A COMPARISON OF AFRICAN AMERICAN AND CAUCASIAN COLLEGE STUDENTS' ATTITUDES TOWARD COMPUTERS

by

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ABSTRACT

A COMPARISON OF AFRICAN AMERICAN AND CAUCASION COLLEGE STUDENTS' ATTITUDES TOWARD COMPUTERS

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As computer usage becomes mandatory on college campuses across the world, the issue of examining students' attitudes toward computers becomes very important. The major goal of this study was to examine the relationship between gender and ethnicity and African American and Caucasian college students attitudes toward computers. The Computer Attitude Scale instrument was used to measure the students' attitudes.

During the Summer of the 1996 academic year, a university in the southeastern United States was selected to participate in this study. A total of 230 African American and Caucasian undergraduate students participated in the study.

The students were pre-tested during the first week of the semester to access their initial computer attitudes. The students were enrolled in one of the mandatory computer literacy courses (Computer Literacy Awareness Course or C, Pascal or FORTRAN Programming Course) for 12 weeks. There were a total of seven different instructors for the courses. During the 12th week of class, the students were post-tested to access their computer attitudes after completing one of the computer literacy courses. Results were analyzed using ANCOVA. While both African Americans and Caucasian students showed a slight increase in their attitudes toward computers after completing the course, no significant difference between the groups was found. However, all groups were found to have positive attitudes toward computers in general.

Data analysis also indicated no significant gender difference among African American and Caucasian undergraduate students. This confirmed findings of previous studies in which no significant gender difference was found to exist among college students.

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LaMarquis JaVon

Jonathan Undra JaVon

and

AnTonia Louise JaVon.

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CHAPTER I

INTRODUCTION

Computer usage in higher education is increasing rapidly. Computers are becoming so prevalent in today's society that basic computer literacy has become a necessity for all students. Universities are now facing the challenge of teaching them computer skills so they can use computers. User attitude is one important factor in the successful implementation of computers. Students are faced with the challenge of deciding what type of computer literacy course they should take, given their direction of study. One of the goals of such a course should be to produce positive student attitudes toward computers and skill acquisition, thus eliminating or reducing computer anxiety.

The widespread use of computers, demonstrated by the proliferation of personal computers, brings with it some positive and negative attitudes toward computers (Omar, 1992). Clement (1981) reported that in general, college students have positive attitudes about computers. For these people, learning how to use computers was found to be a pleasant and rewarding experience. Clement believed that if positive attitudes toward computers increased, students would master computer related skills. Computer usage offers students many advantages to the educational process, such as operating at an individual's pace, development of problem solving techniques, self-tutoring sessions, immediate feedback and the absence of subjectivity. However, Marcoulides (1988) reported that learning how to use computers for many people is not a pleasant experience. Jay (1981) found that students with negative attitudes develop a degree of anxiety when required to master computer skills. In addition, Jay reported that this anxiety generally affects these students' learning processes negatively.

Many computer attitude articles suggest that there is a gender difference connected with computer usage (Jacobson, 1991; Krendl & Brochies, 1992; Liu, Reed & Phillips, 1992; Bernhard, 1992; Levin & Gordon, 1989). In the past ten years, research has indicated that there are differences between males and females with regard to accessibility, use of computers, and attitudes toward computers. In most cases male students tend to display more positive attitudes toward computers than female students. However, in a study conducted by Sacks, Bellisimo, and Mergendoller (1994), female students' attitudes toward computers improved while enrolled in a computer course. The authors speculate that one may express more positive attitudes toward computers based on increased exposure to them. However, some computer attitude studies suggest that there are no gender differences (Francis, 1994; Pope-Davis & Vispoes, 1993; Morahan-Martin, Olinsky, & Schumacher, 1992; Kay, 1989; Temple & Lips, 1989; Leite, 1994).

Kay (1992) conducted a comprehensive review and located 98 studies on gender differences which measured computer attitudes. Forty-eight studies reported that males had more positive attitudes toward computers than females. In 14 studies, females had more positive attitudes toward computers than males. In 36 of the studies conducted, males and females displayed similar attitudes toward computers. Kay attributed the differences and similarities in computer attitudes to the way the researchers defined computer attitudes for the various studies. For these studies, computer attitudes involved the measurement of computer anxiety, computer confidence, computer liking, and computer usefulness.

In the past, most studies concerning the measurement of computer attitudes have been performed using a majority of Caucasian subjects. Only a few studies investigated the computer attitudes of individuals with a focus on cross cultural comparison (Hwang, 1990; Omar, 1992; Makrakis, 1992; Okebukola & Benwoda, 1993; Moon, Kim, & McLean, 1994). The issue of cross cultural comparison of attitudes toward computers is important from both a theoretical and curriculum development perspective. Markrakis (1992) stated that "the culture is usually assumed to have a strong effect on how people form personal beliefs, which in turn determine attitudes toward an object, action or event." In addition to one's culture, several other specific factors can influence how students develop their attitudes toward computers, such as gender and easy accessibility to computers.

Smith (1995) reported that African American college students have continued to trail Caucasian college students in many areas in education, such as mathematics and science, and in completion of college. Factors such as race, gender, and type of computer course enrolled in need to be compared in order to gain insight into the involvement of computer attitudes of African American and Caucasian college students.

As computer literacy becomes a requirement throughout college campuses, it has become increasingly important to study computer attitudes, specifically with regard to ethnicity backgrounds. This is important when specific groups of people display negative attitudes toward computers that may lead to their avoidance of using computers and ultimately limit their chances of getting a job in the future (Omar, 1992).

The purpose of this study was to measure differences in computer attitudes by comparing African American and Caucasian college students, in order to determine whether ethnic differences and/or gender differences exist between the two groups and among the two groups, and to determine whether students enrolled in a science discipline had better attitudes toward computers than students in non-science disciplines. The instrument used to measure these factors was the Computer Attitude Scale (Loyd & Loyd, 1985).

Statement of the Problem

Measurement was made of the computer attitudes among and between African American and Caucasian college students. This study investigated the following research questions:

1. Are there differences in computer attitudes in computer attitudes between African American and Caucasian college students?
2. Are there gender differences among African American and Caucasian college students?
3. Do students in a science discipline have more positive attitudes toward computers than students in a non-science discipline after completing a specific type of computer literacy course?

Significance of the Study

This study provides information concerning gender differences among and between African American and Caucasian college students attitude toward computers. The study also provides recommendations to educators concerning the possible issue differences in computer attitudes of African American and Caucasian college students. If differences exist, educators can monitor and adjust their teaching methods to accommodate or produce positive attitudes within the student group that displays negative attitudes toward computers. Helping college students decide what type of mandatory computer course they should take according to their majors was also a focus of this study.

Research Questions and Null Hypotheses

Research Questions

This study utilized the following research questions to guide the investigation reported in this dissertation.

1. Are there gender differences among college students who take a Computer Attitude Scale inventory?
2. Do African American and Caucasian students differ in computer attitudes measured by the Computer Attitude Scale inventory?
3. Is there a difference in computer attitudes as measured by the Computer Attitude Scale of college students who enroll in different types of computer literacy courses?
4. Is there a difference in computer attitudes as measured by the Computer Attitude Scale of college students who major in a science discipline or non-science discipline?
5. Are there any interactions among college students' gender, ethnic background, course, and major on the Computer Attitude Scale inventory?
6. Does taking a computer literacy course affect attitudes as measured by the Computer Attitude Scale inventory?

Null Hypotheses

The following null hypotheses were tested in this study.

1. There are no gender differences among college students who take a Computer Attitude Scale inventory.
2. African American and Caucasian students do not differ in computer attitudes measured by the Computer Attitude Scale inventory.
3. There is no difference in computer attitudes as measured by the Computer Attitude Scale of college students who enroll in different types of computer literacy courses.
4. There is no difference in computer attitudes as measured by the Computer Attitude Scale of college students who major in a science discipline or non-science discipline.
5. There are no interactions among college students' gender, ethnic background, course, and major on the Computer Attitude Scale inventory.
6. Attitudes are not affected as a result of taking a computer literacy course as measured by the Computer Attitude Scale inventory.

Definition of Terms

An understanding of the following terms is essential to this study:

1. Computer Attitudes consist of positive and negative feelings toward computers.
2. Computer Literacy is the ability to know how to use computers and understand computer implications (Mandell, 1982).
3. Programming course will consist of one of the following courses: FORTRAN, Pascal, or C.
4. Computer Literacy Awareness Course teaches computer history and gives hands-on experience using a word processor, database, and spreadsheet applications.
5. Science Majors consist of those students from the School of Arts and Science, Human Science, Liberal and Information Systems, Nursing, and Engineering.
6. Non-Science Majors consist of those students from the School of Business, Education, Criminology and Criminal Justice, Law, Social Sciences, Social Work, Communication, Motion Pictures, TV and Arts, Music, Theater, Visual Arts and Dance, and those students who have not decided on a major.
7. Computer Attitude Scale is a Likert-type instrument consisting of 40 items which present statements of attitudes toward computers and the use of computers. (Loyd & Loyd, 1985). The Computer Attitude Scale consists of four sections: computer anxiety; computer confidence; computer liking; and computer usefulness.

   a) Computer Anxiety is the threat or fear of computers, and hostile thoughts toward computers (Jay, 1981; Loyd & Loyd, 1985).

   b) Computer Confidence is demonstrated by the self-reliance when using a computer (Loyd & Loyd, 1985).

c) Computer Liking consists of one's enjoyment and appreciation of computers (Loyd & Loyd, 1985).

d) Computer Usefulness consists of the perceived usefulness of computers in present or future work (Loyd & Loyd, 1985).

Operational Definitions

Following is a list of terms that have been operationally defined for the reader's understanding.

1. Pre-Test score is measured by the Computer Attitude Scale.
2. Post-Test score is measured by the Computer Attitude Scale.
3. Positive computer attitudes refers to a high score on the Computer Liking, Computer Confidence, and Computer Usefulness portions of the Computer Attitude Scale.
4. Negative computer attitudes refers to a high score on the Computer Anxiety portion of the Computer Attitude Scale.

CHAPTER II

REVIEW OF RELATED LITERATURE

Research concerning computers in education has focused on computer usage in schools, gender related issues, and the effectiveness of computer related courses on computer literacy. The majority of research studies in these areas have been performed on Caucasian students in secondary and post-secondary schools. Few studies have been done on cross-cultural student attitudes toward computers. No research to date has examined the effect of different types of computer literacy courses on attitudes toward computers comparing African American college students and Caucasian college students.

Literature reviewed in support of this research was summarized according to: (a) computer attitudes and gender issues, (b) socioeconomic status, (c) cross cultural studies, and (d) attitudes of African American and Caucasian students toward college.

Empirical Research on Attitudes Toward Computers

Several studies have been conducted focusing on gender related issues concerning student attitudes toward computers. These research efforts reported that males have more positive attitudes toward computers than females. However, there have been studies which indicate that females have more positive attitudes than males. Some research conducted has found no significant difference in female and male attitudes toward computers.

In a study of 1,138 high school students Chen (1986) found that males had greater exposure to computers than females. This finding was based primarily on an increased enrollment in computer programming courses and home computer usage.

It was also found that males had more positive attitudes when related to computer confidence. However, no gender differences were found regarding enrollment in classes using computers for purposes other than programming.

The attitudes of 60 college students were examined by Koohang (1989). The purpose of this study was to measure student attitudes toward computers. Results of this research showed that gender was significant in the area of perceived computer usefulness, favoring male college students. In addition, students who had more computer experience, such as keyboarding or programming, displayed more positive attitudes toward computers than those students who did not have such experiences.

Massoud (1991) reported significant gender differences in for Computer Anxiety, Computer Liking, Computer Confidence favoring males. Male adult students had more positive attitudes toward computers than female adults. This research corresponded with the Popovich (1987) study, which reported that out of 365 undergraduate students, female college students presented more negative reactions to computers than male students. Popovich also reported the number of college level computer courses taken and number of hours spent per week using a computer differ greatly among male and female students, with males using computers more than females.

In 1987, Abler and Sedlacek found significant gender differences favoring males in attitudes toward computers among 289 freshman college students, whereas Loyd and Gressard (1984) reported no significant gender differences related to computer attitudes in a sample of 354 students high school and college students. Both studies utilized Loyd and Gressard's (1984) Computer Attitude Scale, comprised of four sections: 1) computer anxiety; 2) computer liking; 3) computer confidence; and 4) computer usefulness.

Kay (1989) found that male and female college students did not differ in their cognitive or affective attitudes toward computers. However, Kay also reported that male college students had significantly higher scores than females on all portions of the Computer Literacy Inventory, and that males showed more commitment to computers than females.

Liu, Reed, and Phillips (1992) examined the relationship of computer experience and attitudes of 914 teacher education college students. Those students were enrolled in a mandatory computer awareness course and the data were collected over a four year period. During the first year, more than 50 percent of the college students had no prior computer experience. In the fourth year that percentage dropped to 32 percent. Results of this study indicated that although more males than females had no prior computer experience, males were found to exhibit less anxiety about computers than females.

Siann, Macleod, Glissov, and Durnadell (1990) reported that primary school males were more likely to describe themselves as frequent computer users than females. Sacks, Bellisimo, and Mergendoller (1994) reported that although males had a significantly more positive attitude toward computer than females, female high school students' attitudes toward computers improved while taking a computer course, whereas male high school students' attitudes remained the same. Often research has reported no significant difference exists between male and female students in their attitude toward computers. Overall, males had more positive attitudes toward computers than females.

The purpose of a study by Morahan-Martin, Olinsky, and Schumacher (1992) was to investigate gender differences in computer experience, skills, and attitudes among freshman undergraduate students. The results indicated that no significant gender difference existed among students using computers. However, significant gender differences were reported in response to specific computer applications. Males demonstrated greater programming experience than females. These results were similar to other studies that reported males as having more programming experience than females (Liu, Reed, & Phillips, 1992; Chen, 1986).

In 1989, Temple and Lips conducted a study that assessed gender differences and similarities of 311 undergraduate student attitudes toward computers. This study determined that males who completed Computer Science courses in order to become more knowledgeable about computer languages were more likely to major in Computer Science than females. They also engaged in video games more often than females. No gender differences were reported with regard to computer exposure in Non-Computer Science courses. However, males in all cases reported more comfort and confidence with computers than females.

Gender stereotyping of computer usage among students has become apparent from past research studies. However, a majority of the research has indicated that males possess more positive attitudes toward computers than females. A small number of studies report that females have more positive attitudes toward computers, or report that no gender differences exist. With a majority of the studies indicating that female students exhibit more computer anxiety than male students, special attention should be given in schools to reduce gender differences related to computer attitudes.

Socioeconomic Status

In the 1980's, four national surveys were conducted that compared student access to computers (Sutton, 1991). These surveys focused on social class and ethnic background. All four surveys found consistent and predictable inequalities. For example, poor and minority students had less access to computers at school and at home than did other groups.

Becker and colleagues (1983) conducted two national surveys in the 1980's. His first survey asked teachers who used computers to identify the number of computers in their building. In 1983, he reported that the mean ratio of computers to elementary school students with high socioeconomic status (SES) enrolled at predominately Caucasian, low SES schools was 155:1. The mean ratio of computers to elementary school students with low SES enrolled at predominately minority schools was reported at 215:1. In 1985, Becker reported similar results to those reported in the 1983 survey. He reported that 94 percent of K-6 schools with less than four percent African American enrollment owned computers, compared to 67 percent with a majority of African American enrollment. In middle schools with fewer than four percent African American enrollment, 96 percent owned at least one computer compared to 90 percent in predominately African American schools (Becker & Sterling, 1987). This indicated a decline in computer access inequities between elementary schools and middle schools. At public schools that actually owned computers, African Americans still had less access to computers than Caucasians. Becker and Sterling (1987) reported the student mean computer ratio was 72:1 for fifth grade African American students compared to 55:1 for fifth grade Caucasians; for eleventh grade African American students, the student median computer ratio was 43:1 compared to 35:1 for Caucasians students.

In 1982 the National Assessment of Educational Progress (NAEP) Science assessment was given to over 15,500 students. The survey focused on whether students had used computers or computer terminals at school. Sutton reported that over 32 percent of the students living in wealthy urban/suburban areas had used computers compared to fewer than 17 percent of students from poor urban and rural areas.

In 1986 the NAEP Science assessment was given to 24,000 third, seventh, and eleventh grade students. The major interest in this survey was computer access and competence. Computer usage for third grade Caucasian students was reported at 78 percent compared to 65 percent for African Americans. These inequalities were less dramatic for students at the high school level. Martinez and Mead (1988) reported that 89 percent of Caucasians students and 81 percent of African American students had computer experience. However, the study did report whether these differences were significant or not.

The NAEP survey also provided information on inequalities among children of different backgrounds with regard to computer ownership at home. It was reported that 32 percent of Caucasian eleventh grade students owned computers compared to 22 percent of African American students. It was also found that those students whose parents had graduated from college were more likely to own a computer than those students whose parents had not completed high school (Martinez & Mead, 1988). The study concluded that poor and minority children had less access to computers both at home and at school.

Accessibility to microcomputers in schools has been given little attention. Nobel (1984) reported that in order for children in the United States to be successful in the information age, exposure to computers is a necessity. Cuban (1986) reported that middle-class parents raised money for the purchase of computers, so their children would have access to computers. When determining the accessibility students have with computers, SES of the parents plays a major role. Students whose parents have a low SES had less access to computers.

There is a lack of research on African American students. Most studies that have reported accessibility of computers were conducted on middle-class Caucasian students. The knowledge gained from those studies could not be generalized to African American students or students from a lower SES.

Cross-Cultural Studies on Attitudes Toward Computers

A perspective on cross-cultural characteristics can be a very important approach that may explain the nature of attitudes toward computers. It is necessary to examine whether or not a cross-cultural validation study on a computer attitude scale can measure the constructs for samples from different cultural backgrounds (Moon, Kim, & McLean, 1994). Several studies have examined cross-cultural computer attitudes of secondary students (Levin & Gordon, 1989; Hwang, 1990; Makrakis, 1992; Okebukola & Benwoda, 1993) and college students (Omar, 1992; Moon, Kim, & McLean, 1994).

A study by Levin and Gordon (1989) assessing the computer attitudes of 222 Israeli students in the 8th through 10th grade, showed that prior computer exposure had a stronger effect on attitudes toward computers than gender. However, a cross-cultural comparison of attitudes toward computers of Japanese and Swedish 9th grade students was conducted by Makrakis (1992). It was found that most of the differences between the Japanese and Swedish students were best explained by the country and the student gender variable. The culture and society of residence appeared to be of greater importance in determining a student's attitude toward computers than the possession of a computer.

Okebukola and Benwoda (1993) and Hwang (1990) conducted similar studies in Australia and Korea. Okebukola and Benwoda reported that Australian female high school students had a higher mean anxiety score than Australian male high school students. The Australian males had an higher overall score for computer interest. Hwang reported that Korean males in the 5th and 4th grades were also found to possess more positive attitudes toward computers than Korean females. In addition, Korean students with higher achievement motivation showed more positive computer attitudes than Korean students with lower achievement motivation.

Omar (1992) conducted a study comparing the computer attitudes of United States college students and college students in Kuwait. The results showed that no significant relationships exist between gender and attitudes to computers in the United States, but there was a significant relationship in Kuwait. However, females from both Kuwait and the United States showed a significantly less positive attitude about computers than males from those countries. This seems to be consistent with several studies conducted in the United States concerning gender effect (Koohang, 1989; Massoud, 1991; Liu, Reed, & Phillips; 1992). However, Moon, Kim, and McLean (1994) reported that Korean college students who had more computer experience expressed more positive attitudes toward computers than those who had less computer experience. Korean male students displayed a higher computer confidence than Korean female students. In addition, it was also discovered that attitudes toward computers and computer experience were culture-free constructs (Moon, Kim, & McLean, 1994).

Some studies have been conducted, examining the computer attitudes toward computers from a cultural perspective. However, no study to date has compared African American college students' and Caucasian college students' attitudes toward computers.

African American and Caucasian College Students'

Attitudes Toward College

Both African Americans and Caucasians have made important gains in education over the past two decades (Smith, 1995). There has been an increase in groups of students aspiring to attend college after graduation from high school, and more are attending. Despite these overall gains, African Americans continue to trail Caucasian in several areas, such as educational aspirations, and college enrollment and completion. One area that is in need of exploration is determining attitude differences and similarities between African American college students and Caucasian college students.

A wide variety of variables have been associated with African American college students' and Caucasian college students' attitudes toward college (Rowser, 1994; Mallinckrodt, 1988; Steward, Gimenez, & Jackson, 1995; Guloyan, 1986; Carter 1990). Some of these studies have concentrated on academic variables while some studies have focused on the campus social environment.

Academic Comparison

Smith (1995) reported that from the early 1980's, the percentage of African Americans enrolled in college increased. This increase persisted through the late 1980's, when there appeared to be a leveling off. However, the enrollment rate for Caucasians also increased rapidly during that time period, increasing the gap between African Americans and Caucasian students.

For African Americans, the number and rate of those who attained a Bachelors Degree was far lower than Caucasians (Smith, 1995). Smith stated that, on average, it took African Americans longer to complete college than Caucasians. However, Rowser (1994) found significant results indicating that Caucasian students perceived that it would take a greater number of years to graduate from college than their African American counterparts. This finding is disturbing because other research would suggest the reverse. For example, one would expect African American students to experience more difficulty than Caucasians in meeting graduation requirements, regardless of the level of academic preparation (Rowser, 1994).

In a study assessing the academic attitudes of African American and Caucasian college students, Whipple (1991) reported that African Americans from a lower socioeconomic background were more academically motivated, more liberal, more socially conscious, and more peer independent than Caucasian college students from the same socioeconomic background. However, White (1988) found that ethnicity had no effect on performance when comparing African American college student and Caucasian college student academic experience.

Although African Americans have made significant strides in academics, Caucasians still lead African Americans in many areas of education. To date, research is very limited when comparing African American and Caucasian college students' attitudes toward computers. Therefore, additional studies are needed.

Social Support Comparison

In a study consisting of 500 minority and non-minority college students Guloyan (1986) reported that minorities had more socialization problems than nonminorities, and that minority females had greater problems with socialization issues than minority males. Mallincrodt (1988) conducted a study of 98 African American college students and Caucasian college students. This study confirmed Guloyan's contention that social support could be an important factor to college students. It was found that African American college students viewed social support from members of the campus community as very crucial, whereas it was not important for Caucasian college students. In addition, Rowser (1994) reported that after their freshman year, African American college students and Caucasian college students perceived their social preparation as less than adequate for life on a college campus.

African American and Caucasian students' attitudes toward college differed in many ways, such as in the areas of academic and social support while attending college. From an academic perspective, African American college students were less likely to major in a Science discipline. From a social support perspective, African American college students displayed greater socialization problems than Caucasian college students. Caucasian college students viewed family support as very important, whereas African American viewed the support of peers on campus to be of importance.

Summary

Several studies suggest that gender related differences in attitudes toward computers do exist. In a majority of the studies, males have consistently displayed more positive attitudes toward computers than females (Chen, 1986; Abler & Sedlacek; Popvich, 1987; Koohang, 1989; Massoud, 1991; Liu, Reed, & Phillips, 1992). There is no doubt that negative attitudes toward computers exist among female students more often than males. However, with increased exposure to computers, these negative attitudes in females could diminish.

From a socioeconomic perspective, Caucasian students enrolled at predominately Caucasian schools with a high or low SES have greater accessibility to computers in their schools than African American students who attend a predominantly minority school with a low SES. Research indicated that African American students had lower access to computers than Caucasian students, and boys used computers in and out of school more than females.

Cross cultural studies can be an important approach which may help explain the nature of attitudes toward computers. From the literature, most cross cultural studies have reported similar findings, and a majority of studies has been conducted on Caucasian students. Most of these studies have reported very similar and mostly positive attitudes toward computers. However, no studies on African American student attitudes toward computers have been conducted.

Based on previous research findings about African American students' and Caucasian students attitudes' toward college, equity issues concerning computer usage, and the lack of studies concerning African American attitudes toward computers, there is a need to study the comparison of African American students' and Caucasian students' attitudes toward computers.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

This study was designed to determine if there was a difference in computer attitudes between African American college students and Caucasian college students enrolled in a mandatory computer course. The study examined whether a gender difference concerning computer attitudes existed between and among African American college students and Caucasian college students who took a computer course to satisfy the Computer Literacy Requirement. In addition, information regarding whether a science major had a more positive computer attitude than a non-science major after taking a programming course or a Computer Literacy Awareness Course.

Population and Sample

The target population consisted of African American and Caucasian college students. The accessible population consisted of African American and Caucasian college students who attended a state university in the southeastern portion of the United States. The sample consisted of undergraduate students enrolled in a Computer Literacy Awareness Course or a programming course (FORTRAN, C, or Pascal) during the summer 1996 semester. The students who participated enrolled on a first-come, first-served basis and the students were free to choose either course. The subjects consisted of a total of 230 male and female students majoring in various subject areas. The demographic information collected on the students consisted of race, gender, major, classification in college, computer ownership, family computer ownership, age, and computer experience.

The university that participated in this study was a public institution with an undergraduate population of approximately 24,000. This university offers undergraduate, graduate, advanced graduate, and professional programs of study. Additionally, the university provides services to the public in accordance with the school's mission statement. The university's primary role is to serve as a center for advanced graduate and professional studies while emphasizing research and providing excellence in undergraduate programs. Some specific characteristics of the student population are listed below:

Gender	
Male	46%
Females	54%
Classification	
Freshman	20%
Sophomore	15%
Junior	28%
Senior	29%
Unclassified	8%
School	
Science Majors	36%
Non-Science Majors	52%
Undecided	12%

Ethnic Composition

African American	10%
American Indian	1%
Asian/Pacific	2%
Hispanic	5%
International	2%
Caucasian	80%

All subjects were given the rationale for their involvement, and were assured that their responses would remain anonymous and confidential.

COMPUTER COURSES

This section provided a general description of each course that was used in this study.

Computer Literacy Course

The Computer Literacy Awareness Course covered introductory topics, information processing and computer applications. This course also covered hands-on experience with microcomputer applications, such as wordprocessors, spreadsheets, and database programs.

C for Nonspecialists

C programming for nonspecialists was an introductory course that covered types; operators and expressions; control flow; functions and programs structure; and software design techniques. This course included numerous programming projects. (Nonspecialist refers to non-computer science majors.)

FORTRAN for Nonspecialists

FORTRAN programming for nonspecialists was an introductory course that covered fundamental rudiments, problem solving by computer usage, basic data type, basic control structures, subprograms and formatted input/output usage. This course included numerous programming projects.

Pascal for Nonspecialists

Pascal programming for nonspecialists was an introductory course that covered such topics as problem solving by computer usage, basic data types, control structures, procedures, and functions. This course included numerous programming assignments.

Overall Course Structure

Sections of the Computer Literacy Awareness Course and Programming course were taught on a twelve week semester system. Lectures, assignments and examinations were conducted by the instructor of each course. The measuring instrument is discussed in the next section.

Design

The research design for this study consisted of a one-shot case study and a quasi-experimental design (Campbell & Stanley, 1963). However, a one group pretest - posttest design was incorporated into the study, in order to determine if there was a change in students' attitude toward computers after taking a computer literacy course. Both groups were administered a pre-test. One group received the Computer Literacy Awareness Course, the other group received one of the programming courses (Pascal, FORTRAN or C), and both groups were post-tested. As shown in Table 3-1, 112 students were enrolled in the Computer Literacy

Table 3-1

Descriptive Statistics of Groups in the Computer Literacy Courses

Course	# of Students	African Americans		Caucasians	
		M	F	M	F
C.L.A.C.	112	13	35	15	49
P.C.	118	19	26	55	18
Total	230	32	61	70	67

C.L.A.C. = Computer Literacy Awareness Course

P.C. = Programming Courses (C, Pascal, or FORTRAN)

M = Males

F = Females

course. Both groups were administered a pre-test. One group received the Computer Literacy Awareness Course, the other group received one of the programming courses (Pascal, FORTRAN or C), and both groups were post-tested. As shown in Table 3-1, 112 students were enrolled in the Computer Literacy Awareness Course. Forty-eight students were African Americans and 64 students were Caucasians. One-hundred and eighty students were enrolled in the programming courses. Forty-five students were African Americans and 73 students were Caucasians.

Instrumentation

In this study the measurements consisted of administering a pre-test and a post-test. The pretest was given to find out students' initial attitudes toward computers. The post-test was administered to measure the attitudes toward computers after they participated in one of the computer courses.

The first section of the pre-test requested demographic information on students, such as gender, major and ethnicity. Additional questions related to students' familiarity with computers, such as prior computer learning/experience and ownership of a computer was also asked.

The second section of the pre-test surveyed students' attitudes toward computers. The Loyd and Loyd Computer Attitude Scale (CAS, 1985) which consisted of a four point Likert scale, was used to determine student attitudes. The CAS consisted of 40 items, divided into four ten-item subscales: Computer Anxiety, Computer Confidence, Computer Liking, and Computer Usefulness. This instrument included positive and negative items with higher scores representing a more favorable attitude toward computers, and lower scores representing a less favorable attitude toward computers. The highest score possible for each section of the CAS was 40, and the highest total score was 140.

The alpha reliability coefficients were reported by Loyd and Loyd (1985) as .90, .89, .89, and .82 for the four subscales Computer Anxiety, Computer Confidence, Computer Liking, and Computer Usefulness, respectively. A total score alpha reliability coefficient was estimated at .95 for the overall CAS score.

A second reliability test was conducted for the study with the CAS instrument by the researcher in the spring of 1996. This was done because no reports indicated that the CAS had been tested with African American students. A total of 21 African American and Caucasian college students participated. These students had been enrolled in an introductory computer course or a programming course at a private university in southeastern portion of the United States. The results of the coefficient alpha reliability for the Computer Anxiety, Computer Confidence, Computer Liking, Computer Usefulness, and total scores were: .86, .82, .86, .85, and .87 respectively. These scores were lower than those scores reported by Loyd and Loyd (1985). However, the results of the study indicated that the CAS is reliable for African American and Caucasian college students.

The post-test was the CAS instrument which was used as the pre-test. As shown in Figure 1 the study took place during a 12 week time period. The pre-test was administered on the first day of class during the first week of the semester. The course was taught during an 11 week time period. The post-test was administered on the first day of class during the last week of the semester.

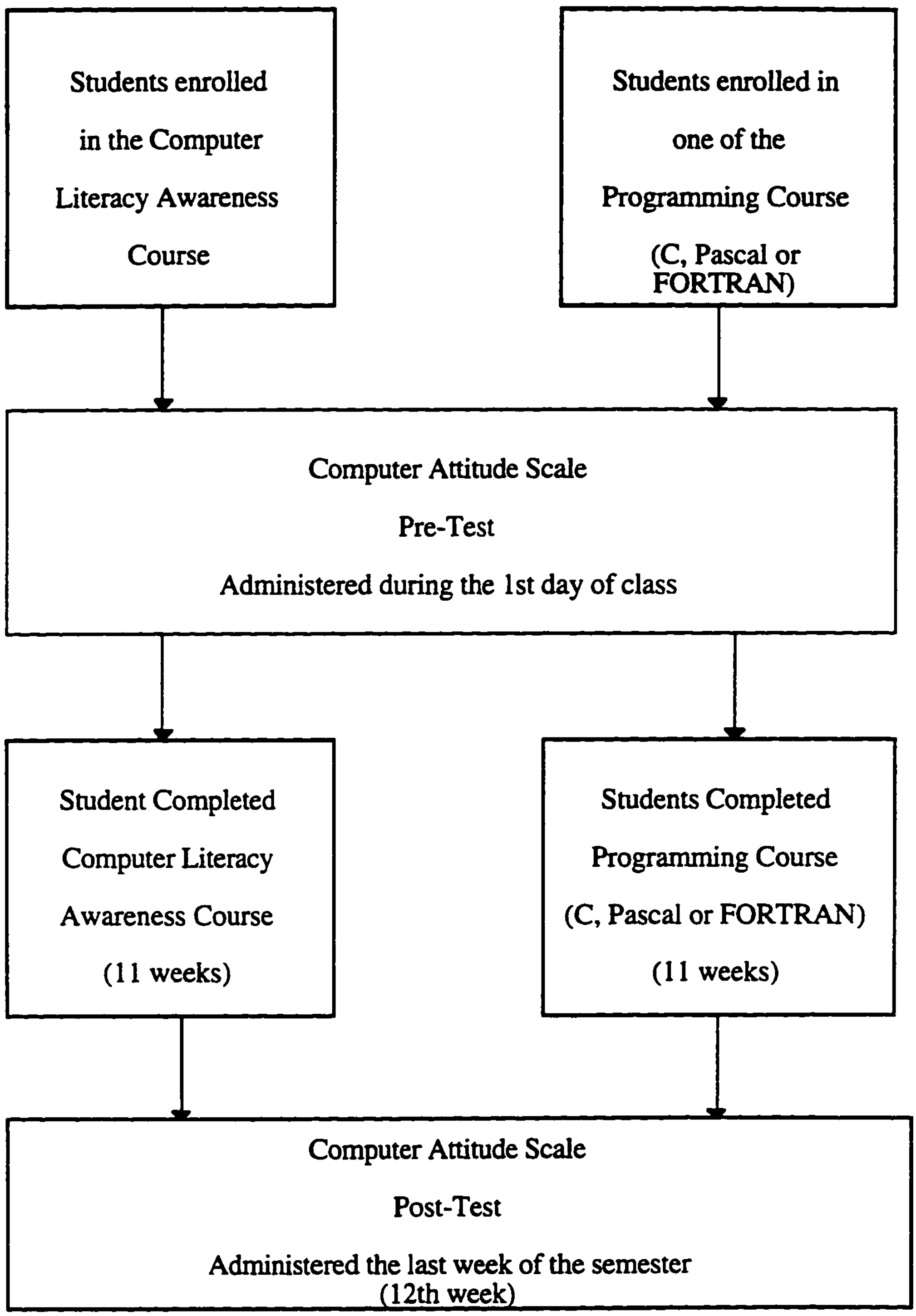
Students enrolled in the Computer Literacy Awareness Course
Students enrolled in one of the Programming Course (C, Pascal or FORTRAN)
Computer Attitude Scale
Pre-Test
Administered during the 1st day of class
Student Completed Computer Literacy Awareness Course (11 weeks)
Students Completed Programming Course (C, Pascal or FORTRAN) (11 weeks)
Computer Attitude Scale
Post-Test
Administered the last week of the semester (12th week)

FIGURE 1

Data Analysis

A one-shot quasi-experimental design was used in this study due to the lack of random assignment in the groups. The null hypothesis was tested by administering the Computer Attitude Scale (CAS) to all students enrolled in either a programming course (FORTRAN, C, or PASCAL) or a Computer Literacy Awareness Course during the first week of the summer 1996 semester. The data were analyzed by using analysis of covariance (ANCOVA), which is a variation of analysis of variance (ANOVA). ANCOVA was used to compensate for initial differences between groups on the pre-test by adjusting the post-test mean scores. The same test was administered and analyzed for the post-test. Alpha was set at 0.05 and beta was set at 0.20. Power was set as 1-β, which equals 0.80. A small effect size was set at 0.20. After setting alpha, power, and the effect size, the necessary sample size was calculated at 48 subjects, using the standard tables by Cohen and Cohen (1983).

Addressing Internal and External Validity Threats

External and internal validity threats must be addressed in any study. External validity refers to the degree to which results are generalizable, or applicable, to groups and environments outside the research setting. Internal validity refers to the degree to which observed differences on the dependent variable are directly related to the independent variable, not to some other uncontrolled variable.

External Validity

The following section consists of a discussion on external validity that could have affected this study.

Population Validity. The sample of students used for this study consisted of all students enrolled in a Computer Literacy Awareness Course or Programming course during the first week of the summer 1996 semester. The accessible population can be generalized to all college students required to enroll in either a Programming Course or a Computer Literacy Awareness Course.

Multiple Treatment Interface. Because a treatment was given to the students and the treatment had no interface, the Multiple Treatment Interface was not considered a validity threat.

Hawthorne Effect. Students was aware of their participation in this study, but since only a pre-test and post-test was given, the instructor assured the students and the researcher that the actual course would be routine.

Novelty/Disruption. No disruption or novelties were presented during the experiment. Therefore, this was not considered a threat.

Implementer Effect. Implementer Effect was considered as a potential threat because the courses were not taught in the same manner and were taught by different instructors.

Pre-Test Sensitization. All subjects took the pre-test, which consisted of 40 questions. There was an eleven week interval for desensitization before the post-test was administered, which controlled for this threat.

Interaction of History and Treatment. Interaction of history and treatment did not affect this study. Therefore, this was not considered as a threat.

Internal Validity

The following section consists of a discussion on internal validity that could have affected this study.

History. No unusual events occurred during the summer 1996 semester which created internal validity concerns.

Maturation. This was a possible threat because any student classification could enroll in these courses. Because this course was required, it was expected that many freshmen students would enrolled in the courses to help control for this threat. Instead of more freshmen enrolled in the course, there were more seniors enrolled in the courses that controlled for this threat.

Instrumentation. The following relate to possible instrument and experimenter effects on internal validity:

Instrument Decay. The same instrument was used for the pre-test and the post-test for all college students, thereby eliminating this threat.

Data Collector Characteristics. This was not a problem because the same data collector was used for all classes.

Data Collector Bias. This was not a problem because a standardized test was given to all students and the results came directly from those test scores.

Statistical Regression. Statistical regression was not considered a potential threat in this study because subjects were not selected on the basis of extreme scores.

Mortality. There was a concern with students dropping the course. Because this course was required, it was hoped that this would minimize this threat.

Location. There was a concern with location because the courses were held at different times and at different sites. All courses were not held in a constant location. This threat was minimized by ensuring that different locations was not systematically favoring the hypothesis. In addition, the researcher had no control over the location. The university decided where classes would be held.

Testing. There was a problem with giving a pre-test, but this threat was minimized by allowing eleven weeks between the pre-test and post-test.

Attitudes of Subjects. This was a possible threat due to the way the students viewed their participation in this study. This was minimized by the researcher and the instructor by assuring the students that this study was a regular part of the course.

Implementation. This was a possible threat because there were different teachers for each course. This threat was controlled by obtaining information on the details of what information and how that information was presented in the course. In addition, because the CAS is a standardized test, the threat of implementation was minimal.

CHAPTER IV

Results

This chapter is divided into three sections. The first section presents the descriptive statistics obtained from the scores on the Computer Attitude Scale (CAS) pre-test and post-test. The second section of this chapter presents the inferential statistical data yielded from testing the six null hypotheses outlined in Chapter I. Finally, the third section consists of a narrative description of the univariate statistics.

Descriptive Statistics

Computer Attitude Scale

The data collected are summarized in Table 4-1 to provide characteristics of this sample. There were more females (n=128) enrolled in the computer literacy courses than males (n=102), as shown in Table 4-1. There were seven freshman students, 34 sophomore students, 72 junior students and 117 senior students who participated in this study. With these courses being mandatory, it was expected that more freshman and sophomore students would be enrolled in the courses. However, there were a larger number of juniors and seniors students enrolled in the courses, which could be due to the juniors and seniors putting off taking the course until the summer semester. Family ownership corresponded to the student ownership variable: 111 families owned a computer and 119 families did not own a computer and 111 students owned a computer and 119 students did not own a computer. Two-hundred and seven students reported the main reason for enrolling in a computer literacy course was to fulfill the university's mandatory requirement; 23 students reported taking the course for the experience.

Table 4-1

Descriptive Statistics of the Computer Attitude Scale (CAS)

Variable	Group	# of
Gender	Female	128
	Male	102
Age	(19-24)	197
	(25-30)	23
	(31&over)	10
Length of C.E.	0-6 months	48
	6 months - 1 year	26
	more than 1 year	156
Enrollment Status	Full-Time	221
	Part-Time	9
Student Classification	Freshman	7
	Sophomore	34
	Junior	72
	Senior	117
C.E.	Had C.E.	226
	Never had C.E.	4
C.E. in High School	Had C.E.	182
	Never had C.E.	48
Computers Owned by Students	Owns a computer	111
	Does not own a computer	119
Computers Owned by Student's Families	Owns a computer	111
	Does not own a computer	119
Access to Computers	Have access to a computer	211
	Does not have computer access	19
Reason for Enrolling in the Course	Mandatory	207
	More experience	23

C.E. = Computer Experience

One part of the study consisted of measuring differences in computer attitudes by comparing African American and Caucasian college students, in order to determine whether an ethnic difference and a gender difference exists between the two groups and among the two groups. The other part of the study consisted of determining whether students enrolled in a science discipline have better attitudes toward computers than students in non-science disciplines, as measured by the Computer Attitude Scale (CAS)

The pre-test and post-test results of the Computer Attitude Scale questionnaire are presented in Table 4-2. The CAS provides a measure of computer attitudes. Higher scores indicated a more positive attitude toward computers, while a lower score represented a more negative attitude toward computers. The maximum score on the CAS was 140. The CAS used a Likert-type scale with scores ranging from 4.0 (strongly agree) to 1.0 (strongly disagree). Table 4-2 presents the pre-test and post-test computer attitude mean scores for all students who participated in this study according to the type of computer literacy course, gender, and ethnicity.

Results for African American college students participating in this study were: mean scores from females who were enrolled in the Computer Literacy Awareness course increased 2.4 points while mean scores from females enrolled in one of the programming courses decreased 0.2 points. Means scores from males who were enrolled in the Computer Literacy Awareness course showed a slight increase of 0.7 and mean scores from males enrolled in one of the programming course also showed a slight increase of 0.8. Females scores showed the largest overall mean score increase of 1.3. However, none of the changes were significant.

Table 4-2

Computer Attitude Scale (CAS) Results According to Gender, Ethnicity, and Type of Computer Literacy Course

Ethnicity	Type of Course	Gender	n	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Change in Mean Score
African American	C.L.A.	Female	35	99.0	3.7	101.4	5.1	2.4
		Male	13	103.4	8.4	104.1	9.0	0.7
	C.P.	Female	26	99.2	2.5	99.0	5.0	- 0.2
		Male	19	99.5	2.3	100.3	5.0	0.8
	All	Female	61	99.1	3.2	100.4	5.1	1.3
		Male	32	101.1	5.9	102.0	7.0	0.9
Caucasian	C.L.A.	Female	49	99.3	3.6	98.0	4.0	- 0.7
		Male	15	98.3	2.0	99.2	4.4	0.9
	C.P.	Female	18	100.0	3.5	100.0	4.0	0.0
		Male	55	98.5	4.0	99.4	3.8	0.9
	All	Female	67	99.3	3.5	98.4	4.0	- 0.9
		Male	70	98.4	3.7	99.3	3.9	0.9
All		Female	128	99.2	3.4	99.3	4.7	0.1
		Male	102	99.3	4.6	100.1	5.2	0.8

Note. N = 230; SD = Standard Deviation
C.L.A. = Computer Literacy Awareness Course
C.P. = Computer Programming Course (C, Pascal, or FORTRAN)

The overall mean score for Caucasian female college students showed a decrease of 0.9 when the pre-test and post-test were compared. The overall mean score for Caucasian male college students showed a increase of 0.9 when the pre-test and post-test scores were compared. Scores of females who were enrolled in the Computer Literacy Awareness course showed a slight decrease of 0.7 while scores of females enrolled in a computer programming course showed no differences when comparing the pre-test and the post-test. Scores of males who were enrolled in the Computer Literacy Awareness course or the a computer programming course showed a slight increase of 0.9.

The overall scores for African American and Caucasian female college students participating in this study showed a slight increase, 0.1, when comparing the pre-test and post-test computer attitude scores. The CAS scores of African American and Caucasian male college students showed a increase of 0.8 when comparing the pre-test and post-test computer attitude scores. Overall, male college students showed a slightly higher CAS score than female college students (0.7), when the pre-test and post-test were compared. Although some differences existed between and among African American and Caucasian college students, none of the differences were significant.

Inferential Statistics

This section presents an evaluation of the six research hypotheses which were stated in Chapter I of this study. The statistical analyses in this section were carried out using the statistical program StatView 4.02 on a Macintosh Performa 636 computer and are presented in Appendix F.

Missing Data

Before examining the inferential test used in this study, the question of missing data must first be addressed. In the current study, data were originally collected from 226 individual students on the CAS pre-test questionnaire. After the twelve week course, 230 students were post-tested using the CAS questionnaire. Out of the 279 students pre-tested and/or post-tested, 177 students completed the pre-test and the post-test, 49 students completed the pre-test but not the post-test, and 53 students completed the post-test but not the pre-test, as shown in Figure 2.

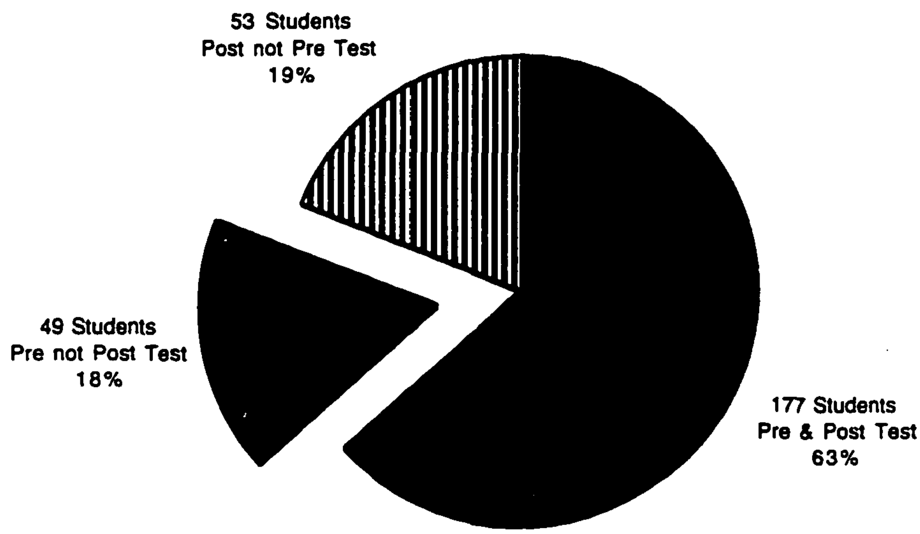

Figure 2: Students Participating in Study

Those subjects who missed the pre-test or post-test did so for a variety of reasons, including having being absent on the day the questionnaire was given, dropping the course before the end of the twelve week period, or adding the course after the pre-test was given. Questionnaire data were collected from all 177 students who completed the pre-test and post-test.

The treatment of missing data was conducted according to the guidelines suggested by Cohen and Cohen (1983), to drop subjects whose post-test score were missing. Therefore, 49 students not completing the post-test were dropped from the analyses, because little can be done when post-test scores (Y) are unknown.

Since there were multiple independent variables that had exactly the same missing data, coding all of them would have resulted in carrying redundant information. Therefore, the guidelines suggested by Cohen and Cohen (1983) were followed to code only one independent variable (pre-test scores).

Missing data in any research is always treated as a research factor in order to determine if the data were missing randomly or nonrandomly. Missing data are important because they carry information, regardless of whether the data are missing randomly or nonrandomly. If the data are missing randomly, then there is some systematic reason or rationale that can explain the missing data. To handle the missing data for the pre-test variable in this study, a dummy variable was created and coded 0 for data not missing and 1 for data missing, as represented in Appendix E. Once the information was coded, the variable post-test was regressed on to the missing data variable. From the regression analysis, the data were found to be missing randomly, thereby, causing the dummy variable to be discarded and allowing the missing pre-test scores to be plugged with the mean group pre-test scores for subsequent analyses.

Homogeneity of Regression

The use of the analysis of covariance necessitates the testing of the homogeneity of the regression assumption for the analysis of partial variance to be valid. This test examines the increase of the post-test variance (Y) that is attributable to set A x B (interaction), but not attributable to set A or B. If the increment in R^2 is significant, the homogeneity of regression assumption is rejected and the analysis of partial variance is invalid. If the increment in R^2 is not significant, the homogeneity of regression assumption is valid.

The results of the homogeneity test are presented in Table 4-3. The test for homogeneity was performed in 3 steps. First, Y (post-test) was regressed on the covariate set A (pre-test). Secondly, set B (independent variables) was entered into the regression equation and the test for significance of the increment of R^2 was determined. Finally, set A x B (interaction) was entered into the regression equation and the test of significance of the increment in R^2 was also determined. As shown in Table 4-3, the increment or increase in R^2, due to the addition of the interaction variable (A x B) did not result in significance, thereby indicating that the ANCOVA was an appropriate test to use.

ANCOVA Results

Once the assumption of homogeneity was shown to be valid, ANCOVA (Analysis of Covariance) was used to test the six null hypotheses in this study. This procedure was selected because it compensates for initial differences between groups on the pre-test by adjusting the post-test mean scores. In this study, the research factor of interest consisted of the results of the post-test score. When one administers a pre-test the information obtained from the experience of taking the pre-test could have an effect on the post-test scores. Since the pre-test scores are related to the post-test scores (Y), those effects need to be controlled. If those effects were not controlled, the scores could lead to confounding effects. Therefore, it is

Table 4-3

Hierarchical Cumulative R^2 Analysis of the Homogeneity of Regression Assumption for CAS in the ANCOVA Model

I.V. Set Added	df	Cum R^2	I	F
Set A	1, 228	0.324		
Set B	18, 211	0.410		
Set A x B	34, 195	0.464	0.004	1.69

Note, N = 230; I = Increment in R^2

I.V. = Independent Variable

Set A = Covariates (pre-test scores)

Set B = Independent Variables

Set A x B = Interaction

necessary to use ANCOVA, to remove any carry over information from preexisting conditions from the data.

Table 4-4 presents the ANCOVA results from the overall model analysis. Set A contained the covariate (pre-test), which were the results obtained on the pre-questionnaire. Set B consisted of the 18 independent variables (pre-test, ethnicity, age, student status (full-time or part-time), gender, student classification (freshman, sophomore, junior or senior), computer usage in high school, student computer ownership, student's family computer ownership, access, computer experience (0 to 6 months, 6 months to 1 year or more than 1 year), major, reason for taking the course and what type computer course enrolled in (programming or computer awareness)), which are presented in Appendix F. Set A x B included the interaction set. Table 4-4 shows that the covariate pre-test was significant to the model's variance. Table 4-4 also shows that no significant differences were observed in set B or set A x B.

No significant overall differences were observed, thus, the rules of statistical analysis prevented the researcher from conducting any further analyses. However, univariate statistical information was provided by the statistical program used in this analysis and is described later in this chapter.

Table 4-4

Analysis of Covariance of the Computer Attitude Scale Inventory

Source	df	MS	F	p
Set A (covariate)				
Pre-test	1, 228	16.340	109.28	0.0001*
Set B				
I.V.	18, 211	15.403	3.87	1.8120
Set A x B				
Interaction	34, 195	15.156	1.69	0.0853

Note, N = 230

*p < .05

Null Hypotheses

There were six null hypotheses that were tested in this study. Alpha was preset at .05 while power was preset for .80. Below, each null hypothesis is restated and then compared to the results.

Null Hypothesis 1

Ho_1: μ female = μ male. There will be no gender differences among African American and Caucasian college students computer attitudes as measured by the Computer Attitude Scale (CAS) inventory.

When examining the mean score data of gender, a small difference was observed, as can be seen in Appendix F. However, ANCOVA results indicated no statistical significantly differences between the female score and the male score. Based on this data, null hypothesis 1 could not be rejected.

Null Hypothesis 2

Ho_2: μ African American = μ Caucasian. There will be no difference among African American and Caucasian college students computer attitudes as measured by the CAS inventory.

ANCOVA results indicated no significant differences due to ethnicity. Therefore, null hypothesis 2 could not be rejected.

Null Hypothesis 3

Ho_3: μ programming course = μ computer literacy course. There will be no difference in computer attitudes between African American and Caucasian college students who enrolled in a programming course and those who enrolled computer literacy course as measured by the CAS inventory.

ANCOVA results indicated no significant differences due to the type of computer course. Null hypothesis 3 could not be rejected at this level.

Null Hypothesis 4

Ho_4: μ Science Major = μ Non-Science Major. There will be no difference in computer attitudes among African American and Caucasian college students who major in either a Science discipline or Non-Science discipline as measured by the CAS inventory.

ANCOVA results indicated no significant differences due to major. Based on this data null hypothesis 4 could not be rejected.

Null Hypothesis 5

Ho_5: μ (gender x ethnicity x course x major). No interaction effect exist between gender, ethnicity, course and major as measured by the CAS.

ANCOVA results indicated no significant interaction effect. Therefore, null hypothesis 5 could not be rejected.

Null Hypothesis 6

Ho_6: μ computer attitudes = 0. There will be no difference in computer attitudes of African American and Caucasian college students as a result of taking a computer literacy course as measured by the CAS inventory.

ANCOVA results indicated no significant difference in computer attitudes. Based on this data, Null hypothesis 6 could not be rejected.

Summary of Inferential Statistics

Statistical analysis failed to detect any differences in computer attitudes for the 230 college students who participated in this study. Enrolling in either a Computer Literacy Awareness Course or a programming course (C, Pascal, or FORTRAN) had no detectable effect on students' attitudes towards computers. Therefore, the six null hypothesis could not be rejected at the $p < .05$ level, based on these results. The ANCOVA and univariate statistical findings are discussed in the next chapter. The current results will be compared to the results of past studies and suggestions will be stated concerning finding.

Univariate ANCOVA of CAS

The rules of statistical analysis prohibit the researcher from further analyses when there is no statistical significant differences in the overall model. However, StatView, which was the statistical program used in analyzing the data, provided some univariate analysis results. These results will be discussed in this section.

The results of the univariate analysis are presented in Appendix F. It should be noted that when examining the univariate statistic, the increment procedure was not performed. No statistically significant results were obtained for most of the variables in the univariate analysis. However, the results obtained when set B (pre-test, ethnicity, age, student status (full-time or part-time), gender, student classification (freshman, sophomore, junior or senior), computer usage in high school, student computer ownership, student's family computer ownership, access, computer experience (0 to 6 months, 6 months to 1 year, or more than 1 year), major, reason for taking the course and what type computer course enrolled in (programming or computer awareness)), was entered into the equation was found to be significant at the $p < .0001$ level. Table 4-5 shows the independent variables that

Table 4-5

Analysis of Covariance of the Computer Attitude Scale Inventory

Source	t-Value	p-Value
Set A (covariate)		
Pre-test	10.454	0.0001*
Set B (I.V.)		
Ethnicity	-2.218	.0276*
Age	- .138	.0374*
Usage	-2.123	.0349*
Set A x B (Interaction)		
Access	-2.052	.0415*
Pre * Access	2.111	.0361*
Experience 2	2.795	.0057*
Pre * Experience 2	-3.067	.0025*

Pre = Pre-Test

*p < .05

were significant from set B include ethnicity ($p < .0276$), age ($p < .0374$) and Computer Usage (.0349) when alpha was preset at 0.05. However, set B overall was not found to be significant after the increment was calculated. It is suggested that ethnicity, age, computer usage, and computer attitudes be further examined in subsequent studies.

The results obtained after the interaction set was entered into the equation was also found to be significant at the $p < .0001$ level. The variables that were significant include Computer Access, the interaction of Computer Access and Pre-test, Computer Experience 2 and the interaction of Computer Experience and Pre-test.

Note that if the overall interaction set had been significant the ANCOVA would have been invalid, thereby, causing this study to be analyzed using Aptitude Treatment Interaction (ATI). In ATI an attempt is made to identify an interaction between two independent variables based on some trait(s) or attributes subjects bring into a research experiment.

CHAPTER V

DISCUSSIONS AND CONCLUSIONS

Summary of the Study

The principal goal of this research was to determine if differences in computer attitudes existed among African American and Caucasian college students based on gender and ethnicity. However, there were other variables that were analyzed, such as pre-test score, ethnicity, age, student status (full-time or part-time), gender, student classification (freshman, sophomore, junior or senior), computer usage in high school, student computer ownership, student's family computer ownership, access, computer experience (0 to 6 months, 6 months to 1 year, or more than 1 year), major, reason for taking the course and what type computer course enrolled in (programming or computer awareness). This study utilized two different designs: the one-shot and the quasi-experimental design. Two-hundred and thirty students, seven instructors, two sections of Computer Literacy Awareness courses, and five sections of a either a C, Pascal, or FORTRAN Programming course were used in this study.

The Computer Attitude Scale (CAS) was the instrument used to assess the students' attitudes. The CAS was designed by Brenda Loyd and Douglas Loyd in 1985. The CAS consists of 4 different sections comprised of Computer Confidence, Computer Liking, Computer Anxiety, and Computer Usefulness. The CAS was given during the first week (pre-test) of the semester and during the last week (post-test) of the twelve week semester. The same instrument was used for both pre-test and post-test. The data were analyzed using the Analysis of Covariance (ANCOVA).

Differences between and within groups did not prove to be statistically significant using the ANCOVA analysis. Therefore, research did not support the following research questions, as stated below.

1. Are there any gender differences among African American and Caucasian college students computer attitudes as measured by the Computer Attitude Scale (CAS) inventory? No gender differences were evident within or between African American and Caucasian college students.
2. Do African American and Caucasian college students differ in computer attitudes as measured by the CAS inventory? No differences in computer attitudes were evident between African American and Caucasian college students/
3. Is there a difference in computer attitudes among African American and Caucasian college students computer attitudes who enroll in a programming course or a computer literacy course as measured by the CAS inventory? No differences were evident between African American and Caucasian college students who enrolled in either a programming course or a computer literacy course.
4. Is there a difference among African American and Caucasian college students computer attitudes who major in either a science discipline or non-science discipline as measured by the CAS inventory? No difference was evident between African American and Caucasian college students who majored in either a science discipline or non-science discpline.
5. Are there any interactions among effect college students' gender, ethnicity, course, and major as measured by the CAS inventory? No interactions were found to exist between the college students' gender, ethnicity, course, and major.

6. Does taking a computer literacy course affect attitudes as measured by the CAS inventory? No computer attitude affects were found, as a result of having taken a computer literacy course.

Discussion of Results

The relationship among gender, ethnicity, and computer attitudes is important because research suggests that a failure to acquire computer literacy may become a barrier to women's and minorities' advancement in certain careers (Miura & Hess, 1983; Sutton, 1991). Several previous researchers had reported that a gender difference existed among students concerning attitudes toward computers. A majority of theses studies indicated that males and Caucasians had generally more positive attitudes toward computers than females and minorities. However, in this study no significant gender or ethnic differences were found to exist among African American and Caucasian college students. This finding confirmed studies by Morahan-Martin (1992), Temple & Lips (1989), Kay (1989) and Loyd & Gressard (1984) which failed to find a significant difference between male and female students in their attitude toward computers. Some possible explanation for these results are: (a) a majority of both African American and Caucasian college students reported having had prior computer experience; (b) there were more upper level students (juniors and seniors) enrolled in the computer literacy courses than lower level students (freshmen and sophomores); and (c) the study focused on to many independent variables.

The results of this study concerning gender and ethnic differences could be attributed to more computer experience and accessibility that college students have to computers versus other groups. As reported in earlier studies, poor and minority students who had little or no computer access had negative attitudes toward computers. Now, with the proliferation of computers in schools, those results are starting to diminish. In this study, nearly 32% reported at least 0 to 1 year of computer experience, while 68% reported having more than 1 year of computer experience. In general, students who had more computer experience expressed more positive attitudes toward computers. Koohang (1989) reported similar findings and also reported that building a strong experimental background with computers enhanced positive attitudes toward computers.

In 1987, Pea reported that minority students had inadequate access to computers and were experiencing an extreme educational disadvantage that would hamper their educational progress. However, the results of this study suggest this belief may be no longer true. These results could be due to both African American and Caucasian students being exposed to computers in high school and/or at home. Nearly 60% of the students participating in this research had computer experience in high school and 60% had computers at home.

The results could also be due to more upper level students enrollment in the computer literacy courses. Omar (1992) reported that there was a significant relationship between the college students' classification and attitude toward computers. It was reported that upper-level students (juniors and seniors) had more positive attitudes toward computers than lower-level students (freshmen and sophomores). When the ANCOVA results were analyzed, students' classification was not found to be significant. Through the observation of the descriptive statistics in this study, both male and female students showed a slight increase in positive attitudes toward computers after taking a computer literacy course. The mean score on the CAS pre-test and post-test consisted of 99.3 and 100.1 for male students (with a standard deviation of 4.6 and 6.1), and 99.2 and 99.3 for female students (with a standard deviation of 3.4 and 4.7), respectively. These close scores could be attributed to the fact that the majority of the sample (81%) consisted of junior and senior students who had already reported having had some computer experience. However, those results were not significant, as indicated in Chapter IV ($p < .05$). The students in this research were found to have positive attitudes toward computers before and after taking the mandatory computer course. The positive attitude associated with this sample could be attributed to the fact that most students might have had a significant amount of computer experience from having had other courses that required computer usage at the university. It was assumed that lower level students would not have had an excessive amount of computer experience from the university. From these results, further studies should be conducted employing a sample that consist of freshmen and sophomore students to ascertain if the results will be the same as the results in this study.

In addition, some other variables which were not the primary focus of this study also showed no significant difference when the overall ANCOVA was performed. These variables were age, student status (full-time or part-time), student classification (freshman, sophomore, junior or senior), computer usage in high school, student computer ownership, student's family computer ownership, access, computer experience (0 to 6 months, 6 months to 1 year, or more than 1 year), major, reason for taking the course and what type computer course enrolled in (programming or computer awareness). When observing the univariate statistics, some of these characteristic were found to be significant, such as ethnicity, age, computer experience and computer access. However, with the addition of the 18 independent variables, as described above, the overall ANCOVA results were found to be nonsignificant. Cohen and Cohen (1983) recommended that the smaller number of independent variables be used in a research project, the better the research will be. Using a considerable number of independent variables increases the researcher's chances of committing an experiment-wise error and not finding information that is possible there. Therefore it is recommended that further studies be conducted, focusing only on ethnicity, age, accessibility, and computer experience.

One noteworthy finding was that although there was no significant difference in African American and Caucasian students' attitudes toward college, the attitude toward computers of African American females measured before the course (99.1) and after the course (100.4) showed the largest improvement of any group studied in this research. Although these results were not significant, they suggest that more computer experience produces more positive attitudes toward computers for African American females. Due to the conflicting results of the ANCOVA procedure and the univariate statistics, further research should be conducted on this finding.

Previous research showed mixed results on gender differences in attitudes toward computers (Kay, 1992). This study confirmed studies that reported no statistical significant gender difference among college students attitudes toward computers (Chen, 1986; Kay, 1989; Koohang, 1989; Loyd & Gressard, 1986). Although the overall ANCOVA for this study was found to be nonsignificant, male students showed a slightly more positive attitude toward computers than female students before and after the CAS was administered. This finding mirrored with Moon, Kim, and McLean (1994) study which found that by the univariate analysis, male students had a slightly more positive attitude toward computers than female students. These results indicate some slight gender differences may exist.

Therefore, continuing efforts should be made to encourage computer usage and favorable computer experience among female students.

The results from this research did not indicate the presence of significant ethnic group differences in college students attitudes toward computers. African American and Caucasian college students' attitudes were very close, which indicated that both groups had similar attitudes towards computers. This study confirmed Campbell and Perry's (1988) research which found no ethnic group difference in computer attitudes, which suggest possibly that ethnicity does not determine computer attitudes. However, the mixed results from the univariate statistics show that some possible differences do exist. Therefore, it is recommended that further research on ethnicity and computer attitudes be conducted.

Omar (1992) reported that age would be an important factor when examining computer attitudes because younger people were found to have more positive attitudes toward computers than older people. The current study found no significant relationship between students' ages and their attitudes toward computers. However, in the univariate analysis, age was found to be significant. The finding from the univariate analysis could be attributed to younger students having computer experience and computer accessibility at an early age, whereas, computer accessibility for older students were very limited years ago. Given these results, further studies should be conducted.

The variables related to computer experience or computer exposure were analyzed because Levin and Gordon (1989) reported that prior computer exposure (in particular, having a computer at home) had a strong influence on a student's attitude toward computers. This study found no significant relationship between prior computer experience of African American and Caucasian college students' attitudes toward computers when the ANCOVA was analyzed. Some differences were present when analyzing the univariate statistics. The results from the univariate analysis suggest that computer experience has an impact on computer attitude. Overall, a majority of the African American and Caucasian college students reported having had prior computer experience. These mixed results warrant further investigations on computer experience, ethnicity and computer attitudes.

It was assumed that students enrolled in a science discipline would have more positive attitudes toward computers than students enrolled in a non-science discipline, because a majority of science field disciplines work closely with current computer technology to conduct experiments. However, in this study, no significant relationship was found to exist between the student's major and attitude toward computers. These results suggest that attitudes toward computer are not determined by a student's major. In general, both African American and Caucasian students' attitudes toward computers were fairly positive, regardless of their major.

While a majority of the research reports significant gender differences, the current research failed to confirm those results. Results from this study found no significant gender or ethnic differences among African American and Caucasian college students attitude toward computers. However, from observation of the univariate results, some of the variables in this study might have shown significant results, such as ethnicity, age, computer experience, computer usage, and computer accessibility if the study had focused on those variables alone. Results from the ANCOVA and univariate statistics sufficiently warrant future studies in these areas, as suggested later in this chapter.

Limitation of Study

The following limitations apply to this study:

1. The major limitation to this study was that the subjects were not randomly selected. This was a one-shot quasi-experimental design with subjects grouped through university registration procedures.
2. There was a possibility that since the majority of the sample consisted of juniors and seniors, they might have had earlier computer experience at the university from having had prior courses which might have required computer usage.
3. Data for this study were collected during only one school semester. A further study in which data should have been gathered for a longer period of time might yield different results.
4. The Computer Literacy Awareness Course and sections of the programming course were taught by different instructors in different locations

Recommendations for Further Research

The results of this study suggest several future research areas. These include:

1. Future research can limit emphasis to ethnicity and computer attitudes.
2. Future research can limit emphasis to socioeconomic status and computer attitudes.
3. Future research can limit emphasis to computer experience, ethnicity, and computer attitudes.
4. Future research can limit emphasis to ethnicity, age, accessibility, and experience of computers and computer attitudes.

5. Further research should employ a larger sample size and be conducted for a longer period of time.
6. Since this study sample consisted of predominately juniors and seniors, future research can place emphasis on freshman and sophomore students to see if the results are the same.
7. This study should be replicated during the Spring or Fall Semester to ascertain if the results will be the same as the results in the Summer Semester.

Conclusion

What does this study mean in terms of African American and Caucasian students attitude toward computers? In past studies associated with different areas of education, African Americans have trailed Caucasian college students. African Americans with low SES, did not have access to computers at home or at school. Now, with the proliferation of computers in schools today, nearly all students, regardless of SES have access to computers at schools. Previous studies have indicated that gender differences existed between male and female students with respect to computer attitudes. Males have been reported to have more positive attitudes toward computers than females. However, in this study, no significant gender or ethnic difference was found to exist between or among African American and Caucasian college students. These results suggest that in general, African American and Caucasian college students have fairly positive attitudes toward computers before and after taking a computer literacy course. The positive attitude toward computers found in this study could be attributed to 68% of the sample having had previous computer experience.

While the overall results indicated no significant differences existed among African American and Caucasian college students attitude toward computers, the univariate analysis suggests otherwise. In fact, as evident from the univariate statistics, some ethnic differences might have been seen if the number of characteristics were limited. The question regarding ethnic differences between African American and Caucasian college students will require additional studies from a national population of college students with a better experimental design. However, gender differences were not found from the ANCOVA procedure or the univariate statistics, which may indicate that gender does not determine attitudes about computers. The differences in results regarding gender differences in computer attitudes from past research may be due to the time when the study was conducted. But with the growth of computer technology in education, gender differences may have decreased dramatically or no longer exist.

Lack of significant results may also be due to some positive factors in today's society. In the past, many studies have reported that females and minorities displayed more negative attitudes toward computers than males and Caucasians, which were attributed to males being more interested in computers and Caucasian having greater access to computers either at home or at school than African American students. From the results of this study, nearly all groups reported having had access to computers either at home or at school. In addition, nearly all students reported having had some computer experience before taking the computer literacy courses. The positive factors in today's society could be that more schools and families are making computer technology available to students regardless of ethnicity or gender.

Since individuals who participated in this study were not randomly selected, it would be inappropriate to conclude from the results that all African American and Caucasian college students had similar attitudes about computers. As discussed previously in this chapter, results did not support some previous studies which indicated that males and Caucasians have significantly more positive attitudes toward computers than females and minorities. The results of this study may indicate that African American and Caucasian college students in this study are moving toward equity in their attitudes toward computers at the college level.

In addition, the results from this study provided no information that indicated to teachers or advisors what type of computer course students should enroll in at college when given a choice between a programming course or a Computer Literacy Awareness Course. According to major, the results suggest that it does not matter what type of computer literacy course students take.

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APPENDIX A

CONSENT TO SERVE AS A SUBJECT IN RESEARCH

I am seeking your participation in a research project involving a study comparing the computer attitudes of college students. This study will involve about 300 persons, who like yourself are enrolled in one of the Computer Literacy Awareness Courses. The results of this research may be reported in a professional journal.

If you agree to participate you will be given a survey concerning your attitude about computers. The survey will take approximately 10 minutes. At the end of the semester you will be given another survey in order to determine your attitude about computers after completion of the course.

Your participation will not subject you to any physical pain or risk. Your name will not be recorded on the interview sheet. You will be assigned an anonymous code number. I assure you that any reports about this research will contain only data of an anonymous or statistical nature. Your name and school will not be disclosed. Your participation will not affect your grade in the course nor will your instructor have access to individualized scores.

Any question you have regarding this research may be directed to Pamela Luckett at (407) 676-6517 or Dr. Robert Fronk at (407)768-8000 ext. 8126.

Your signature on the consent form indicates that you agree to participate in this research and that:

1. You have read and understand the information provided above.
2. You understand that participation is voluntary and that refusal to participate will involve no penalty; and
3. You understand that you are free to discontinue participation at any time without penalty.

APPENDIX B

CONSENT TO SERVE AS A SUBJECT IN RESEARCH

I consent to serve as a subject in the research investigation comparing computer attitudes of college students.

The nature and general purpose of the research procedure and the known risks involved have been explained to me by Pamela Luckett. The investigator is authorized to proceed on the understanding that I may terminate my participation in this research at any time I so desire.

I understand that there are no foreseen risks associated with this study.

I understand also that it is not possible to identify all potential risks in an experimental procedure, and I believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks.

Signed________________________________

Date__________________________________

APPENDIX C

STUDENT QUESTIONNARE

Directions

Read the following questions and circle the correct response or fill-in the appropriate response.

Demographic Information

1. Student ID # ____________________
2. Age ____________________
3. Major ____________________
4. Full-time or Part-time
5. Ethnicity
   - African American
   - Hispanic American
   - Asian American
   - Native American/Eskimo
   - White American
   - Foreign National
6. Gender Female Male
7. Classification Freshman Sophomore Junior Senior
8. Have you ever used a computer? Yes No
9. Did you use a computer in high school? Yes No
10. Do you own a computer? Yes No
11. Did your family own a computer? Yes No
12. Do you have regular access to a computer Yes No

13. Experience with learning about or working with computers:

    Less than six months

    Six months to one year

    More than one year

14. Why are you taking this course during the summer semester?_____________

    ____

COMPUTER ATTITUDE SCALE

Permission was granted to use the Computer Attitude Scale (CAS) designed by Dr. B. Loyd and Dr. D. Loyd.

1. Computers do not scare me at all.
2. I'm no good with computers
3. I would like working with computers.
4. I will use computers many ways in my life.
5. Working with a computer would make me very nervous.
6. Generally I would feel OK about trying a new problem on the computer.
7. The challenge of solving problems with computers does not appeal to me.
8. Learning about computers is a waste of time.
9. I do not feel threatened when others talk about computers.
10. I don't think I would do advanced computer work.
11. I think working with computers would be enjoyable and stimulating.
12. Learning about computers is worthwhile.
13. I feel aggressive and hostile toward computers.
14. I am sure I could do work with computers.

15. Figuring out computer problems does not appeal to me
16. I'll need a firm mastery of computers for my future work.
17. It wouldn't bother me at all to take computer courses.
18. I'm not the type to do well with computers.
19. When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer.
20. I expect to have little use for computers in my daily life.
21. Computers make me feel uncomfortable.
22. I am sure I could learn a computer language.
23. I don't understand how some people can spend so much time working with computers and seem to enjoy it.
24. I can't think of any way that I will use computers in my career.
25. I would feel at ease in a computer class.
26. I think using a computer would be very hard for me.
27. Once I start to work with the computer, I would find it hard to stop.
28. Knowing how to work with computers will increase my job possibilities.
29. I get a sinking feeling when I think of trying to use a computer.
30. I could get good grades in computer courses.
31. I will do as little work with computers as possible.
32. Anything that a computer can be used for, I can do just as well some other way.
33. I would feel comfortable working with a computer.
34. I do not think I could handle a computer course.
35. If a problem is left unsolved in a computer class, I would continue to think about it afterward.

36. It is important to me to do well in computer classes.
37. Computers make me feel uneasy and confused.
38. I have a lot of self-confidence when it comes to working with computers.
39. I do not enjoy talking with others about computers.
40. Working with computers will not be important to me in my life's work.

Appendix D

DESCRIPTIVE STATISTICS

Table D1

CAS Pre-test and CAS Post-test Scores for All Students

	CAS Pre-Test	CAS Post-Test
Mean	99.235	99.691
Std. Dev.	3.951	4.906
Std. Error	.261	.323
Count	230	230
# Missing	0	0

Table D2

CAS Pre-test and CAS Post-test Scores for All Female Students

	CAS Pre-Test	CAS Post-Test
Mean	99.211	99.344
Std. Dev.	3.373	4.673
Std. Error	.298	.413
Count	128	128
# Missing	0	0

Table D3

CAS Pre-test and CAS Post-test Scores for All Male Students

	CAS Pre-Test	CAS Post-Test
Mean	99.265	100.127
Std. Dev.	4.592	5.174
Std. Error	.455	.512
Count	102	102
# Missing	0	0

Table D4

CAS Pre-test and CAS Post-test Scores for All African American Students

	CAS Pre-Test	CAS Post-Test
Mean	99.763	100.871
Std. Dev.	4.367	5.861
Std. Error	.453	.608
Count	93	93
# Missing	0	0

Table D5

CAS Pre-test and CAS Post-test Scores for All Caucasian Students

	CAS Pre-Test	CAS Post-Test
Mean	98.876	98.891
Std. Dev.	3.615	3.961
Std. Error	.309	.338
Count	137	137
# Missing	0	0

Table D6

CAS Pre-test and CAS Post-test Scores for All African American Female Students

	CAS Pre-Test	CAS Post-Test
Mean	99.082	100.361
Std. Dev.	3.200	5.135
Std. Error	.410	.657
Count	61	61
# Missing	0	0

Table D7

CAS Pre-test and CAS Post-test Scores for All African American Male Students

	CAS Pre-Test	CAS Post-Test
Mean	101.062	101.844
Std. Dev.	5.842	7.030
Std. Error	1.033	1.243
Count	32	32
# Missing	0	0

Table D8

CAS Pre-test and CAS Post-test Scores for All Caucasian Female Students

	CAS Pre-Test	CAS Post-Test
Mean	99.328	98.418
Std. Dev.	3.544	4.027
Std. Error	.433	.492
Count	67	67
# Missing	0	0

Table D9

CAS Pre-test and CAS Post-test Scores for All Caucasian Male Students

	CAS Pre-Test	CAS Post-Test
Mean	98.443	99.343
Std. Dev.	3.654	3.871
Std. Error	.437	.463
Count	70	70
# Missing	0	0

Table D10

CAS Pre-test and CAS Post-test Scores for All African American Female Students Enrolled in the Computer Literacy Awareness Course

	CAS Pre-Test	CAS Post-Test
Mean	98.971	101.400
Std. Dev.	3.650	5.077
Std. Error	.617	.858
Count	35	35
# Missing	0	0

Table D11

CAS Pre-test and CAS Post-test Scores for All African American Male Students Enrolled in the Computer Literacy Awareness Course

	CAS Pre-Test	CAS Post-Test
Mean	103.385	104.077
Std. Dev.	8.372	9.014
Std. Error	2.322	2.500
Count	13	13
# Missing	0	0

Table D12

CAS Pre-test and CAS Post-test Scores for All Caucasian Female Students Enrolled in the Computer Literacy Awareness Course

	CAS Pre-Test	CAS Post-Test
Mean	99.265	97.939
Std. Dev.	3.598	4.013
Std. Error	.514	.573
Count	49	49
# Missing	0	0

Table D13

CAS Pre-test and CAS Post-test Scores for All Caucasian Male Students

Enrolled in the Computer Literacy Awareness Course

	CAS Pre-Test	CAS Post-Test
Mean	98.267	99.200
Std. Dev.	2.017	4.395
Std. Error	.521	1.135
Count	15	15
# Missing	0	0

Table D14

CAS Pre-test and CAS Post-test Scores for All African American Female Students

Enrolled in a Computer Programming Course

(C, Pascal, or FORTRAN)

	CAS Pre-Test	CAS Post-Test
Mean	99.231	98.962
Std. Dev.	2.535	4.968
Std. Error	.497	.974
Count	26	26
# Missing	0	0

Table D15

CAS Pre-test and CAS Post-test Scores for All African American Male Students Enrolled in a Computer Programming Course (C, Pascal, or FORTRAN)

	CAS Pre-Test	CAS Post-Test
Mean	99.474	100.316
Std. Dev.	2.343	4.989
Std. Error	.537	1.145
Count	19	19
# Missing	0	0

Table D16

CAS Pre-test and CAS Post-test Scores for All Caucasian Female Students Enrolled in a Computer Programming Course (C, Pascal, or FORTRAN)

	CAS Pre-Test	CAS Post-Test
Mean	99.500	99.722
Std. Dev.	3.485	3.878
Std. Error	.821	.914
Count	18	18
# Missing	0	0

Table D17

CAS Pre-test and CAS Post-test Scores for All Caucasian Male Students

Enrolled in a Computer Programming Course

(C, Pascal, or FORTRAN)

	CAS Pre-Test	CAS Post-Test
Mean	98.491	99.382
Std. Dev.	3.999	3.759
Std. Error	.539	2.500
Count	55	55
# Missing	0	0

Appendix E

MISSING DATA ANALYSIS

Correlation Matrix

	POST-TEST	PRE-Mis
POST-TEST	1.000	-.096
PRE-Mis	-.096	1.000

230 observations were used in this computation.

This is the bivariate correlation between Y (post-test) and the missing data variable pre-test.

Regression Summary

POST-TEST vs. PRE-Mis

Count	230
Num. Missing	0
R	.096
R Squared	9.267E-3
Adjusted R Squared	4.921E-3
RMS Residual	4.894

ANOVA Table

POST-TEST vs. PRE-Mis

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Regression	1	51.069	51.069	2.133	.1456
Residual	228	5460.014	23.947		
Total	229	5511.083			

Regression Coefficients

POST-TEST vs. PRE-Mis

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	99.949	.368	99.949	271.729	<.0001
PRE-Mis	-1.119	.766	-.096	-1.460	.1456

This shows that the bivariate r2 is not significant at the 0.05 level. As a result the dummy variable that was created from missing pre-test can be discarded and the conclusion can be made that the data are missing randomly. No the missing entries can be plugged with the mean of pre-test, which is 94 and the regression equation can be re-analyzed.

Appendix F

INFERENTIAL STATISTICS

Hierarchical R^2 Analysis of the Homgeneity of the Regression Assumption in the ANCOVA Model

Set A

Step 1: Regress Post-test (Y) on the covariate Pre-test and examine R^2.

Regression Summary

POST-TEST vs. PRE-TEST

Count	230
Num. Missing	0
R	.569
R Squared	.324
Adjusted R Squared	.321
RMS Residual	4.042

ANOVA Table

POST-TEST vs. PRE-TEST

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Regression	1	1785.590	1785.590	109.278	<.0001
Residual	228	3725.493	16.340		
Total	229	5511.083			

POST-TEST vs. PRE-TEST

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	29.562	6.714	29.562	4.403	<.0001
PRE-TEST	.707	.068	.569	10.454	<.0001

The covariate (pre-test) is barely significant. 32% of the post-test (Y) variance is accounted for by the pre-test.

Set B

Step 2: Enter the IVs from set B into the equation.

POST-TEST vs. 18 Independents

Count	230
Num. Missing	0
R	.641
R Squared	.410
Adjusted R Squared	.360
RMS Residual	3.925

ANOVA Table
POST-TEST vs. 18 Independents

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Regression	18	2261.067	125.615	8.155	<.0001
Residual	211	3250.015	15.403		
Total	229	5511.083			

Regression Coefficients
POST-TEST vs. 18 Independents

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	40.629	7.893	40.629	5.148	<.0001
PRE-TEST	.695	.070	.560	9.975	<.0001
ETHNICITY	-1.245	.561	-.125	-2.218	.0276
AGE	-.196	.094	-.138	-2.095	.0374
STATUS	-.091	1.417	-3.592E-3	-.064	.9490
GENDER	-.815	.596	-.083	-1.369	.1726
Class1	-.420	1.594	-.015	-.263	.7925
Class2	1.050	.844	.076	1.244	.2149
Class3	.783	.634	.074	1.236	.2179
USAGE	-4.543	2.139	-.121	-2.123	.0349
USE IN H.S.	-1.394	.817	-.116	-1.707	.0893
OWNERSHIP	.525	.629	.054	.836	.4043
FAMILY OWN	.109	.585	.011	.186	.8527
ACCESS	1.574	1.051	.089	1.498	.1356
Experience1	-.353	.817	-.029	-.432	.6660
Experience2	.286	.907	.018	.315	.7532
MAJOR	-.201	1.141	-.021	-.176	.8601
REASON	-.875	.916	-.054	-.956	.3403
PROG. OR CL	.341	1.171	.035	.291	.7713

The increment of $R^2_{y \cdot AB}$ is .410 - .324 = .096. An F test with df = 1, 228 (3.87) shows that this increment is not significant (F = 1.812) for p< .05. This is the overall F test of the ANCOVA.

Set B gives the impression of being significant, however the increment had not been calculated.

We still do not know whether we have a valid ANCOVA as far as meeting the assumption of homogeniety of regression of post-test (Y) on set A. We must investigate the interaction.

Set A x B

Step 3: Enter the interaction into the equation and observe R^2.

Regression Summary
POST-TEST vs. 34 Independents

Count	230
Num. Missing	0
R	.681
R Squared	.464
Adjusted R Squared	.370
RMS Residual	3.893

ANOVA Table
POST-TEST vs. 34 Independents

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Regression	34	2555.705	75.168	4.960	<.0001
Residual	195	2955.377	15.156		
Total	229	5511.083			

Regression Coefficients
POST-TEST vs. 34 Independents

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	30.936	78.913	30.936	.392	.6955
PRE-TEST	.773	.789	.623	.980	.3283
ETHNICITY	-.828	3.872	-.083	-.214	.8310
Pre*Ethnicity	-6.643E-3	.039	-.066	-.171	.8641
AGE	-.151	.099	-.106	-1.531	.1273
STATUS	22.904	42.435	.907	.540	.5900
Pre*Status	-.229	.426	-.918	-.537	.5917
GENDER	22.036	16.005	2.236	1.377	.1701
Pre*Gender	-.227	.161	-2.291	-1.410	.1601
Class1	-2.900	4.241	-.102	-.684	.4950
Pre * Class1	.024	.040	.088	.596	.5515
Class2	1.053	3.961	.076	.266	.7906
Pre*Class2	9.673E-5	.041	6.900E-4	2.388E-3	.9981
Class3	1.782	2.820	.169	.632	.5282
Pre*Class3	-9.793E-3	.028	-.093	-.344	.7310
USAGE	35.778	61.245	.955	.584	.5598
Pre*Usage	-.395	.605	-1.092	-.653	.5146
USE IN H.S.	1.518	20.893	.126	.073	.9422
Pre*Use In HS	-.032	.211	-.267	-.154	.8780
OWNERSHIP	.892	4.011	.091	.222	.8242
Pre*Owner	-3.185E-3	.041	-.032	-.079	.9375
FAMILY OWN	-2.665	16.081	-.272	-.166	.8685
Pre*Fam Own	.028	.162	.284	.173	.8626
ACCESS	-49.684	24.214	-2.794	-2.052	.0415
Pre*Access	.511	.242	2.872	2.111	.0361
Experience1	.981	4.264	.081	.230	.8182
Pre*Exp1	-.011	.043	-.089	-.252	.8015
Experience2	4.606	1.648	.293	2.795	.0057
Pre*Exp3	-.043	.014	-.312	-3.067	.0025
MAJOR	-40.733	35.871	-4.159	-1.136	.2575
Pre*Major	.415	.371	4.222	1.120	.2642
REASON	-15.252	20.570	-.935	-.741	.4593
Pre*Reason	.151	.209	.927	.723	.4706
PROG. OR CL.	31.909	34.899	3.258	.914	.3617
Pre*Pro or Cl	-.329	.361	-3.354	-.913	.3623

The $R^2_{y \cdot AB \times AxB}$ for all the IVs is 0.464. The increment is 0.464 - 0.460 = .004. The corresponding (calculated) F value for this increment is 1.65, which is not significant for $p < .05$. Therefore, we can go back to step 2 and adjust the mean because we have a valid ANCOVA.

Appendix G

Raw Data

	A	B	C	D	E	F
1	PRE-TEST . = Missing Data	POST-TEST	ETHNICITY 1 = African 2 = Caucasian	AGE	STATUS 1 = Full-Time 2 = PartTime	GENDER 1 = Female 2 = Male
2	96	102	1	20	1	1
3	105	103	1	19	0	1
4	98	99	1	21	1	1
5	103	99	1	21	1	1
6	97	96	1	20	0	1
7	96	99	1	20	1	1
8	100	96	1	21	1	0
9	99	100	1	25	1	1
10	100	103	1	21	1	1
11	96	96	1	19	1	1
12	93	81	1	21	1	1
13	98	97	1	19	1	1
14	99	98	1	42	1	1
15	108	102	1	34	1	1
16	92	98	1	20	1	1
17	93	97	1	19	1	1
18	102	100	1	19	1	1
19	100	99	1	26	1	1
20	96	102	1	20	1	0
21	99	99	1	19	1	1
22	101	100	1	20	1	0
23	96	95	1	30	1	0
24	97	95	1	25	1	1
25	98	100	1	22	0	1
26	97	100	1	24	0	1
27	99	97	1	19	1	1
28	102	96	1	22	1	1
29	103	100	1	29	1	0
30	94	99	1	22	1	0
31	99	100	1	21	1	0
32	97	103	1	23	1	0
33	107	106	1	22	1	0
34	96	95	1	35	0	0
35	97	97	1	24	1	0
36	100	97	1	27	1	0
37	99	102	1	46	0	0
38	94	92	1	20	1	0
39	98	96	1	20	1	0
40	97	97	1	21	1	0

	A	B	C	D	E	F
1	PRE-TEST . = Missing Data	POST-TEST	ETHNICITY 1 = African 2 = Caucasian	AGE	STATUS 1 = Full-Time 2 = PartTime	GENDER 1 = Female 2 = Male
41	89	88	1	24	1	0
42	100	99	1	24	1	1
43	93	92	1	25	1	1
44	100	100	1	20	1	1
45	99	98	1	20	1	1
46	102	103	1	23	1	1
47	98	95	1	20	1	1
48	99	93	1	22	1	1
49	106	104	0	20	1	1
50	99	102	0	21	1	0
51	97	100	0	21	1	0
52	98	100	0	24	1	0
53	99	106	0	21	1	1
54	106	106	0	20	1	1
55	103	105	0	22	1	1
56	95	99	0	23	1	1
57	100	100	1	22	1	0
58	95	98	0	19	1	1
59	103	103	0	22	1	0
60	108	109	0	23	1	0
61	98	100	0	23	1	0
62	95	98	C	22	1	1
63	101	93	1	27	1	1
64	95	96	1	20	1	1
65	98	94	1	22	1	1
66	98	92	1	19	0	1
67	103	99	1	20	1	1
68	99	103	1	20	1	0
69	103	97	1	24	1	1
70	105	103	1	34	1	1
71	110	94	1	31	1	1
72	101	99	1	22	1	1
73	97	93	1	21	1	1
74	99	96	1	21	1	1
75	97	96	1	21	1	1
76	101	98	1	20	0	0
77	106	103	1	19	0	1
78	96	103	1	23	1	0
79	95	97	1	22	1	0

	A	B	C	D	E	F
1	PRE-TEST . = Missing Data	POST-TEST	ETHNICITY 1 = African 2 = Caucasian	AGE	STATUS 1 = Full-Time 2 = PartTime	GENDER 1 = Female 2 = Male
80	97	94	1	25	1	1
81	97	99	1	25	1	0
82	102	102	1	22	1	0
83	97	91	1	25	1	0
84	98	103	1	20	1	1
85	99	101	1	21	1	1
86	95	99	1	19	1	1
87	92	108	0	20	1	1
88	95	98	0	19	1	0
89	104	97	0	23	1	0
90	97	99	0	20	1	1
91	95	108	0	20	1	1
92	105	97	0	22	1	1
93	102	103	0	20	1	1
94	96	94	0	23	1	1
95	95	101	0	19	1	1
96	107	98	0	19	1	1
97	96	99	0	25	1	1
98	98	101	0	21	1	1
99	101	109	0	19	1	1
100	99	98	0	20	1	1
101	96	102	0	22	1	1
102	98	99	0	24	1	1
103	102	101	0	20	1	1
104	96	98	0	21	1	1
105	94	94	1	20	1	0
106	100	99	1	30	1	0
107	96	94	1	27	1	0
108	101	100	1	21	1	0
109	101	98	1	28	1	0
110	99	100	1	25	1	0
111	102	102	1	23	1	0
112	96	100	1	19	1	0
113	102	102	1	20	1	0
114	101	102	1	22	1	1
115	105	110	1	23	1	0
116	93	95	1	21	1	0
117	94	95	1	20	1	0
118	100	100	1	22	1	0

	A	B	C	D	E	F
1	PRE-TEST . = Missing Data	POST-TEST	ETHNICITY 1 = African 2 = Caucasian	AGE	STATUS 1 = Full-Time 2 = PartTime	GENDER 1 = Female 2 = Male
119	99	100	1	21	1	0
120	93	96	1	22	1	0
121	106	106	1	20	1	0
122	100	102	1	22	1	0
123	97	100	1	23	1	0
124	102	101	1	23	1	1
125	103	104	1	23	1	0
126	103	103	1	24	1	1
127	97	98	1	22	1	0
128	101	100	1	23	1	0
129	97	100	1	21	1	0
130	96	98	1	22	1	0
131	100	100	1	23	1	0
132	98	100	1	24	1	0
133	103	105	1	20	1	1
134	99	101	1	22	1	1
135	103	103	1	23	1	0
136	99	100	1	22	1	0
137	91	95	1	23	1	1
138	87	100	1	22	1	0
139	97	100	1	24	1	0
140	94	100	1	23	1	0
141	96	100	1	24	1	1
142	99	100	1	25	1	1
143	100	100	1	25	1	0
144	110	110	1	20	1	0
145	98	100	1	21	1	0
146	99	100	1	25	1	0
147	98	98	1	22	1	0
148	100	100	1	22	1	0
149	99	100	1	19	1	1
150	97	97	1	24	1	0
151	97	99	1	23	1	0
152	105	106	1	21	1	1
153	98	96	1	34	1	0
154	99	100	1	24	1	0
155	102	102	1	28	1	1
156	99	100	0	19	1	1
157	102	103	0	20	1	1

	A	B	C	D	E	F
1	PRE-TEST . = Missing Data	POST-TEST	ETHNICITY 1 = African 2 = Caucasian	AGE	STATUS 1 = Full-Time 2 = PartTime	GENDER 1 = Female 2 = Male
158	94	95	0	21	1	0
159	103	100	0	20	1	0
160	104	110	0	21	1	1
161	103	105	0	24	1	1
162	93	95	0	24	1	1
163	97	100	0	23	1	0
164	95	100	0	22	1	1
165	101	100	0	23	1	1
166	108	110	0	34	1	0
167	98	100	0	23	1	0
168	100	100	0	21	1	1
169	114	118	0	19	1	0
170	106	110	0	25	1	1
171	100	105	0	26	1	1
172	98	98	0	21	1	0
173	120	120	0	21	1	0
174	115	118	0	19	1	0
175	92	95	0	20	1	1
176	103	103	1	20	1	1
177	100	103	0	24	1	1
178	100	106	0	21	1	1
179	.	114	0	23	1	1
180	.	95	1	22	1	1
181	.	100	1	23	1	1
182	.	98	1	24	1	0
183	.	108	1	24	1	0
184	.	101	1	22	1	1
185	.	95	1	23	1	1
186	.	97	1	21	1	0
187	.	93	1	22	1	1
188	.	103	1	21	1	1
189	.	103	1	21	1	0
190	.	94	1	22	1	0
191	.	102	1	22	1	1
192	.	99	1	23	1	1
193	.	91	0	21	1	1
194	.	100	0	23	1	1
195	.	98	0	24	1	1
196	.	100	0	22	1	0

	A	B	C	D	E	F
1	PRE-TEST . = Missing Data	POST-TEST	ETHNICITY 1 = African 2 = Caucasian	AGE	STATUS 1 = Full-Time 2 = PartTime	GENDER 1 = Female 2 = Male
197	.	99	0	24	1	0
198	.	103	0	21	1	1
199	.	96	0	22	1	1
200	.	98	0	25	1	0
201	.	98	0	24	1	0
202	.	97	0	23	1	1
203	.	100	0	24	1	1
204	.	101	0	25	1	0
205	.	91	0	23	1	1
206	.	96	0	23	1	0
207	.	101	0	22	1	1
208	.	98	0	24	1	0
209	.	92	0	23	1	0
210	.	92	0	25	1	0
211	.	90	0	23	1	1
212	.	97	0	22	1	1
213	.	108	0	23	1	1
214	.	92	0	24	1	1
215	.	100	0	24	1	1
216	.	99	0	23	1	1
217	.	97	0	23	1	1
218	.	107	0	24	1	0
219	.	93	0	24	1	1
220	.	100	0	23	1	1
221	.	103	0	22	1	1
222	.	99	0	23	1	1
223	.	103	0	24	1	1
224	.	94	0	24	1	0
225	.	103	0	23	1	0
226	.	96	0	22	1	1
227	.	90	0	22	1	1
228	.	110	0	23	1	0
229	.	101	0	22	1	1
230	.	101	0	20	1	0
231		102	0	24	1	0

	G	H	I	J	K	L
1	CLASSIFICATION F=Freshmen SO=Sophomore J=Junior S=Senior	USAGE 1 = Yes 0 = No	USE IN H.S. 1 = Yes 0 = No	OWNERSHIP 1 = Yes 2 = No	FAMILY OWN 1 = Yes 2 = No	ACCESS 1 =Yes 2 = No
2	J	1	1	0	1	1
3	J	1	1	0	0	0
4	J	1	1	1	0	1
5	S	1	1	0	1	1
6	S	1	1	0	1	0
7	J	1	1	0	0	1
8	J	1	1	0	0	1
9	S	1	1	1	0	1
10	S	1	0	0	0	1
11	SO	1	1	0	1	0
12	S	1	1	1	1	1
13	J	1	1	0	0	1
14	S	1	0	0	0	0
15	S	1	0	1	0	1
16	SO	1	1	1	1	1
17	SO	1	1	0	1	1
18	SO	1	1	1	1	1
19	S	1	0	1	0	1
20	S	1	1	1	1	1
21	SO	1	1	0	1	1
22	SO	1	1	0	0	1
23	S	1	0	1	1	1
24	S	1	1	1	1	1
25	S	1	0	1	0	1
26	J	1	1	0	0	1
27	J	1	1	0	1	1
28	S	1	1	0	0	1
29	J	1	0	1	0	1
30	S	1	1	1	1	1
31	J	1	1	1	1	1
32	S	1	0	1	0	1
33	S	1	1	1	0	1
34	S	1	0	1	0	1
35	S	1	1	1	0	1
36	S	1	1	1	1	1
37	S	1	0	1	0	1
38	SO	1	1	1	1	1
39	SO	1	1	1	1	1
40	S	1	1	1	1	1

	G	H	I	J	K	L
1	CLASSIFICATION F=Freshmen SO=Sophomore J=Junior S=Senior	USAGE 1 = Yes 0 = No	USE IN H.S. 1 = Yes 0 = No	OWNERSHIP 1 = Yes 2 = No	FAMILY OWN 1 = Yes 2 = No	ACCESS 1 =Yes 2 = No
41	S	1	1	0	0	0
42	S	1	1	0	1	1
43	S	1	0	1	1	1
44	S	1	1	1	1	1
45	S	1	1	0	1	1
46	S	1	1	0	0	1
47	S	1	1	1	1	1
48	S	1	1	1	1	1
49	S	1	1	0	1	1
50	S	1	1	0	1	1
51	S	1	1	1	1	1
52	S	1	1	1	1	1
53	S	1	1	1	1	1
54	SO	1	1	0	0	1
55	J	1	1	1	1	1
56	S	1	0	1	0	1
57	S	1	1	1	1	1
58	SO	1	1	0	0	1
59	S	1	1	0	0	1
60	S	1	1	0	0	1
61	S	1	0	1	0	1
62	S	1	1	0	0	1
63	S	1	1	0	0	0
64	F	1	1	1	1	1
65	F	1	1	1	1	1
66	J	1	1	0	1	0
67	J	1	1	0	0	1
68	SO	1	0	0	1	1
69	S	1	1	1	1	1
70	J	1	0	0	0	0
71	J	1	0	0	0	0
72	J	1	1	0	1	1
73	S	1	1	0	1	1
74	S	1	1	0	0	0
75	S	1	1	0	1	1
76	J	1	1	1	1	1
77	J	1	1	0	0	1
78	S	1	1	0	0	1
79	S	1	1	0	0	1

	G	H	I	J	K	L
1	CLASSIFICATION F=Freshmen SO=Sophomore J=Junior S=Senior	USAGE 1 = Yes 0 = No	USE IN H.S. 1 = Yes 0 = No	OWNERSHIP 1 = Yes 2 = No	FAMILY OWN 1 = Yes 2 = No	ACCESS 1 =Yes 2 = No
80	S	1	0	0	1	1
81	S	1	1	1	0	1
82	S	1	0	0	0	0
83	S	1	1	0	1	1
84	J	1	1	0	1	1
85	S	1	1	0	0	1
86	SO	1	1	1	1	1
87	SO	1	1	1	1	1
88	F	1	0	1	0	1
89	S	1	1	0	0	1
90	J	1	1	0	0	1
91	J	1	1	1	1	1
92	S	1	0	0	1	0
93	J	1	1	0	0	1
94	J	1	1	0	0	1
95	J	1	1	0	1	0
96	SO	1	1	0	0	0
97	F	1	0	1	0	1
98	S	1	1	0	1	1
99	J	1	1	0	1	0
100	J	1	1	0	1	1
101	S	1	1	1	1	1
102	S	1	1	0	0	0
103	J	1	1	1	1	1
104	S	1	1	1	1	1
105	J	1	1	0	0	1
106	S	1	0	1	0	1
107	S	1	0	1	1	1
108	J	1	1	1	1	1
109	S	1	1	1	1	1
110	J	1	1	0	0	1
111	J	1	1	1	1	1
112	SO	1	1	1	1	1
113	J	1	1	1	1	1
114	S	1	1	1	1	1
115	S	1	1	1	1	1
116	J	1	1	1	1	1
117	S	1	1	0	0	1
118	S	1	1	0	0	1

	G	H	I	J	K	L
1	CLASSIFICATION F=Freshmen SO=Sophomore J=Junior S=Senior	USAGE 1 = Yes 0 = No	USE IN H.S. 1 = Yes 0 = No	OWNERSHIP 1 = Yes 2 = No	FAMILY OWN 1 = Yes 2 = No	ACCESS 1 =Yes 2 = No
119	J	1	1	1	1	1
120	S	1	1	0	0	1
121	SO	1	1	0	0	1
122	S	0	0	0	0	1
123	S	1	1	0	0	1
124	J	1	1	0	0	1
125	S	1	1	0	0	1
126	S	1	1	1	1	1
127	J	1	1	1	1	1
128	S	1	0	1	0	1
129	J	1	1	1	0	1
130	S	1	1	1	1	1
131	S	1	1	1	1	1
132	S	1	1	1	1	1
133	J	1	0	0	0	1
134	S	1	1	0	0	1
135	S	1	1	1	1	1
136	S	1	1	1	1	1
137	S	1	1	1	1	1
138	J	1	1	1	1	1
139	S	1	1	1	1	1
140	S	1	0	1	0	1
141	S	1	1	1	1	1
142	S	1	1	0	0	1
143	S	1	1	1	1	1
144	S	1	1	1	1	1
145	S	1	0	1	0	1
146	S	1	1	1	1	1
147	S	1	1	1	0	1
148	J	1	1	0	0	1
149	F	1	1	1	0	1
150	S	1	1	0	0	1
151	J	1	1	0	1	0
152	J	1	1	1	1	1
153	S	1	0	1	0	1
154	S	1	1	1	0	1
155	F	1	0	0	0	1
156	SO	1	1	0	0	1
157	SO	1	1	1	1	1

	G	H	I	J	K	L
1	CLASSIFICATION F=Freshmen SO=Sophomore J=Junior S=Senior	USAGE 1 = Yes 0 = No	USE IN H.S. 1 = Yes 0 = No	OWNERSHIP 1 = Yes 2 = No	FAMILY OWN 1 = Yes 2 = No	ACCESS 1 =Yes 2 = No
158	S	1	1	0	0	1
159	J	1	1	0	0	1
160	J	1	0	0	0	1
161	J	1	0	0	0	1
162	J	1	1	0	0	1
163	J	1	1	0	0	1
164	SO	1	1	0	0	1
165	S	1	1	0	0	1
166	J	0	0	0	0	0
167	J	1	1	1	1	1
168	J	1	1	0	0	1
169	SO	1	0	0	0	1
170	S	1	1	1	0	1
171	S	1	1	1	1	1
172	J	1	1	1	1	1
173	J	1	1	1	1	1
174	SO	1	1	0	1	1
175	SO	1	1	0	1	1
176	SO	1	1	1	1	1
177	S	1	1	0	1	0
178	J	1	1	0	0	1
179	SO	1	0	0	1	1
180	SO	1	0	0	1	1
181	J	1	1	0	1	1
182	J	1	1	1	1	1
183	J	0	0	0	0	1
184	S	1	1	0	1	1
185	SO	1	1	0	1	1
186	J	1	1	0	0	1
187	J	1	1	0	0	1
188	J	1	0	0	1	1
189	J	1	1	0	0	1
190	S	1	1	0	0	1
191	SO	1	1	1	1	1
192	SO	1	1	0	1	1
193	S	1	1	1	1	1
194	S	1	1	0	1	1
195	S	1	0	1	1	1
196	J	1	0	1	1	1

	G	H	I	J	K	L
1	CLASSIFICATION F=Freshmen SO=Sophomore J=Junior S=Senior	USAGE 1 = Yes 0 = No	USE IN H.S. 1 = Yes 0 = No	OWNERSHIP 1 = Yes 2 = No	FAMILY OWN 1 = Yes 2 = No	ACCESS 1 =Yes 2 = No
197	J	1	1	1	1	1
198	S	1	1	0	0	1
199	SO	1	1	1	0	1
200	J	1	0	1	0	1
201	J	1	1	0	0	1
202	J	1	1	0	0	1
203	J	1	1	1	0	1
204	S	1	1	1	0	1
205	S	1	1	1	0	1
206	SO	1	1	1	0	1
207	S	1	1	1	0	1
208	SO	1	1	1	1	1
209	S	1	1	0	1	1
210	S	1	0	0	1	1
211	S	1	1	1	0	1
212	SO	1	0	0	1	1
213	S	1	1	1	1	1
214	J	1	1	1	1	1
215	S	1	1	0	1	1
216	J	1	1	1	0	1
217	SO	1	1	0	0	1
218	S	1	0	1	0	1
219	S	1	1	0	0	1
220	S	1	1	0	0	1
221	S	1	1	1	0	1
222	J	1	1	0	1	1
223	S	0	0	0	0	1
224	S	1	0	1	1	1
225	J	1	0	1	1	1
226	J	1	1	0	1	1
227	S	1	1	0	1	1
228	J	1	0	0	1	1
229	SO	1	1	1	1	1
230	F	1	1	0	1	1
231	S	1	1	0	0	1

	M	N	O	P
1	EXPERIENCE 1 = 0-6 mo 2 = 6mo-1yr 3 = more than 1yr	MAJOR 1 = Non-Science 0 = Science	REASON 1 = Required 2 = Interest	PROG. OR CL 1 = CL 0 = Prog
2	3	1	1	1
3	1	1	1	1
4	3	1	1	1
5	3	1	1	1
6	1	1	1	1
7	2	1	1	1
8	3	1	1	1
9	3	1	1	1
10	1	1	1	1
11	3	1	1	1
12	3	1	1	1
13	2	1	1	1
14	1	1	1	1
15	1	1	1	1
16	3	1	0	1
17	3	1	1	1
18	1	1	1	1
19	3	1	1	1
20	3	0	1	1
21	3	1	1	1
22	1	1	1	1
23	3	0	0	1
24	3	1	1	1
25	3	1	1	1
26	1	1	0	1
27	1	1	1	1
28	3	1	1	1
29	3	0	1	0
30	3	0	1	0
31	3	0	1	0
32	2	0	1	0
33	3	0	1	0
34	3	0	1	0
35	3	0	1	0
36	3	0	1	0
37	3	0	0	0
38	3	0	1	0
39	3	0	1	0
40	3	0	1	0

	M	N	O	P
1	EXPERIENCE 1 = 0-6 mo 2 = 6mo-1yr 3 = more than 1yr	MAJOR 1 = Non-Science 0 = Science	REASON 1 = Required 2 = Interest	PROG. OR CL 1 = CL 0 = Prog
41	3	1	1	0
42	3	0	1	0
43	3	1	1	0
44	3	0	1	0
45	3	0	1	0
46	3	0	1	0
47	3	0	1	0
48	3	0	1	0
49	3	0	1	0
50	3	0	1	0
51	3	0	1	0
52	3	0	1	0
53	3	0	1	0
54	1	0	1	0
55	3	0	1	0
56	3	0	1	0
57	3	0	1	0
58	3	0	1	0
59	3	0	1	0
60	3	0	1	0
61	3	0	1	0
62	3	0	1	0
63	2	1	0	1
64	3	1	1	1
65	3	1	1	1
66	3	1	1	1
67	1	1	0	1
68	2	1	1	1
69	3	0	1	1
70	1	1	1	1
71	1	1	1	1
72	3	1	1	1
73	3	1	1	1
74	2	1	1	1
75	3	1	0	1
76	3	0	1	0
77	1	1	1	1
78	2	1	1	1
79	2	1	0	1

	M	N	O	P
1	EXPERIENCE 1 = 0-6 mo 2 = 6mo-1yr 3 = more than 1yr	MAJOR 1 = Non-Science 0 = Science	REASON 1 = Required 2 = Interest	PROG. OR CL 1 = CL 0 = Prog
80	2	1	1	1
81	3	1	1	1
82	1	1	1	1
83	3	1	1	1
84	3	1	1	1
85	3	1	1	1
86	3	1	1	1
87	3	1	0	1
88	2	1	1	1
89	2	1	1	1
90	1	1	0	1
91	3	1	1	1
92	1	1	1	1
93	3	1	0	1
94	1	1	0	1
95	1	1	0	1
96	3	1	1	[illegible]
97	3	1	0	1
98	1	1	1	1
99	3	1	1	1
100	3	1	1	1
101	3	1	1	1
102	2	1	0	1
103	3	1	0	1
104	3	1	0	1
105	3	0	0	0
106	3	1	0	0
107	3	1	1	0
108	3	0	1	0
109	3	0	1	0
110	3	0	1	0
111	2	0	1	0
112	2	0	1	0
113	3	0	1	0
114	3	0	1	0
115	3	0	1	0
116	3	0	1	0
117	3	0	1	0
118	2	0	1	0

	M	N	O	P
1	EXPERIENCE 1 = 0-6 mo 2 = 6mo-1yr 3 = more than 1yr	MAJOR 1 = Non-Science 0 = Science	REASON 1 = Required 2 = Interest	PROG. OR CL 1 = CL 0 = Prog
119	3	0	1	0
120	3	0	1	0
121	1	0	1	0
122	1	1	0	0
123	2	1	1	0
124	1	0	1	0
125	1	0	1	0
126	3	0	1	0
127	3	0	1	0
128	2	0	1	0
129	3	0	1	0
130	3	1	1	0
131	3	0	1	0
132	3	0	1	0
133	1	0	1	0
134	3	0	1	0
135	3	0	1	0
136	3	0	1	0
137	3	0	1	0
138	3	0	1	0
139	3	1	1	0
140	2	1	1	0
141	3	0	1	0
142	3	0	1	0
143	3	0	1	0
144	3	0	1	0
145	3	0	1	0
146	3	0	1	0
147	3	0	1	0
148	2	0	1	0
149	3	0	1	0
150	3	0	1	0
151	3	0	1	0
152	3	0	1	0
153	3	1	1	0
154	3	0	1	0
155	2	0	1	0
156	1	1	1	1
157	2	1	1	1

	M	N	O	P
1	EXPERIENCE 1 = 0-6 mo 2 = 6mo-1yr 3 = more than 1yr	MAJOR 1 = Non-Science 0 = Science	REASON 1 = Required 2 = Interest	PROG. OR CL 1 = CL 0 = Prog
158	3	1	1	1
159	3	1	1	1
160	1	1	1	1
161	1	1	1	1
162	3	0	1	1
163	3	1	1	1
164	3	1	1	1
165	3	1	1	1
166	1	1	1	1
167	3	1	1	1
168	3	1	1	1
169	1	1	1	1
170	3	1	1	1
171	3	1	1	1
172	3	1	0	1
173	3	1	0	1
174		1	1	1
175	3	1	1	1
176	3	1	1	1
177	1	1	1	1
178	3	1	0	1
179	1	1	1	1
180	1	1	1	1
181	3	1	1	1
182	3	1	1	1
183	1	1	1	1
184	3	1	1	1
185	3	1	1	1
186	3	1	1	1
187	3	1	1	1
188	1	1	1	1
189	3	1	1	1
190	3	1	1	1
191	2	1	1	1
192	1	1	1	1
193	3	1	1	1
194	3	1	1	1
195	1	1	1	1
196	1	1	1	1

	M	N	O	P
1	EXPERIENCE 1 = 0-6 mo 2 = 6mo-1yr 3 = more than 1yr	MAJOR 1 = Non-Science 0 = Science	REASON 1 = Required 2 = Interest	PROG. OR CL 1 = CL 0 = Prog
197	1	1	1	1
198	3	1	1	1
199	3	1	1	1
200	1	0	1	0
201	3	0	1	0
202	3	0	1	0
203	3	0	1	0
204	3	0	1	0
205	1	0	1	0
206	2	0	1	0
207	3	0	1	0
208	1	0	1	0
209	3	0	1	0
210	3	0	1	0
211	3	0	1	0
212	1	0	1	0
213	3	0	1	0
214	3	0	1	0
215	2	0	1	0
216	3	0	1	0
217	3	0	1	0
218	1	0	1	0
219	3	0	1	0
220	2	0	1	0
221	3	0	1	0
222	3	0	1	0
223	1	0	1	0
224	3	0	1	0
225	1	0	1	0
226	3	0	1	0
227	1	0	1	0
228	3	0	1	0
229	1	0	1	0
230	2	0	1	0
231	3	0	1	0