the researcher. Completing the surveys only took approximately 20 minutes. The entire process of distributing the forms, having students fill out the forms and the questionnaires, and collecting the forms took approximately 45 minutes to 1 hour. Both the signed consent form and the survey will be secured in a locked file cabinet for a minimum of 3 years then shredded. No attempt will be made to match the consent forms with the completed surveys.

No scholarly journals presented the results of an exploration of student attitude toward CAI in the USAREUR and USAFE DoDDS military environment. Investigating relationships and differences in students' attitude and perceptions was important. The relationship between student descriptive variables and student attitudes toward computer delivery systems was found in the work of many investigators. The study clarified the relationship between the students in a military service academic environment computer-related attitudes and attitudes toward CAI. The most important step in accomplishing this task was the proper selection of measurement scales that provide adequate levels of reliability and validity. The study sought a scale or combination of scales that would render superior levels of reliability and validity. Through careful selection of a measurement scale, the researcher constructed a design permitting other investigators to replicate the study with comparable levels of reliability and validity.

Many researchers have chosen the reliability and validity of existing attitude scales as a focus of a study. Researchers either made comparisons of existing scales or focused on a particular scale and replicated the study in a different context. From these empirical studies, conclusions about the generalizability of the reliability and validity of those scales and about the possibility of achieving some degree of advantage from combinations of the attitude scales.

The primary data were collected at USAREUR and USAFE DoDDSs. The overseas sites were used to increase the size of the participant group. The data were collected using survey instruments with questions posed in English. Attitude was measured using the BCCAS and ATCAI instruments charting the spectrum of computer-related attitudes of the student such as anxiety, apprehension, resistance, avoidance, and confidence. The scores on the two instruments constituted the dependent variable in the comparison analysis (see Appendix F and Appendix G).

Population

The target population for this survey study was juniors and seniors enrolled in participating USAREUR and USAFE DoDDSs. The participants were all students of one of the core subjects in algebra, geometry, physics, chemistry, computer science, or English. Many of the students had some computer-based experience using CAI.
There were approximately 1,536 students in the grades 9-12 high schools and approximately 678 were in grades 11 and 12, all of the eligible students were invited to participate in the study.

The students were not randomly selected because the sample consisted of volunteers from a specific population and reflected a selection bias. The only degree of randomization was the students at school on the day the CAI survey was administered. The entire student body was asked to participate in the survey. Students are required to be U.S. citizens to attend the USAREUR and USAFE DoDDSs. The students were from a variety of locations in the United States. The students also had different socioeconomic backgrounds. The representation from different geographic locations and different socioeconomic backgrounds was evenly distributed among the demographic variables of interest through the randomization that brought the students to the school. The majority of the students were from households with middle-class to upper-middle-class incomes.
A number of minorities were represented in the group of high school students

representing African Americans, Hispanic Americans, Native Americans, Asian Americans, and females.

Survey Instrument

Several instruments have been developed to measure attitudes toward computers. The CAS was developed by Loyd and Gressard in 1984 and was revised by Loyd and Loyd in 1985, the General Attitude Measure (GAM) was developed by Levin and Gordon in 1989, and the BCCAS was developed by Bear et al. in 1987 (see Appendix E).

Loyd and Gressard (1984) performed a study to aid in assessing student attitudes toward computer-related programs. Loyd and Gressard explained CAS was a valuable and dependable tool for evaluating student's attitudes toward learning about computer and how to use computers. "The CAS subscales, computer liking, computer confidence, and computer anxiety, were investigated for dependability and factorial reliability" (as cited in Sederberg, 1996, p. 13). The CAS is a 5-point Likert-type device with 30 items. The coefficient alpha consistencies were .86, .91, .91, and .95 for computer liking, computer confidence, computer anxiety, and total score, correspondingly (as cited in Sederberg).

Kluever, Lam, Hoffman, Green, and Swearingen (1994) and Massoud (1991) used the CAS. The researchers divided the CAS instrument into three subscales: computer anxiety, computer confidence, and computer liking. Both Kluever et al. and Massoud found positive attitudes toward computers, although Massoud noted, "A difference in computer attitudes of males and females is shown to be statistically significant in this study, i.e., males had more positive attitudes than females" (p. 261). Massoud explained a limitation of different studies on computer attitudes involved the nature of the sample taken.

The Kluever et al. (1994) study was composed primarily of a group of teachers in a rural teaching environment. “Participants were volunteers who probably had more positive attitudes at the beginning of the study than one would expect to find in a random sample of subjects” (p. 260). In the Dyck and Smither (1994) study using the CAS, older adults (55 years and over) were compared to younger adults (30 and under). Dyck and Smither discovered that for both younger and older adults, a more positive attitude toward computers was associated with higher levels of computer experience. Dyck and Smither noted the influence of computer experience may explain mixed results in prior work and future studies examining computer anxiety and attitudes should take computer experience into account (p. 246).

As cited in Sederberg (1996), Kinzie and Sullivan (1989) conducted a study with students in an interactive CAI class. Students were arbitrarily placed into two groups: program controlled and learner controlled. The subject matter of the study focused on solar energy. Both the program and the learner groups were allowed to independently work through the computer program, respond to practice questions, and were given feedback on the correctness on answers. All participants received comments regarding if the answers were accurate or inaccurate. In the learner-control group, if participants responded inaccurately they had an opportunity to reexamine the subject matter before attempting to respond the question again. In the program-control group, the students were not given the same opportunity to include the subject matter being routinely examined for them. Each group had three opportunities to appropriately answer the questions. A posttest was distributed involving the same subject matter as the computer-generated questions. The outcomes were analyzed using the Kuder-Richardson Formula 20 (KR 20), a system developed by Kuder and Richardson for estimating the reliability of a test. “The system has become the standard for estimating reliability for the single administration of a single form” (Kinzie & Sullivan 1989, as cited in Sederberg, 1996, p. 6). The estimation became Kuder-Richardson’s measure of interitem consistency and is equivalent to computing a split-half reliability on all categories of levels resulting from different splitting of the test. When schools can sustain item-level data, the KR 20, which is a difficult set of calculations to compute by hand, is easily calculated by a spreadsheet or basic statistical package. Kinzie and Sullivan’s results using KR 20 showed .71 reliability on the posttest.

Prior to completing the solar energy assignment, the participants were asked to answer another survey to assess the method of instruction and the ongoing motivation for the subject (Kinzie & Sullivan, 1989, as cited in Sederberg, 1996, p. 8). The questions were as follows:

Would you prefer to:

1. study science or study another subject,
2. study science on computers or study another subject on computers,
3. study science on computers or study another subject without computers,
4. study science without using computers or study another subject without computers.

5. finish out their time with a science program like the one they just had (learner control over program control) or the other type (program control over learner control). (Kinzie & Sullivan, as cited in Sederberg, p. 8)

A multivariate analysis of variance was used to test for overall discrepancies among behaviors in response to the five questions (Kinzie & Sullivan, as cited in Sederberg, 1996, p. 13). Five students correctly answered all the exercise questions and were eliminated from the study. Outcome of the posttest revealed students favored assignments offered on the computer more than conventional assignments, and students favored learner-centered learning over program-centered learning. Insignificant score discrepancies existed between the two groups. The mean scores were 72% for learner control and 77% for program control. Kinzie and Sullivan concluded that computers have a positive effect on students' motivation to learn. Kinzie and Sullivan made two analyses through the study: a learner-centered application will encourage students and student encouragement is increased by assignments and different subject matter being made accessible on the computer (as cited in Sederberg, p. 13). "A significant MANOVA effect, F (5.53) = 6.69, $p < .001$, was obtained in the multivariate analysis for differences in continuing motivation on the five questionnaire items by type of instructional control" (Kinzie & Sullivan, as cited in Sederberg, p. 13). Univariate analyses exposed a discrepancy between behaviors only on the concluding survey item. Nineteen percent in the program-control group chose to return to the program-centered application but only 79% in the learner-control group chose to return to a self-directed application. Overall, 80% of the participants chose learner control. The outcomes were F (1.57) = 30.78, $p <$ .001 (Kinzie & Sullivan, as cited in Sederberg, p. 14).

Following the work of Ruffin (2000), the researcher was granted permission use the BCCAS in the study (see Appendix D and Appendix F). Many researchers have used the BCCAS in different languages, including Hebrew (Francis, Katz, & Jones, 2000) and Chinese (Chin, 2001). The reliability and validity of the instrument was very high in these studies, and each subscale was able to stand by itself. According to Bear et al. (1987), "Attitude change is an important index of the effectiveness of CBI" (as cited in Sederberg, 1996, p. 14).

Bear et al.'s (1987) instrument began with 38 items, three-choice, 5-point Likert-type questions intended to evaluate attitudes in five areas: CAI, computer history, programming and technical concepts, general computer use, social issues surrounding, and computer use (as cited in Sederberg, 1996, p. 14). A revised instrument was created from 26 items, 5-point Likert-type questions with an alpha dependability of .94. Two other instruments were used to substantiate Bear et al.'s study: (a) a survey of computer experience and usage, educational and career plans, and favorite school subjects and (b) a measure of attitudes toward school subjects (as cited in Sederberg, p. 14). Bear et al. concluded the one-dimensional and internally consistent scale was valid. According to Ruffin (2000), the BCCAS instrument was designed to measure elementary and secondary school students' attitudes toward computers. Although the instrument was originally designed for children in Grades 4–12, it has been revised and used in many different contexts with adult populations around the world. Examples of these studies include Yaghi (1997), Katz, Evans, and Francis (1995), and Francis and Evans (1995).

According to Ruffin (2000), Katz et al. (1995) reported on the properties of the BCCAS among 339 undergraduate students in Israel. Katz et al. noted the study was conducted using a single course in a single university with a small proportion of men. These were both limitations of the study. In addition, "results of the study support the reliability and validity BCCAS in a different cultural context and among a different age group from those in which the instrument was developed" (Katz et al., as cited in Ruffin, p. 242).

Katz et al. (1995) reported the studies by Bear et al. (1987) and Francis and Evans (1995), demonstrated the reliability and validity of the BCCAS across a wide age range of students and within the cultural contexts of the United States, United Kingdom, South Africa, India, and Israel. Katz et al. believed "these findings suggest that the instrument is ideally placed to be used to monitor differences in computer-related attitudes across different cultures" (p. 242). Katz et al. condoned further studies "among other age groups and in different cultures to confirm the wider usefulness of the BCCAS" (pp. 242–243).

Francis and Evans (1995) explored the properties of the BCCAS among a sample of undergraduate students in the United Kingdom. Francis and Evans reported, "The data support the reliability and validity of this scale in a different cultural context and among a different age group from those in which the instrument was originally developed" (Francis & Evans, p. 142). Francis and Evans presented mean scale scores for male and female undergraduate students separately.

Francis and Evans (1995) highlighted the study by Bear et al. (1987). Francis and Evans concluded,

> Validity and reliability of the BCCAS had [a] positive result about students' attitude toward computers from a wide range of students from grade school

students to college students and within cultural contexts of the United States, the United Kingdom and South Africa. (p. 142)

Francis and Evans also concluded the BCCAS is ideally suited for researchers to monitor differences in computer-related attitudes across different cultures or over wide age ranges. The authors noted, "Further studies are conducted to confirm the wider usefulness of the BCCAS" (Francis & Evans, p. 143). The BCCAS has been proven, through peer review, to be a valid and reliable instrument to measure computer-related attitudes. According to Bear et al. (1987), CBI investigators can use the CAS as a reliable dependent measure of attitudes toward CBI.

Bues (1934) developed an additional instrument, the Attitude Toward Computer-Assisted Instruction (ATCAI) addressed CAI more than the BCCAS. The ATCAI instrument has alpha scores between .75 and .80. Although ATCAI does not have the notoriety of the BCCAS, the ATCAI should correlate highly with the BCCAS with more focus on CAI. The modified instrument was chosen because no such psychometric instrument exists specifically to assess CAI. ATCAI was verified in a different context to substantiate the external validity.

Design

In an attempt to explore the relationship between student descriptive variables and attitudes toward CAI, the study had as its independent variables mathematics aptitude scores, race, gender, age, computer science courses, math placement, algebra and geometry/trigonometry level and frequency of computer usage. The dependent variables were the measures of attitude from the BCCAS and ATCAI. The instruments charted the spectrum of computer-related attitudes such as anxiety, apprehension, resistance, avoidance, and confidence.

Data Analysis

Preparation for the data included building two access databases and a web interface to receive the data. The first database was constructed based on entities from the questionnaires and surveys. The participants were given the option of completing the questionnaires and surveys online or the paper document in a classroom environment. In addition, the participants were allowed to use computer labs to expedite the process for simultaneous data collection. The survey did not require students to give personal information such as name, address, or phone number; only demographic information was gathered to insure the students could remain anonymous (see Appendix F and Appendix G). One week prior to taking the survey, the students were required to show identification to the researcher only to verify the age. Those students under the age of 18 were required to return both a signed parental consent form and the volunteer consent form upon entering the classroom (see Appendix C). Those students who were 18 or older were only required to sign and return the volunteer consent form upon entering the classroom (see Appendix C). The day of administering the survey, each volunteer student was required to show identification and consent form(s) upon entering the classroom. Those students who did not have proper identification and signed documentation the day the survey was administered were not allowed to participate. The students were also given scores from SAT, ACT, and math placement on a separate document. The scores were sorted in numerical order.

The data were collected from the questionnaire survey to answer the research questions. The demographic data were summarized to describe the population of the study. The research study investigated the relationship between demographic variables and computer-related attitudes toward CAI. The study identified if differences exist based on gender, education, or computer-related experience and sought to improve individualization of CAI.

Following the work of Ruffin (2000), this research used a Pearson Product Moment correlation and analysis of variance (ANOVA) to test the research questions posed for this study. ANOVA was used to test for differences between the scores of the BCCAS and ATCAI based on gender, age group, and ethnic group, compute usage and knowledge, algebra and geometry level placement. A general linear model was used for the ANOVA analysis with a probability level of p=.05 for accepting or rejecting the null hypotheses.

Pearson correlations were used to examine the relationship between math experiences and computer-related attitudes. More exploration was conducted on if math liking and math confidence are positively associated with computer interest and computer confidence. The research also used Pearson correlations to explore if math experiences and attitudes toward CAI are positively correlated. Analysis of the Pearson correlation coefficients were assessed by investigating the strength of the relationship if a statistically significant probability level of p=.05 or less existed.

Validity and Reliability

According to Ruffin (2000), "Reliable attitude measures are necessary to make any claims of explanations of variance attitudes toward computer delivery systems" (p.

58). Gardner, Discenza, and Dukes (1993) maintained, “One result of research on computer anxiety and other computer attitudes has been the development of self-report measures that purport to measure them” (p. 486). Gardner et al. pointed out weaknesses in the development of the attitude measures by reporting that “Although there have been numerous measures developed to assess attitudes toward computers in an effort to predict computer-related behaviors, unfortunately, most do not demonstrate evidence of construct validity outside of the original studies in which the instruments were developed” (p. 487).

Weaknesses in methods used to assess computer-related attitudes contribute to the lack of reliable explanations. Gardner et al. (1993) maintained, “Many of the attitude measures have been shown to be statistically weak and/or theoretically vague. Often a biased selection of subjects coupled with small sample sizes will have major statistical problems” (p. 487). Gardner et al. were very critical of studies that attempt to assess attitude but use inadequate sample sizes and noted, “Before research on computer attitudes can become effective at allaying self-defeating attitudes about computer usage, the constructs themselves must be measured validly” (p. 488).

The primary purpose of the study by Gardner et al. (1993) was to investigate the relative psychometric qualities (reliability and construct validity) of four measures of computer attitudes, with an emphasis on the central construct of computer anxiety. Construct validation was a prerequisite to Gardner et al.’s research. Gardner et al. reported, “If the scales are valid and reliable, a secondary goal of the present research is to investigate a shortened measure of computer attitudes that can be completed quickly, yet is highly reliable and exhibits acceptable validity” (Gardner et al., p. 488). These investigators also described characteristics of ideal attitude measures and insisted, "Researchers must develop measures of computer attitudes that have as few items as possible, so that measures of other relevant constructs can be incorporated into relatively short questionnaires" (Gardner et al., p. 488).

Gardner et al. (1993) compared four available measures of computer attitudes in one large heterogeneous sample and identified four instruments developed to measure computer anxiety and other computer-related attitudes. These were the Computer Anxiety Index (Mauer, 1983), the CAS (Loyd & Gressard, 1984), the Attitudes Toward Computers (Raub, 1981), and the Blomber-Erikson-Lowrey Computer Attitude Task (BELCAT; Erikson, 1987). The results of the study by Gardner et al. revealed that the four computer attitude instruments were reliable and valid. Gardner et al. were not able to empirically derive improved scales but did determine that two of the measures, the CAS and the BELCAT, were superior on a number of other criteria because "they contain subscales measuring the constructs of interest" (p. 501). Gardner et al. insisted the use of any of these scales would produce sufficiently reliable and reasonably valid information.

Conclusion

Chapter 3 described the research procedures used to answer the questions posed in the study. The chapter included a description of the population and a description of the instruments, BCCAS and the ATCAI, was selected because of the reliability and validity measures. The chapter also outlined the procedure used to collect the data.

Several statistical tests were used to analyze the data, including ANOVA and Pearson correlation coefficients. The tests were used to determine the extent to which attitude toward computers and attitude toward CAI differ along the lines of math aptitude scores, race, gender, age, computer-related experiences, and attitude toward computers. The analysis identified the best predictors of the dependent variable and aimed to determine which combinations of independent variables are the best predictors of the variance in measures of attitudes toward computers and attitudes toward CAI. Chapter 4 presents the findings of the data collection and analysis.

CHAPTER 4: RESULTS

The purpose of the study was to analyze student attitudes toward CAI using quantitative methodology resulting through the use of descriptive analysis and comparison of CAI perceptions based on demographic variables. The study was guided by two research questions and examined factors related to the attitudes of students in the USAREUR and USAFE DoDDSs toward computers and CAI. Student's characteristics were addressed by examining mathematics aptitude, level of education, race, gender, age, computer science experience, frequency of computer usage, and student attitudes toward computers. The research questions guiding the study were as follows:

Research Question 1: What is the correlation between student scores on the BCCAS, ATCAI, mathematics aptitude, average daily exposure to computers, computer experience, and math placement assessment?

Research Question 2: What are the differences in ATCAI scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement and computer knowledge (CS/CP) assessment?

Research Question 3: What are the differences in BCCAS scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement, and computer knowledge (CS/CP) assessment?

The goal of the study was to identify the attitudes and perceptions of students to provide improved individualized instruction for USAREUR and USAFE DoDDS students. More efficient learning systems can be created, according to Milheim (1993), during the design, development, and delivery of CAI. The information received from implementing CAI will assist educational leaders in finding ways to improve instructional methods. The study may contribute knowledge helping to improve decision making about the allocation of educational resources.

Study Participants

The participants in the study consisted of 220 high school students completing the survey. Approximately 1,536 students attend grades 9 through 12 in USAREUR and USAFE DoDD schools in Germany and constituted the total population for this study. However, the study targeted only juniors and seniors in high school resulting in a target population of approximately 678 students. All of the students enrolled in Algebra, Geometry, Physics, Chemistry, Computer Science, and English were invited to participate in the study. All of the eligible students were invited to complete the two surveys used in this study but only 219 students were interested and completed the surveys resulting in a response rate of 32.3%. The study group consisted of males (n=190, 86.8%) and females (n=28, 12.8%). Study participants represented Caucasians (n=109, 49.8%), African Americans (n=49, 22.4%), Hispanics (n=44, 20.1%), and other minorities (n=17, 7.8%). Students were placed in first year algebra (n=71, 32.4%) or second year algebra (n=148, 67.6%) and first year geometry/trigonometry (n=120, 54.9%) and second year geometry/ trigonometry. Students ranged in age from 16 to 19 with an average age of 17.28, (SD = .946). Since all students were invited to participate in the study, some of the students are older as they might have been identified as special education although this information was not asked as a part of the survey.

Data Analysis

Prior to completing the analysis for the questions posed by the study, the ATCAI and BCCAS instruments were scored to create a comparable mean score for instrument for each person. The ATCAI consisted of 37 items and each was an assigned *Q* value. To score the survey, the responses from each survey question were added to obtain a total score. Item scoring was accomplished by dividing the total number of responses to calculate the final score for the question. The highest possible score for a question was 11.0. The lowest possible score was 2.2. Higher scores represented the more positive attitudes toward CAI while lower scores represented the more negative attitudes towards CAI. Student mean scores for the ATCAI ranged from 1.93 to 9.70 with an overall mean of 7.57 (SD=1.28).

The BCCAS consisted of 20 items using a response scale of Strongly Disagree (1) to Strongly Agree (5) and measure students' attitudes about the use of computers in present day society. The highest possible score on the BCCAS was 130, and the lowest possible score was 26. To make comparisons between the two scales, the total received from the BCCAS was multiplied by a factor of .08462 to convert it to a scale from approximately 2.2 to 11. Conversion allowed the comparison of the BCCAS and the ATCAI instrument. The mean for all students on the BCCAS was 7.94 (SD=1.42) and ranged from a low mean of 2.88 to a high mean of 10.58. The mean scores for BCCAS and ATCAI were used in all subsequent analysis.

Research Question 1

The first question and corresponding null hypothesis posed by this study were as follows:

Research Question 1: What is the correlation between student mean scores on the BCCAS, ATCAI, aptitude (SAT Math, SAT Verbal, ACT Math, ACT Reading, ACT English, and ACT Science) average daily exposure to computers (ADEC), computer experience (CS/CP assessment, math placement score (MP) and student age?

Hypothesis1: There will be no relationship between student mean scores on the BCCAS, ATCAI, mathematics aptitude, average daily exposure to computers, computer experience, and math placement?

The analysis used to address this question was a Pearson Product Moment correlation with a probability level of p=.05 as the criteria for accepting or rejecting the null hypothesis there would be a statistically significant correlation. The Pearson Product Moment correlation is a measure of the strength of the relationship between two variables. Correlation coefficients can range from +1 to 0 to –1. The closer the correlation coefficient is to +1 or –1, the stronger the relationship. In a positive relationship (+1) both variables increase at a corresponding rate and in a negative correlation (-1) as one variable goes up the other goes down. The Hopkins scaling of correlation coefficients was used to interpret the strength of the relationship in addition to statistical significance.

Inspection of the correlation coefficients (see Table 1) indicate there were no statistically significant correlations among the variables and correlation coefficients were in the low to low trivial range using the Hopkins scaling. The correlation between the BCCAS and ATCAI was r=.544, p=<.001. The null hypothesis was retained for each of the variables as the correlations were non-significant and for the most part trivial. Table 2 presents the correlation of variables with BCCAS and ATCAI. Table 3 presents the descriptive statistics for the analysis.

Table 1

Hopkins Scaling of Correlation Coefficients

Correlation Coefficient	Descriptor
0.0 - 0.1	trivial, very small insubstantial tiny, practically zero
0.1 - 0.3	small, low, minor
0.3 - 0.5	moderate, medium
0.5 - 0.7	large, high, major
0.7 - 0.9	very large, very high, huge
0.9 - 1.0	near, practically, or almost perfect, distinct, infinite

Table 2

Correlation of Variables with BCCAS and ATCAI

Variable	BCCAS	ATCAI
ADEC	*r*=-.084, *p*=.261	*r*=-.088, *p*=.242
CS/CP	*r*=.117, *p*=.120	*r*=.074, *p*=.326
SAT MATH	*r*=-.070, *p*=.405	*r*=-.015, *p*=.860
SAT VERBAL	*r*=-.145, *p=0.84*	*r*=-.029, *p*=.731
ACE SCIENCE	*r*=.037, *p*=.707	*r*=-.014, *p*=.883
ACT MATH	*r*=.000, *p*=.997	*r*=-.107, *p*=.275
ACT READING	*r*=.078, *p*=*.427*	*r*=.022, *p*=.821
ACT ENG	*r*=-.038, *p*=.427	*r*=-.115, *p*=.240
AGE	*r*=.068, *p*=.383	*r*=-.037, *p*=.819
Math Placement	*r*=.067, *p*=.359	*r*=-.018, *p*=.808

Table 3

Descriptive Statistics for Correlation Analysis

Variable	N	Mean	Std Dev
ADEC	180	2.68	2.06
CS/CP	179	1.58	2.51
SAT MATH	177	556.72	55.49
SAT VERBAL	177	541.07	61.69
ACE SCIENCE	130	23.71	3.28
ACT MATH	130	23.96	3.22
ACT READING	30	24.21	4.68
ACT ENG	130	22.43	3.42
AGE	181	18.48	.964
Math Placement	181	24.48	6.94
BCCAS	180	7.94	1.42
ATCAI	180	7.56	1.27

Research Question 2

The second research question and corresponding null hypothesis was as follows:

Research Question 2: What are the differences in ATCAI scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, and computer knowledge (CS/CP) assessment?

Hypothesis 2: There will be no difference when the ATCAI scores of students are compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra and geometry/trigonometry placement, and computer knowledge (CS/CP) assessment?

Prior to completing the analyses for question 2, it was necessary to re-group the data so comparisons could be made. The independent variables of ethnicity, AEDC, age, and CS/CP were recoded to enable analysis. Age ranged from 16 through 19 with the majority of the students being 17 year of age. This variable was regrouped into 16 (n=137, 62.6%) and those 18 and older (n=44, 20.1%). AEDC ranged from 0 to 14 and was divided at a mid point with student reporting 0-2 (n=58, 32.2%) and 2.1-14 (n=122, 67.8%). CS/CP was separated also separated into two groups based on reported CS/CP scores. Those with 0-1 were placed into one group (n=118, 65.9%) and those with scores between 2 and 20 were placed in a second group (n=61, 34.1%). These groupings were used for both research questions 2 and 3.

A general linear model analysis of variance (ANOVA) was used to make comparisons between the groups on the ATCAI with a probability level of p=.05 as the criteria for accepting or rejecting the stated null hypotheses. GLM was used for robustness to differences in group size since the number of study participants in this analysis was not equal. Table 4 presents the findings of the ANOVA analysis and Table 5 present the descriptive data for the different groups. Findings for gender, ethnic, age, ADCE, algebra placement, geometry/trigonometry placement indicated the differences in the groups were not statistically significant and the null hypothesis was retained for these variables. There were significant differences identified for CS/CP (F (1, 177) = 6.287, p=.013). Students with low (0-1) CS/CP scores (*M*=7.39, *SD*=1.40) had significantly lower perceptions of CAI as measured by the ATCAI scale than did students with higher

CS/CP scores (*M*=7.88, *SD*=.91). This appears to indicate those with more computer experience have higher perceptions or attitudes about CAI than do those with lower computer experience.

Table 4

ANOVA Findings for ATCAI

	Df	*F*	*P*
Gender	1, 177	.024	.877
Ethnic (4 groups)	3, 176	1.402	.244
Age (2 groups)	1, 178	.896	.345
ADEC (2 groups)	1, 177	.349	.555
CS/CP (2 groups)*	1, 177	6.287	.013
Algebra Placement	1, 178	1.377	.242
Geo/Trig Placement	1, 178	.037	.848

Significant at p=<.05

Table 5

Descriptive Findings for ATCAI

	Group	Mean	Std Dev
Gender	Male	7.55	1.26
	Female	7.60	1.44
Ethnic (4 groups)	African Am	7.44	1.23
	Caucasian	7.92	1.31
	Hispanic	8.13	1.93
	Other Min	7.57	1.11
Age (2 groups)	18	7.57	1.32
	19+	7.55	1.16
ADEC (2 groups)	0-2.0	7.64	1.07
	2.1+	7.52	1.37
CS/CP (2 groups)*	0-1	7.39	1.40
	2+	7.86	.912
Algebra Placement	100	7.72	1.04
	200	7.48	1.37
Geo/Trig Placement	100	7.55	1.29
	200	7.58	1.26

Research Question 3

Research question 3 and the corresponding null hypothesis were as follows:

Research Question 3: What are the differences in BCCAS scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement, and computer knowledge (CS/CP) assessment?

Hypothesis 3: There will be no difference in the BCCAS scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement, and computer knowledge (CS/CP) assessment?

A general linear model analysis of variance (ANOVA) was used to make comparisons between the groups on the ATCAI with a probability level of p=.05 as the criteria for accepting or rejecting the stated null hypotheses. GLM was used for robustness to differences in group size since the number of study participants in this analysis was not equal. Table 6 presents the findings of this ANOVA analysis and Table 7 present the descriptive data for the different groups. Findings for gender, ethnic, age, ADCE, algebra placement, geometry/trigonometry placement indicated the differences in the groups were not statistically significant and the null hypothesis was retained for these variables. There were significant differences identified for CS/CP (F (1, 177) = 7.856, p=.006). Students with low (0-1) CS/CP scores (M=7.72, SD=1.38) had significantly lower perceptions of CAI as measured by the ATCAI scale than did students with higher CS/CP scores (M=8.34, SD=.1.42). This appears to indicate those with more computer experience have higher perceptions or attitudes about CAI than do those with lower computer experience.

Table 6

ANOVA Findings for BCCAS

	df	*F*	*p*
Gender	1, 177	.385	.536
Ethnic (4 groups)	3, 176	.528	.664
Age (2 groups)	1, 178	.037	.847
ADEC (2 groups)	1, 177	1.863	.174
CS/CP (2 groups)*	1, 177	7.856	.006
Algebra Placement	1.178	.419	.519
Geo/Trig Placement	1, 178	.279	.598

Table 7

Descriptive Findings for BCCAS

	Group	Mean	Std Dev
Gender	Male	7.96	1.39
	Female	7.75	0.67
Ethnic (4 groups)	African Am	7.90	1.23
	Caucasian	7.92	1.31
	Hispanic	8.13	1.93
	Other Min	7.57	1.12
Age (2 groups)	18	7.87	1.48
	19+	8.11	1.19
ADEC (2 groups)	0-2.0	8.13	1.24
	2.1+	7.82	1.49
CS/CP (2 groups)*	0-1	7.72	1.38
	2+	8.34	1.42
Algebra Placement	100	8.00	7.66
	200	7.88	1.46
Geo/Trig Placement	100	7.88	1.46
	200	7.99	1.35

Summary

Chapter 4 presented the findings of the analysis for the study. ANOVA and Pearson correlations were presented along with descriptive data. Findings indicated there were no statistically or strong correlations between the BCCAS and ATCAI and selected variables. No significant differences were identified on the ATCAI scale for AEDC, age group, gender, algebra placement, geometry/trigonometry placement or ethnicity and the null hypothesis was retained for these variables. There were significant differences identified for CS/CP assessment indicating the more experience a student had with computers the higher the level of perception or attitude. No significant differences were identified on the BCCAS attitude scale for AEDC, age group, gender, algebra placement, geometry/trigonometry placement or ethnicity and the null hypothesis was retained for these variables. Significant differences were found for CS/CP on the BCCAS scale and higher computer usage had higher perceptions or attitudes than did those with lower usage. Chapter 5 will discuss these findings in relation to the literature and previous research, present limitations to the study, and recommendations for future research.

CHAPTER 5: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

CAI models need to use findings from both the field of psychology and the field of computer science to provide an adequate picture of the current status of CAI in schools. Findings from the field of psychology address the psychological factors associated with learning, whereas findings from the field of computer science address the engineering and configuration factors associated with the fit of learning systems to the organization as well as to the individual. Many existing models do not strike the needed balance between the two broad fields. Adequate research designs, according to McNeal and Nelson (1991), would address instructional content, environmental factors, features of the learning materials, computer-related experiences of the learner, and other characteristics of the learner. An understanding of the effects of these factors is necessary to explain variations in student computer-related attitudes and attitudes toward CAI.

The study has presented research showing increases in computing capacity have helped tremendously to enable the production of more sophisticated hardware and software making the computer an increasingly valuable tool for CAI. The increases in computing capacity accompanying the computer revolution allow CAI to be customized to meet the needs of a culturally diverse population. Advances in microcomputing technology and substantial increases in the use of computers have enabled CAI to move toward new standards for efficiency and effectiveness in training and education.

One of the keys to increased efficiency in training and education rests with the potential to get the maximum transfer of knowledge from the learning process. The aim can be achieved through individualizing the learning system to the student. To make the best use of this individualized approach, student characteristics the effects on student learning should be understood.

To study student characteristics, this research investigated the relationship between descriptive student variables such as mathematics aptitude, level of education, race, gender, age, computer-related experience, and computer science experience, student attitudes toward computers and student attitudes toward CAI. Knowledge of student characteristics and past experiences serve as an important starting point for organizing the content of classroom instruction.

One important student characteristic is student attitude. A positive attitude toward CAI is essential to a student's success with CAI. One of the areas where attitude is paramount is CAI program implementation. Assessing student attitudes so that methods can be implemented to improve the attitudes is a mainstream issue among researchers who study computer-related attitudes. Improving students' computer-related attitudes and attitudes toward learning through the use of computers is one key to maximizing the learning process with CAI. Student attitudes were the focus of the present study.

The study was concerned with assessing the CAI-related attitudes of USAREUR and USAFE DoDDS students participating in computer-assisted education. In the course of presenting this research, the advantages and disadvantages of CAI have been discussed. In addition, the disparities existing in education and employment and the potential CAI has for correcting these inequities. These two points underline the importance of improving the enduring system of feelings called attitude.

The mission of the USAREUR and USAFE DoDDS is to provide an exemplary education that inspires and prepares all DoDDS students for success in a dynamic, global environment. Computer-assisted instruction plays a vital role in achieving the mission. Through the efficient and effective use of developing computer technologies, the educational and training goals of the USAREUR and USAFE DoDDS can be achieved much easier. The use of CAI for education and training makes it possible to have better communicate and achieve the organization's vision, mission, strategies, purpose, values, culture, priorities, and goals.

The first aim of the study was to determine the attitudes of the students participating in CAI in the USAREUR and USAFE DoDDS. Another aim of the study was to more accurately identify, prioritize, and account for the attitudes of the participants. The study examined the factors that affected the students' attitude toward CAI. The results could help support future decisions concerning the allocation of resources to maximize effectiveness with the help of CAI and assist teachers in implementing more individualize classroom instructions.

The context of existing studies was different from the present study, as the context did not take place in a U.S. military European academic environment making the study unique. Within the context of the study were important environmental factors. For example, the military has its own distinct culture profoundly different from a typical high culture. The students participating in the study often transfer to different schools due to the student's parent or guardian being a military member or deployed making these student uniquely different from typical high school students. As noted in chapter 3, the environment of a military sponsored school is also different with a more regimented routine for students.

The study investigated psychological literature on computer use for learning to chart the wide change of negative and positive responses generated by the current growth and accessibility of computer technology. Student reactions to the technology can vary with CAI design. Certain students may perform better, depending on the instructional design. Yaghi (1997) posited student avoidance of computers may be attributed to attitudes built on simple misconceptions or misunderstandings about computers. Students may not comprehend the full potential an instructional delivery system has to offer. The dominant Anglo-Saxon male culture, according to Shashaani (1995), reinforces an educational and occupational computing segregation. Shashaani noted this type of research was needed to assist in breaking the cycle.

Identifying the most significant demographic variables and computer-related experiences affecting student attitudes toward CAI helps to profile student who may not fare as well as others with the different types of learning systems. Descriptively highlighting these groups and individuals through profiling might be an important step in identifying student needs and was another important step to take to better meet the needs of students who do not benefit from CAI as well as other computer-assisted programs. From this point intervention can begin to take place.

The first research question asked, Is there a positive relationship between student mean scores on the BCCAS, ATCAI, aptitude (SAT Math, SAT Verbal, ACT Math, ACT Reading, ACT English, and ACT Science) average daily exposure to computer (ADEC), computer experience (CS/CP assessment, math placement score (MP) and student age? The question was addressed by Pearson Product Moment correlation with a probability level of p=.05. The question was also addressed by the Hopkins scaling of correlation coefficients to interpret the strength of the relationship in addition to statistical significance. The results revealed no statistically significant or strong correlation between the students' mean scores on the BCCASS and ATCAI and no significant difference existed amongst the descriptive statistics. For instance, males scored slightly higher than females in mathematics placement tests indicating males' prior experience with mathematics was greater than females. The differences in male and female attitudes were not statistically significant. The results could be based on the socialization and institutionalization of males into mathematics courses. Snelbecker et al. (1992) highlighted the factor of math aptitude and hypothesized that gender, math background, or previous experience with computers would indicate who might be successful with computers. Findings from the present study also relate to the findings by Miura and Hess (1983), reporting mathematics and high technology has been regarded as male domains.

The second research question asked: Are there differences in the ATCAI scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement and computer knowledge (CS/CP) assessment? The results indicate there were no significant differences for gender, ethnic, age, ADCE, algebra placement and geometry/trigonometry placement. The differences between high and low computer science /computer placement did find significant differences. Those in the high CS/CP group had significantly higher scores on the ATCAI indicating experience affected attitudes about computers. The findings confirm a common sense idea that the more comfortable the individual is with computers the easier learning may become (C. C. Kulik & Kulik, 1991).

The third research question asked: Are there differences in the BCCAS scores of students when compared by gender, ethnicity, and frequency of computer usage (AEDC), age group, algebra placement, geometry/trigonometry placement, and computer knowledge (CS/CP) assessment? The results indicate there were no gender, ethnic, age, ADCE, algebra placement; geometry/trigonometry placement significant differences. A significant difference was identified for CS/CP assessment. The more computer experience a student encounter the better the attitude toward CAI and computers. The results coincide with findings by C. C. Kulik and Kulik (1991). The use of computers produced positive changes in student attitudes and 88% reported attitudes that are more favorable for students in CBI classes. C. C. Kulik and Kulik reported the results of their study were consistent with the findings of earlier literature reviews, such as J. A. Kulik, Bangert, and Williams (1983) and J. A. Kulik et al. (1985).

The five categories of ethnicity were categorized as Native American, Asian American, African American, and Caucasian American. Combined, Hispanic Americans and African Americans comprised approximately 50% of the student population. Neither Asian Americans nor Native Americans had enough representation to yield statistically reliable results for their race or ethnicity. Even though minorities reported that they spent, on average, more time on the computer and were slightly more educated than non minority students, they also reported taking lower numbers of computer science courses and lower math scores. These variables were the amalgamation of the significant variables of the key related studies highlighted in the study because none of these differences were by significant amounts. Existing studies cast minorities with lower scores than the Caucasian male population.

Minorities tended to be over-represented in the USAREUR and USAFE DoDDS population. Specifically, Hispanic Americans and African Americans had almost twice as many students as compared to the general U.S. population. Reasons are social, institutional, and economic. Institutions making up the American society are dominated by the Caucasian male culture. Opportunities provided by the dominant culture are limited to young gifted minorities. The military provides a viable option for minorities, which explains why the minority representation was so high in the surveyed population.

Conclusion and Recommendation

Findings indicated adequate levels of experience in mathematics are indicators for positive attitudes toward computers and CAI. The review revealed the presence of key experiences stimulated certain corresponding positive computer-related attitudes from students. For example, individuals exhibiting negative attitudes tended to avoid contact with the computer systems and individuals exhibiting positive attitudes tended to maximize the amount of time they used computer systems. Researchers seeking to find ways to maximize the positive attitudes will assist in eliminating some existing disparities associated with access to education and employment in high-technology-related fields.

Computer-assisted instruction has been found to be an effective medium in classrooms. While some disadvantages have been highlighted, CAI, when used as a supplement to conventional classroom instruction, has been found to be suitable due to its individualization, achievement gains, cost effectiveness, interactivity, and consistency.

The study considered environmental conditions. Environmental conditions were considered and had an effect on students' overall opinion of instruction and included such factors as extraneous noise, crowded seating, interruptions, and poor lighting. More important, the psychological climate was also taken into account. Students were more at ease within a considerate, receptive, and supportive climate. The context of the study required the environment be taken into account. The psychological climate in the study was not typical. For example, crude but effective methods are often used for mental conditioning in the militaristic environment of U.S. Military Europe. Moreover, the psychological climate existed in the context of the study does not always fit the conditions that would produce the best results from students (Milheim, 1993).

The evidence of gender differences in computer literacy will have an economic and educational impact and eventually have effects on the careers of individuals who do not have the requisite technological skills. The theoretical importance indicates the need to analyze the psychological processes that contribute to these differences in computer literacy in an effort to develop effective intervention strategies to minimize the growing gender gap in computer access, interest, and usage (Miura & Hess, 1983).

Future Research

CAI does not have the same effect on all individuals. Attitudes toward CAI depend greatly on who the individuals (USAREUR and USAFE DODDS students) are. Computer-assisted instruction may be used to improve student attitudes, if used in a manner where low-ability students experience degraded and secluded, CAI can have deleterious effects. More research in the area of students' attitudes towards CAI should be conducted in other military environments and in the typical educational environment using the significant variables of the study. The environment and the type and quality of the software used also need to be taken into consideration. Future research in the area of student attitudes toward CAI should control for the computer hardware used and the efficiency of the systems network environment providing the instructional delivery system. Researchers should also control for the influence of parents on student attitudes toward computers and mathematics.

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APPENDIX A: INFORMED CONSENT FOR PERMISSION TO USE PREMISES, NAME, AND/OR SUBJECTS

Kaiserslautern American High School

I, hereby authorize Cynthia R. Jackson, student of the University of Phoenix, to use the premises, Department of Defense, and or/subjects requested to conduct a study entitled COMPUTER-ASSISTED INSTRUCTION: THE CORRELATION BETWEEN STUDENT DEMOGRAPHICS AND STUDENT ATTITUDE TOWARD CAI

Signature ***Daniel Mendoza*** Date ***29/09/05***

Title ***Principal***
Kaiserslautern American High School, DoDDS

DoDEA-R 2071.2
Enclosure 2

Superintendent/Principal(s) Approval

I have reviewed the *Research Study Request* for Cynthia Jackson entitled' The correlation on student demographics and their attitude toward CAI

I agree/*disagree* (circle one) that my school will participate in this research study. I also understand that given my approval, this research will be conducted in accordance with DoDEA policy.

Date: 29 Sept 05 **School Name:** Kaiserslautern High School

Principal's Name: Mendoza Daniel J

Principal's Signature: [signature]

Please forward this request to your Superintendent after completion of this form.

The following should be completed by the Superintendent:

I *agree/disagree* (circle one) that my school will participate in this research study. I also understand that given my approval, this research will be conducted in accordance with DoDEA policy.

Date: 3 October 2005

Superintendent's Name: Lawanna Mangleburg

Superintendent's Signature: [signature]

The following should be completed by the Principal and/or Superintendent.

If you disagreed above, please state your reasons below.

Superintendents: Return to the DoDEA: Chief, Research and Evaluation Branch
Fax: 703 696-8924

Form 2071.24 (pending OMB Forms approval)

APPENDIX B: LETTER OF COLLABORATION AMONG INSTITUTIONS

Date: **22/11/05**

To: Office of the Provost/Institutional Review Board
University of Phoenix

This letter acknowledges that

Department of Defense is collaborating with
(Name of the agency)

Ms./Mr. Cynthia R. Jackson
(Name of the student)

enrolled in the EDD program at the University of Phoenix in conducting the

proposed research. We understand the purpose of this research

is to help researchers understand how demographic variables impacts student attitudes towards computer-assisted instruction. In addition, the analysis and results of the study will be submitted in a report to the Commander of USAREUR.

and will be conducted under the supervision of Dr. John C. Sienrukos
(Faculty Name)

This project will be an integral part of our institution/agency and will be conducted as a collaborative effort and will be part of our curriculum/research/data/service delivery model.

Sincerely,
Susanne Whitt, PhD.

Representative
Collaborating Institution/Agency

From: Whitt, Susanne [SMTP:Susanne.Whitt@hq.dodea.edu]
To: 'Cynthia Jackson (CJ)'; Jackson, Cynthia
Cc: Ransing, Candace

Subject: Status of Research Proposal Review
Sent: 11/22/2005 8:07 AM **Importance:** Normal

Cynthia, the Deputy Director, Europe, has given consent for your research. As soon as you submit a copy of your IRB approval, you may proceed with the study, since you have already received approval from the district and school consent. I will send you formal notification as soon as we receive the IRB document(s).
Susanne
"Not everything that can be counted counts, and not everything that counts can be counted."
-- **Albert Einstein**

Susanne Whitt, Ph.D.
Research & Evaluation Specialist
Dept. of Defense Education Activity
4040 N. Fairfax Drive
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(703) 588-3162
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APPENDIX C: INFORMED CONSENT: PARTICIPANTS UNDER 18 YEARS OF AGE, 18 YEARS OF AGE OR OLDER, AND PARENTAL CONSENT FORM

Participant Under 18 years of Age Consent Form

AN INDIVIDUAL CONSENT FORM FOR A RESEARCH STUDY BEING CONDUCTED UNDER THE AUSPICES OF THE UNIVERSITY OF PHOENIX

My name is Cynthia R. Jackson. I am a doctoral student in the Graduate College at the University of Phoenix. I am conducting a study entitled "Demographic Variables and Students' Attitudes toward Computer Assisted Instruction" (CAI) which seeks to study how student's attitude, age, gender, and grades affect CAI. Results of this study may provide educational leaders with information that may help those leaders find ways to improve design, development and delivery of CAI. Results will therefore assist leaders in making better decisions concerning the distribution of educational funds. The results of this survey will be submitted in a report to the Commander of USAREUR. Participant confidentiality will be kept in the final report. Participants may ask for a copy of the final report by asking the principal of the school. The researcher guarantees the privacy of your responses to the questions in the survey that you are being asked to complete. Your involvement in the project should be approximately 10-15 minutes. If you have any questions regarding the rights of research participants, you may contact the University of Phoenix's, School of Advance Studies Office of Research Administration at (602) 387-2791. If you have any questions regarding this survey, you may contact me at my office, DSN 484-7788 or my home (0631) 415-0936.

By signing this informed consent form, you agree to the following:

1. Your participation is voluntary. Refusing to participate will not affect your grades or cause penalty or loss of benefits to you.
2. You are free to refuse to answer any question at any time without penalty.
3. You are free to withdraw from completing the survey at any time without penalty.

There will be no dangers for those who participate in this project. A possible advantage may be that educational policy makers will gain insight related to your attitude toward CAI and therefore seek solutions that make the most of the learning process.

Consent statement: I, _________________, understand that my parents (e.g., mom and/or dad) have given permission (e.g., said it's okay) for me to take part in a study described above under the direction of Cynthia R. Jackson

I am taking part because I want to. I have been told that I can stop at any time I want to and nothing will happen to me if I want to stop.

--(printed)

--(signed)

--(dated)

Participant 18 Years of Age or Older Consent Form

AN INDIVIDUAL CONSENT FORM FOR A RESEARCH STUDY BEING CONDUCTED UNDER THE AUSPICES OF THE UNIVERSITY OF PHOENIX

My name is Cynthia R. Jackson. I am a doctoral student in the Graduate College at the University of Phoenix. I am conducting a study entitled "Demographic Variables and Students' Attitudes toward Computer Assisted Instruction" (CAI) which seeks to study how student's attitude, age, gender, and grades affect CAI. Results of this study may provide educational leaders with information that may help those leaders find ways to improve design, development and delivery of CAI. Results will therefore assist leaders in making better decisions concerning the distribution of educational funds. The results of this survey will be submitted in a report to the Commander of USAREUR. Participant confidentiality will be kept in the final report. Participants may ask for a copy of the final report by asking the principal of the school. The researcher guarantees the privacy of your responses to the questions in the survey that you are being asked to complete. Your involvement in the project should be approximately 10-15 minutes. If you have any questions regarding the rights of research participants, you may contact the University of Phoenix's, School of Advance Studies Office of Research Administration at (602) 387-2791. If you have any questions regarding this survey, you may contact me at my office, DSN 484-7788 or my home (0631) 415-0936.

By signing this informed consent form, you agree to the following:

1. Your participation is voluntary. Refusing to participate will not affect your grades or cause penalty or loss of benefits to you.
2. You are free to refuse to answer any question at any time without penalty.
3. You are free to withdraw from completing the survey at any time without penalty.

There will be no dangers for those who participate in this project. A possible advantage may be that educational policy makers will gain insight related to your attitude toward CAI and therefore seek solutions that make the most of the learning process.

Consent statement: By signing this form I acknowledge that I understand the nature of the study, the potential risks to me as a participant, and the means by which my identity will be kept confidential. My signature on this form also indicates that I am 18 years old or older and that I give my permission to voluntarily serve as a participant in the study described above under the direction of Cynthia R. Jackson

I am taking part because I want to. I have been told that I can stop at any time I want to and nothing will happen to me if I want to stop.

--(printed)

--(signed)

--(dated)

Parental Consent Form

Your child is invited to be in a research study about his or her attitude toward computers. I am asking that your child take part because your child is in the age group I want to study. I ask that you read this form and ask any questions you may have before agreeing to allow your child to take part in this study.

The study: The purpose of this study will be to analyze student attitudes toward CAI using quantitative methodology resulting in a phenomenological description of the most significant demographic variables and the most important computer-related experiences that explain attitudes toward CAI in the United States Army Europe (USAREUR) Department of Defense (DoD) School system. If you agree to allow your child to take part, your child will be asked to fill out a 25-question survey. Your child will be asked to rate how much she or he likes to use computer. Your child will also be asked to if computers will assist them in their academic setting. The questionnaire will take about 10-15 minutes to complete.

Risks and benefits: There are no risks involved. There will be no risks for those who participate in this project. A possible benefit may be that educational policy makers will gain insight related to the student's attitude toward CAI and therefore seek resolutions that maximize the learning process. There are no benefits to you or your child if he or she takes part in the study.

Compensation: Your child will not receive any compensation for participating in this study.

Confidentiality: The records of this study will be kept private. The survey will ask only for gender and age, and will not include your child's name. It will not be possible to figure out your child's answers. Surveys will be kept securely for three (3) years after this study ends.

Voluntary Participation: Your child's participation in this study is voluntary. Your child may skip any questions he or she does not feel comfortable answering. Your decision whether or not to allow your child to take part will not affect your current or future relationship with University of Phoenix or with your child's school. If you decide to allow your child to take part, your child is free to not complete the survey or to skip any questions. You are free to withdraw your child at any time without affecting your relationship with the University or your child's school.

If you have any questions regarding the rights of research participants, you may contact the University of Phoenix's, School of Advance Studies Office of Research Administration at (602) 387-2791. If you have any questions regarding this survey, you may contact me at my office, DSN 484-7788 or my home (0631) 415-0936.

Please enter your child's name and sign below if you give consent for your child to participate in this study.

Your child's name: ________________________

Your signature _____________________________ Date _____________

APPENDIX D: PERMISSION TO USE AN EXISTING SURVEY

From: Lee Dion [SMTP:ldion@copyright.com]
To: cjackson@email.uophx.edu
Cc: Lee Dion

Subject: confirmation[1].pdf - Linked File.pdf
Sent: 9/27/2005 7:56 AM **Importance:** Normal

Cynthia,

Attached is a pdf file copy of the CCC Order Confirmation for the re-use of copyrighted material in your dissertation.

Sincerely,

Lee Dion
Copyright Clearance Center, Inc.
phone: 978-646-2555
www.copyright.com
confirmation[1].pdf

UNIVERSITY OF PHOENIX

PERMISSION TO USE AN EXISTING SURVEY

Date: 27/09/05

Mr. /Ms. Lee Dion
Address 222 Rosewood Drive
Danvers, MA 01923

Thank you for your request for permission to use Bath County Computer Attitude Survey in your research study. We are willing to allow you to reproduce the instrument as outlined in your letter at no charge with the following understanding:

- You will use this survey only for your research study and will not sell or use it with any compensated management/curriculum development activities.
- You will include the copyright statement on all copies of the instrument.
- You will send your research study and one copy of reports, articles, and the like that make use of this survey data promptly to our attention.

If these are acceptable terms and conditions, please indicate so by signing one copy of this letter and returning it to us.

Best wishes with your study.

Sincerely,

Lee Dion
Signature

I understand these conditions and agree to abide by these terms and conditions.

Signed ____________ **Date** 24/07/06

Expected date of completion [redacted]

APPENDIX E: STUDENT SURVEY COVER PAGE

Student Survey Cover Page

The researcher assures confidentiality with all survey responses.

Participation is strictly voluntary.

The purpose of this survey is to help researchers understand how demographic variables affect student attitudes towards computer-assisted instruction. It should take about 10 to 15 minutes of your time to complete. To protect your identity, the survey and consent form will be given to the researcher who will separate the signed individual informed consent form from the survey.

The researcher assures the confidentiality of the student responses on the surveys. Both the signed informed consent form and the survey will be secured in a locked file cabinet. No attempt will be made to match the consent form with the completed survey. You should find the following items enclosed along with this letter: the survey, two (2) copies of the consent form (sign and return one and keep the other for your records), envelope to the researcher. Thanks for your help. Don't forget to sign your consent form.

PLEASE RAISE YOUR HAND AND GIVE THE COMPLETED SURVEYS AND THE SIGNED CONSENT FORMS TO THE RESEARCHER.

APPENDIX F: BATH COUNTY COMPUTER APTITUDE SCALE

Participation Is Strictly Voluntary

INSTRUCTIONS: This instrument is designed to measure attitudes towards the use of computers in our society. It is not a test, so there is no right or wrong answers. Using the scale below, indicate your level of agreement or disagreement in the space that is next to each statement.

1	**2**	**3**	**4**	**5**
Strongly Disagree	**Disagree**	**Undecided**	**Agree**	**Strongly Agree**

___ 1. Computers will never replace human life.

___ 2. Computers make me uncomfortable because I do not understand them.

___ 3. People who like computers are often odd.

___ 4. Computers are responsible for many of the good things we enjoy.

___ 5. Learning about computers is interesting.

___ 6. I feel intimidated by computers.

___ 7. School would be better place without CAI.

___ 8. The overuse of computers may be harmful and damaging to humans.

___ 9. Computers are dehumanizing and boring.

___10. Computers can eliminate a lot of tedious work for people.

___11. The use of computers is enhancing our standard of living.

___12. CAI cannot benefit someone who has common sense.

___13. CAI is a waste of time and money.

___14. Computers are a fast and efficient means of gaining information.

___15. Computers intimidate me because they seem so complex.

___16. Computers will replace the need for working human beings.

___17. Computers are bringing us into a bright new era.

___18. Soon our world will be completely run by computers.

___19. Life will be easier and faster with computers.

___20. I enjoy using a CAI.

Please state responses rounded to the nearest whole number.

21. What is your highest level of education (in years)? ________

22. What is your average daily exposure (or experience) with computers (in hours)?

(Include work, education, and recreation time) ________

23. What is your gender? ________

24. What is your age?________

25. What is your race/ethnic origin(s)? _______________________

26. What is your Mathematics placement scores? ____________________

27. How many computer science or computer programming courses have you taken?___

APPENDIX G: MODIFIED ATTITUDE TOWARD COMPUTER-ASSISTED INSTRUCTION (ATCAI)

Participation Is Strictly Voluntary

Directions: Following is a list of statements about Computer Assisted Instruction (CAI). Place a plus sign (+) before each statement with which you agree with reference to CAI.

1. CAI is better than anything else is.
2. I like CAI better than anything I can think of.
3. CAI is profitable to everyone.
4. CAI is very worthwhile.
5. CAI has an irresistible attraction for me.
6. I enjoy CAI.
7. CAI is liked by almost everyone.
8. I like CAI too well to give it up.
9. CAI makes for happier living.
10. CAI serves a good purpose.
11. CAI develops cooperation.
12. CAI should be appreciated by more people.
13. CAI is being accepted more and more as time goes on.
14. CAI has advantages.
15. If CAI were used more it would developed into a good practice.
16. There is no reason for stopping CAI.
17. CAI is all right as a pastime.
18. I like CAI a little.
19. CAI is all right in some cases.
20. CAI is all right in a few cases.
21. My likes and dislikes are balanced.

22. I dislike CAI but I do not object to others liking it.
23. CAI is not so bad but it is very boring.
24. CAI has limitations and defects.
25. I like many practices better than CAI.
26. CAI has several disadvantages.
27. CAI has several undesirable features.
28. CAI is disliked by many people.
29. CAI should not be tolerated when there are so many better ones.
30. CAI is not endorsed by logical-minded persons.
31. Life would be happier without CAI.
32. CAI cannot benefit someone who has common sense.
33. CAI is a waste of time and money.
34. CAI accomplishes nothing worthwhile for either the individual or society.
35. CAI is sinful.
36. I hate CAI.
37. CAI is the worst thing I know.

Please state responses rounded to the nearest whole number.

1. What is your highest level of education (in years)? ________
2. What is your average daily exposure (or experience) with computers (in hours)?

   (Include work, education, and recreation time) ________
3. What is your gender? ________
4. What is your age? ________
5. What is your race/ethnic origin(s)? _______________________
6. What is your Mathematics placement scores? ____________________
7. How many computer science or computer programming courses have you taken?___