To the Graduate Council:

I am submitting herewith a thesis written by Linda M. Seals entitled "A Comparison of Two Instructional Modes in a College Horticulture Class: Computer-Assisted Instruction versus Traditional Instruction." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Ornamental Horticulture and Landscape Design.

Susan L. Hamilton, Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:

Interim Vice Provost and
Dean of the Graduate School

A COMPARISON OF TWO INSTRUCTIONAL MODES IN A COLLEGE HORTICULTURE CLASS: COMPUTER-ASSISTED INSTRUCTION VERSUS TRADITIONAL INSTRUCTION

A Thesis
Presented for the
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Linda M. Seals
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DEDICATION

This thesis is dedicated to my parents,

George and Rachel Seals.

Your undying love and support

made this degree possible.

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ABSTRACT

As educators continue to integrate computer-assisted instruction (CAI) into college courses, it is important to determine its effectiveness as an instructional mode. Various disciplines such as math, chemistry, nutrition, and business have studied the effect of CAI, but it not yet been determined in the horticulture discipline. The purpose of this study was to determine whether CAI was more effective than traditional instruction (TI) in an introductory-level horticulture college course. To determine the effectiveness of the two instructional modes, this study measured student performance, student attitudes toward the course, and changes in student attitudes toward computers and CAI. Also, this study researched the interaction of course study time, student gender, and student major between instructional mode and student performance.

Six performance assessments were used to measure student performance: total lecture exam scores, total plant identification scores, total quiz scores, career paper scores, total paper scores, and final semester grades. No significant differences were found between instructional mode and student performance.

Student attitudes toward the course were measured using the Student Assessment of Instruction System survey (SAIS). CAI and TI students indicated positive attitudes toward course content and the instructor; however,

there were no significant differences between instructional mode and student attitudes toward the course.

To determine changes in student attitudes toward computers and CAI, an attitudinal survey was administered on the first and last day of class. No significant differences existed between the pretest and posttest survey, indicating that student attitudes toward computers and CAI did not change over the course of the semester.

To record the time they spent studying outside of class, students used a bi-weekly time sheet. This study found no significant interactions between course study time, instructional mode, and student performance. However, this study did find that course study time did significantly relate to student performance on total quiz scores—students who studied the most achieved significantly higher scores.

This study found that gender and student major did not moderate the effect of instructional mode upon student performance in an introductory-level horticulture course. Significant differences were found, however, between student major and student performance on total lecture exams scores and final semester grades. Also, significant differences existed between males and females regarding performance on plant identification exams.

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CHAPTER I

INTRODUCTION

The latest advancements in computer technology have given rise to new opportunities for incorporating computer-assisted instruction (CAI) in college horticulture courses. The first CAI experiments began in the 1950s with the development of BASIC, a computer language that made CAI more available to educators; however, computers were expensive and difficult to use, so CAI never transformed education as many educators predicted (Chambers and Sprecher, 1983). In the 1980s, the microcomputer was introduced. Microcomputers were less expensive than mainframe computers and they were easier to use; as a result, CAI quickly found its way back into college classrooms (Alessi and Trollip, 1991). In the early 1990s, the World Wide Web was introduced—it revolutionized the computer industry and changed the way the world communicates. Today, technological innovations continue to improve computer speeds and software capabilities, leading to increased interest in CAI.

Although many educators are integrating CAI into their college courses, the effectiveness of CAI in horticulture education has not been determined. CAI studies in other disciplines such as business, chemistry, physiology, nutrition, library science, and animal science report increased student performance and positive changes in student attitudes towards computers and

CAI when compared to traditional instruction courses (Day et al., 1998; Cavin et al., 1981; Richardson, 1997; Carew et al., 1997; Barnes et al., 1999; Kulik and Kulik, 1991; Holman, 2000). With this in mind, it is essential to evaluate the effectiveness of CAI in college horticulture courses to provide the optimal learning environment for horticulture students.

Statement of Purpose

The purpose of this study was to determine the effectiveness of CAI in a introductory-level college horticulture course. The study focused on the relationships between instructional mode and student performance, instructional mode and student attitudes, student study time, selected student demographics, and student attitudes toward computers and CAI.

Objectives

The objectives of this study were:

1. To determine the relationship between computer-assisted instruction versus traditional instruction and course performance.
2. To determine the relationship between instructional mode and student attitudes toward instruction.
3. To determine potential moderating effects of instructional time upon the relationships between instructional mode and performance, and instructional mode and attitude toward instruction.

4. To determine potential moderating effects of selected demographic variables upon the relationship between instructional mode and performance and instructional mode and attitude toward instruction.
5. To determine change in student attitudes toward computers and CAI.

Definition of Terms

- **Computer-assisted instruction** – instruction delivered via a computer.
- **Bandwidth** – the rate at which data is transferred over the Internet, also referred to as connection rate (Webster, 1999).
- **Hyperlinks** – an element of a web page that allows a user to navigate to different websites.
- **Hypermedia** – The same as hypertext only links are from a variety of media such as text, video, and sound (Ackerman, 1997).
- **Hypertext** – text that contains links to other text (Ackerman, 1997).
- **Internet** – an electronic communications network of millions of computers (Webster, 1999).
- **Course Study Time** – the time a student spends outside of class to prepare for exams and complete assignments.
- **Traditional Instruction** – instruction delivered face to face by a teacher.
- **World Wide Web** – a component of the Internet that uses graphic user interfaces and hypertext links for easy navigation of the network (Webster, 1999).

CHAPTER 2

REVIEW OF THE LITERATURE

The Evolution of Computer-Assisted Instruction

As the first CAI experiments were being conducted in the 1950s and 1960s, educators were predicting that CAI would "sweep the country and ultimately change the entire structure of education" (Chambers and Sprecher, 1983). By the mid to late 1970s, education was not transformed as predicted and enthusiasm for CAI waned. The high costs of hardware and courseware development, inadequate training for faculty, and the conservatism of many educators prohibited the widespread use of CAI.

In 1981, the first IBM Personal Computer was released resulting in a boom in the microcomputer industry. The Apple Macintosh microcomputer, with its innovative point and click technology, transformed the microcomputer industry (Alessi and Trollip, 1991), and "literally revolutionized the use of CAI in education in the U.S." (Chambers and Sprecher, 1983). Interest in CAI was renewed as microcomputer technologies made computers more affordable and easier to use, and students and instructors alike could use new software programs without extensive training. As a result, microcomputers became more effective for delivering CAI than conventional mainframe computers (Kulik and Kulik, 1991).

In the early 1990s, the World Wide Web was introduced and another technological revolution began. The Web allowed users to access information via hyperlinks in hypertext or hypermedia environments (Ackerman, 1997). Text, graphics, audio, video, and software programs could be digitized and posted onto the Internet for access by students at anytime and anyplace. Today, as faster bandwidths are developed, and technological innovations continue to improve computer speeds and software capabilities, the implications for CAI have yet to be realized.

Description of Computer-Assisted Instruction

CAI is not an instructional method, rather, it is instruction delivered via a computer, which is an instructional medium (Steinberg, 1991). There are five major types of CAI: drill and practice, tutorial, simulation, games, and tests (Alessi and Trollip, 1991; Chambers and Sprecher, 1983). Drill and practice exercises, which are student-centered, do not present new material to students – they permit students to practice material previously presented by the instructor. CAI tutorials are used to present new materials to students (Kulik and Kulik, 1991). This form of CAI is often teacher-centered and more interactive than drill and practice exercises. CAI simulations and games can be used to present new information, guide the learner, drill the learner, or do all three (Alessi and Trollip, 1991). Simulations and games can be used to test learners' knowledge by actively engaging them in activities that require them to apply learned concepts. Tests, the final type of CAI, can be used to

determine whether learners achieved the learning objectives and to evaluate the effectiveness of CAI.

Computer-Assisted Instruction Versus Traditional Instruction

CAI differs from traditional instruction (TI) in several ways. The most obvious difference is mode of communication. In TI courses, instruction is delivered face to face orally, visually, graphically or physically. In a CAI course, however, a computer delivers instruction primarily with visuals, graphics, and audio. Instructor-learner interaction is another major difference between CAI and TI. In a TI classroom, the instructor can observe student behavior, students can ask questions and get immediate responses, and the potential for learner feedback is great.

A TI course is teacher-centered and linear, meaning that everyone in the classroom moves along in the same direction and at the same pace. A CAI course, however, is learner-centered and individualized. Students decide what direction they want to follow, and they do so at their own pace (Steinberg, 1991; Ellis et al., 1999). In a teacher-centered classroom, instructors often rely on textbooks to guide their decision making; however, instructors in a learner-centered classroom use a variety of instructional materials—computer software applications, the World Wide Web, and textbooks might be used independently or dependently of each other—to guide their decision making (Relan and Gillani, 1996).

Benefits of Computer-Assisted Instruction

Researchers have identified several benefits of CAI for learners. One benefit is increased accessibility to both students and instructors (Kjelgren and Rupp, 1998). Through the World Wide Web, students gain access to course information and course materials at anytime, from anyplace (Ellis et al., 1999). This provides students with greater flexibility and independence, permitting them to learn at their own pace (Chambers and Sprecher, 1983; Shah et al., 1999; Ellis et al., 1999). The nonlinear nature of the Web allows students greater control over their learning as they follow hyperlinks that satisfy their own interests. Increased interaction between students and instructors is another benefit of CAI (Kjelgren and Rupp, 1998). Interaction can be achieved through a variety of Internet tools such as email, discussion boards, bulletin boards, newsgroups, chat rooms, and list-serves. This can be especially beneficial to non-traditional students who have family or work commitments. Students can also receive immediate feedback on exams, quizzes, and assignments by checking their grades online, or by communicating electronically with students and instructors (Shurle, 1997; Sistrunk, 1998).

Student Performance and Attitudes

Much of the CAI research is on its effect on student learning. Numerous studies report improved student performance over TI (Cavin et al., 1981; Richardson, 1997; Carew, et al., 1997; Day et al., 1998; Kulik and Kulik, 1991). A study that used a computerized study guide to supplement a CAI

introductory nutrition course found that CAI students performed better than TI students (Carew et al., 1997). However, not all CAI studies report positive improvements in student performance (Kulik and Kulik, 1991; Batchelder and Rachal, 2000). Using drill and practice exercises to reinforce lecture material in a five-week operations management course, Wang and Sleeman (1993) found no significant difference in test scores between CAI and TI.

Many studies have examined student attitudes towards computers and CAI (Cavin et al., 1981; Richardson, 1997; Carew, et al., 1997; Day et al., 1998; Shah et al., 1999; Chambers and Sprecher, 1983). Most studies reveal that students who participate in CAI courses usually develop increased positive attitudes toward computers, and they become increasingly comfortable and confident when using computers (Shah, et al., 1999; Chambers and Sprecher, 1983; Kulik and Kulik, 1991). However, researchers examining student attitudes in an introductory animal and poultry science course reported no change in student perceptions of computers as an instructional tool. Students did indicate increased comfort with using Internet technology (Barnes et al., 1999).

Many studies indicate that most students prefer CAI courses to TI courses (Kulik and Kulik, 1991). In an introductory nutrition course, Carew et al. (1997) reported that students who participated in their CAI course "had the impression that it was a definite benefit to them" (p. 331), and they believed the course helped improve their grades. Student attitudes toward subject

content can improve with CAI (Kulik and Kulik, 1991; Carew et al., 1997; Barnes et al., 1999 Day et al., 1998). Students believed that the most useful elements of CAI courses were those that reinforced lecture material and posted class notes (Carew et al., 1998; Barnes et al., 1999).

Course Study Time

Several studies have compared course study times between CAI and TI courses. According to some researchers, course study time is reduced with CAI (Chambers and Sprecher, 1983; Kulik and Kulik, 1991) while other studies report increased study time in CAI courses (Carew et al., 1997; Richardson, 1999). In a CAI physiology course, students felt that increased study time reduced the overall effectiveness of the course, which resulted in negative attitudes toward CAI (Richardson, 1999).

Demographics

Although most CAI researchers collect demographic data to determine student characteristics, few studies report any significant relationships between demographics and student performance or student attitudes. Arbough (2000), however, suggested that females might learn better than males in an online environment, implying that gender might have an affect on student performance in CAI. Carew et al. (1970) examined the interaction between student major and instructional mode in their CAI nutrition course

study. They determined that students who were required to take the course had lower overall scores than students who took the course for other reasons.

CHAPTER 3

MATERIALS AND METHODS

Research Design

This study used a true experimental posttest-only control group design for analysis of student performance and student attitudes. A pretest-posttest design was used for analysis of changes in student attitudes toward computers and CAI.

Research Sample

The research sample included 75 undergraduate students who were enrolled in the fall 2000 course of Introduction to Ornamental Horticulture and Landscape Design (OHLD 110) at the University of Tennessee. Students were randomly assigned into two sections of this course, CAI or TI, during the first class meeting. This study was exempted from review and approved by the human subjects committee at the University of Tennessee.

Data Collection

A variety of instruments were designed to 1) evaluate student performance, 2) assess student attitudes toward the course, 3) record student course study time, 4) collect demographic data, and 5) changes in student attitudes toward computers and CAI.

Student Performance

In each section of the course, a variety of exams, quizzes, and class assignments were given to evaluate student performance. Grades on the following were used to determine student performance: three multiple-choice lecture exams, two plant identification exams, five unannounced quizzes, and two written reports.

Student Attitudes Toward Course

Student attitudes toward the course were measured using the Student Assessment of Instruction System instrument (SAIS) (Office of Educational Assessment, 1998) (Appendix A). Twenty-two items considered relevant to this study were selected from this instrument. SAIS is a Likert-type instrument consisting of two subscales that measure student attitudes toward the course and student attitudes toward the instructor. Data from the SAIS were collected on the final day of class.

Cronbach's Coefficient Alpha was used to test the internal consistency and reliability of the scales constructed for this study. Cronbach's Alpha is an internal consistency coefficient that is used to determine if respondents' scores on individual items within a scale are consistent with their score on the overall scale (Borg and Gall, 1983). A consistency coefficient of 0.00 would indicate no consistency whereas a coefficient of 1.00 would indicate perfect internal consistency. Many researchers state an "acceptable" level to determine if a scale is reliable; however, there is no established value that can be used to

determine internal consistency. This researcher discussed the issue of "acceptable Alpha scores" with a research methodologist and conducted a review of the subject in several journals, where alpha values of 0.66 to 0.80 were reported as being "acceptable" (Carew et al., 1997; Kinzie et al., 1994). For this study, an alpha of 0.66 was acceptable. Alphas for both subscales were well above 0.66, therefore, further manipulation of the items was unnecessary (Table 3-1).

Course Study Time

Course study time was measured with a bi-weekly time sheet developed by this researcher (Appendix B). To encourage participation, the time sheets counted as 25% of the students' final grade; however, for this study, time sheet scores were not included in students' final grade and were used for data analysis only.

Demographic Data

A seventeen question demographic survey was developed by this researcher to evaluate the moderating effect of gender and student major

Table 3-1. Cronbach's Coefficient Alphas for the two SAIS survey subscales.

Subscale	N of Items	Alpha
Student Attitudes Toward Course Content	7	.924
Student Attitudes Toward Instructor	14	.963

upon instructional mode and student performance as well as instructional mode and student attitudes (Appendix C). Demographic data were collected on the first day of class.

Student Attitudes Toward Computers and CAI

A 27-item Likert-type instrument, derived from the Attitudes Toward Computer Technologies instrument (Kinzie et al, 1994) and the CAI Attitude Assessment Survey (Carew et al, 1997), was developed to examine student attitudes toward CAI and computers (Appendix D). The instrument was administered to the CAI group on both the first and last day of class. The instrument consisted of three subscales that measured 1) computer comfort/anxiety, 2) computer usefulness, and 3) student attitude toward CAI.

Cronbach's Coefficient Alpha was used to test the internal consistency and reliability of the scales for this instrument (Table 3-2). All of the scales scored well about the acceptable alpha coefficient (0.66) except for the CAI posttest scale (.651). Although this scale is considered only marginally acceptable, the alpha could not be improved by dropping any of the items; therefore it was considered acceptable for this study.

Description of Treatments

Two sections of OHLD 110 during the Fall 2000 semester were the treatments for this study. The CAI treatment met for 2 hours and 50 minutes

Table 3-2. Cronbach's Coefficient Alphas for the three student attitudes toward computers and CAI survey subscales.

Subscale	N of Items	Alpha
Student Attitudes Toward Computer Comfort		
Pre Computer Comfort	8	.871
Post Computer Comfort	8	.951
Student Attitudes Toward Computer Usefulness		
Pre Computer Use	11	.773
Post Computer Use	11	.767
Student Attitudes Toward CAI		
Pre Attitude Toward CAI	8	.853
Post Attitude Toward CAI	8	.651

on Monday nights and the TI treatment met for 2 hours and 50 minutes on Wednesday nights. This researcher taught both sections of the course.

Lecture, slide presentations, television, transparencies, chalkboard, handouts, and textbooks were used to deliver instruction to both treatments. In addition, the CAI treatment group received in-class instruction via PowerPoint presentations and was provided supplemental information through the Internet using Blackboard's CourseInfo Version 4.0, a courseware management system (Blackboard, 2001).

Course materials, practice quizzes, and drill and practice lessons were made available through Blackboard's CourseInfo Version 4.0. Students could use the site to check their grades, review course materials, check for announcements, take practice quizzes, download lecture notes, use drill and

practice lessons, and communicate to other classmates or the instructor through Blackboard's CourseInfo email.

Data Analysis

A t-test was used to determine if significant differences existed between instructional mode and student performance, instructional mode and student attitudes, and changes in student attitudes toward computers and CAI. Analysis of variance (ANOVA) was used to determine if course study time, gender, and students' major had significant moderating effects upon instructional mode and performance as well as instructional mode and student attitude toward instruction. A probability level of 0.05 was used to test for significance. In cases of significant difference, the Duncan's Multiple Range test was used to identify pairs of variables significantly different at the 0.05 level. Data were analyzed using the Statistical Package for the Social Sciences (SPSS Release 10.0.7).

CHAPTER 4

RESULTS AND DISCUSSION

Description of the Participants

Seventy-five students representing two sections of the Introduction to Ornamental Horticulture and Landscape Design course (OHLD110) participated in this study. The average student was a 21 year-old (median) male (61.3%). The majority of the students (54.7%) were OHLD majors, and they were taking the course because it was required. Juniors made up 38.6% of the class, 20% were sophomores and 20% were freshmen. The majority of the students (84.0%) reported owning a computer at home and 78.7% had Internet access. Most students (72%) had participated in a CAI course before and 74.7% had used CourseInfo in previous courses. Forty percent of the students rated themselves as competent computer users and 36% rated themselves as new computer users.

Objective 1

The first objective of the study was to determine the relationship between instructional mode (traditional instruction versus computer-assisted instruction) and student performance in the course as measured by six specific performance assessments. Student performance was determined by six dependent variables: total lecture exam scores, total plant identification exam scores, total quiz scores, career paper score, topic paper score, and final

semester grade. Except for the final semester grade, all performance assessments were percentile scores and could have ranged from 0–100%. The final semester grade was reported as a numeric score and could have ranged from 0–75. No statistically significant differences were found between instructional mode and any of the six measures of performance when considering their bivariate relationships (Table 4-1).

Since this study found no significant differences between instructional mode and the six performance assessments, it can be concluded that CAI was as effective as TI for this course. These findings are consistent with other studies that found no significant differences between instructional mode and student performance (Wang and Sleeman, 1993; Kulik and Kulik, 1991; Batchelder and Rachal, 2000).

The similarities between the two groups may have resulted in no significant differences. Both treatments received the same lectures, the same assignments, the same performance assessments, and the same instructor taught both treatments. Both treatments also received the same in-class instruction—the CAI group was supplemented with computers, but not taught solely with computers. Also, students' need for supplementary materials may decrease when an instructor has strong lecture skills

Education research has found that students' levels of motivation can affect learning (Bryant and Hunton, 2000). When asked what they felt detracted most from their learning, most students said they were less motivated in the course

Table 4-1. The bivariate relationship between instructional mode and performance as measured by total lecture exam scores, total plant identification exam scores, total quiz scores, career paper scores, topic paper scores, and final semester grades in OHLD 110.

Performance Measure Instructional Mode	N	Mean	s.d.	df	t	p
Lecture Exam Score						
Traditional Instruction	40	78.86	6.39	73	-.65	.520
Computer-Assisted Instruction	35	80.07	9.29			
ID Exam Score						
Traditional Instruction	40	85.41	15.58	73	1.33	.189
Computer-Assisted Instruction	35	80.43	16.93			
Quiz Score						
Traditional Instruction	40	73.93	17.39	73	-1.66	.101
Computer-Assisted Instruction	35	79.98	13.66			
Career Paper Score						
Traditional Instruction	40	88.02	22.52	73	-.73	.468
Computer-Assisted Instruction	35	91.46	17.45			
Topic Paper Score						
Traditional Instruction	40	85.25	32.86	73	-1.39	.169
Computer-Assisted Instruction	35	93.53	17.12			
Final Semester Grade						
Traditional Instruction	40	61.52	8.53	73	-.577	.566
Computer-Assisted Instruction	35	62.60	7.57			

because it was a night class, and that the class period was too long. One student commented that it was "too late at night to be focused on a class" and another student remarked, "the length of the class was a bit too much." Students also complained that there was too much time between class meetings. One student commented that "only having class once a week" detracted from her learning.

The reason students enrolled in the course may also explain why there were no significant differences. In a study by Carew et al. (1997), students who were required to enroll in their nutrition course achieved significantly lower scores than students taking the course for other reasons. In this study, 54.7% of the students were required to take OHLD 110, which may have led to no significant differences between instructional mode and student performance.

Objective 2

The second objective of the study was to determine the relationship between instructional mode and student attitudes toward instruction as measured by the Student Assessment of Instruction Survey (SAIS) instrument. Student attitude towards the course was determined by the dependent variable: student attitude toward the whole course, which was divided into two subscales: student attitudes toward course content and student attitudes toward the instructor.

Possible scores for the first subscale, student attitudes toward course content, ranged from 7–42 and actual scores ranged from 7–24 (Table 4-2). The overall mean score (13.19) was less than the midpoint (24.5) indicating that students had a positive attitude toward course content. Possible scores for the second subscale, student attitudes toward the instructor, ranged from 14–84 and actual scores ranged from 14–48 (Table 4-2). The overall mean (24.70) was less than the midpoint (49) and indicated that the students had a positive attitude toward the instructor. Although the students indicated a positive attitude toward the course and the instructor, there were no significant differences between instructional mode and student attitudes toward the course (Table 4-3).

Since this study found no significant differences between student attitudes toward the course and instructional mode, it can be concluded that students liked CAI as well as TI. No significant differences may be due to the similarities between the two treatments. Both treatments contained the same content, received the same in-class instruction, and were taught by the same instructor. When the students were asked what aspects of the class contributed most to their learning, many students said "the teacher made [the] materials interesting and understandable," indicating that the students liked the instructor. Students also said they "thoroughly enjoyed the class" and that the "subject matter was interesting," indicating that the students also liked the course content.

Table 4-2. Scores for the Student Assessment of Instruction System survey subscales in OHLD 110.

Attitudinal Scale	Range		Midpoint	Respondents	
	Possible	Actual		Mean*	s.d.
Student Attitudes Toward the Course	7–42	7–24	24.5	13.19	4.64
Student Attitudes Toward the Instructor	14–84	14–48	49	24.70	8.84

* A mean score below the midpoint indicated a positive attitude; a mean score greater than the midpoint indicated a negative attitude.

Table 4-3. A statistical analysis of the relationship between instructional mode and student attitudes toward the course in OHLD 110.

Attitude Measure Instructional Mode	N	Mean	s.d.	df	t	p
Course as a Whole						
Traditional Instruction	37	1.86	.89	68	-.699	.487
Computer-Assisted Instruction	33	2.00	.71			
Student Attitude Toward Course						
Traditional Instruction	37	12.86	4.86	68	-.610	.544
Computer-Assisted Instruction	33	13.55	4.42			
Student Attitude Toward Instructor						
Traditional Instruction	37	24.08	8.42	68	-.618	.539
Computer-Assisted Instruction	33	25.39	9.36			

Objective 3

The third objective of the study was to determine the potential moderating effects of course study time upon the relationships between instructional mode and performance in OHLD 110, and instructional mode and attitude toward the course. Course study time, or time spent studying outside of class, was a continuous variable measured in minutes. Time was broken down into three discrete categories (1235 minutes or less, 1236 to 2620 minutes and more than 2621 minutes) based on a cluster analysis—a multivariate procedure for detecting groupings in the data (SPSS Inc., 1997). The six performance assessments and attitude toward the course were the same variables described earlier in this chapter.

Course Study Time and Performance

Total Lecture Exam Scores

Course study time did not moderate the effect of instructional mode on performance based on the total lecture exam scores ($F_{Interaction} = .426$, df = 2, 69, p = .655 (Table 4-4). After adjusting total lecture exam scores for the effects of course study time, the main effect of mode of instruction was not significantly related to total lecture exam scores ($F_{mode\ of\ instruction} = .432$, df = 2, 69, p = .513), and the main effect of course study time did not significantly relate to total lecture exam scores ($F_{Time} = .986$ d = 2, 69, p = .378).

Table 4-4. The moderating effects of course study time upon the relationship between instructional mode and total lecture exam scores, total plant identification scores, and total quiz scores in OHLD 110.

Source	df	SS	MS	F	p
Total Lecture Exam Scores					
Combined Main Effects	3	151.52	50.51	.801	.497
Instructional Mode (IM)	1	27.26	27.26	.432	.513
Time	2	124.26	62.13	.986	.378
IM – Time Interaction	2	53.67	26.83	.426	.655
Model	5	205.18	41.04	.651	.662
Residual	69	4349.56	63.04		
Total	74	4554.74	51.55		
Total Plant ID Exam Scores					
Combined Main Effects	3	1037.20	345.73	1.30	.282
Instructional Mode (IM)	1	463.67	463.67	1.74	.191
Time	2	573.53	286.76	1.08	.346
IM – Time Interaction	2	282.44	141.22	.531	.591
Model	5	1319.64	263.93	.992	.429
Residual	69	18359.05	266.07		
Total	74	19678.69	265.93		
Total Quiz Scores					
Combined Main Effects	3	2852.44	950.81	4.195	.009
Instructional Mode (IM)	1	684.12	684.12	3.02	.087
Time	2	2168.31	1084.16	4.78	.011
IM – Time Interaction	2	329.33	164.67	.726	.487
Model	5	3181.77	636.35	2.807	.023
Residual	69	15640.62	266.68		
Total	74	18822.39	254.36		

Total Plant Identification Exam Scores

Course study time did not moderate the effect of instructional mode on performance based on the plant identification exam score ($F_{Interaction} = .531$, df=2, 69, p=. 591) (Table 4-4). After adjusting plant identification exam scores for the effects of course study time, the main effect of mode of instruction was not significantly related to exam scores ($F_{mode\ of\ instruction} = 1.74$, df=2, 69, p=. 191), and course study time did not significantly relate to total plant identification exam scores ($F_{Time} = 1.08$ df= 2, 69, p=. 346).

Total Quiz Scores

Course study time did not moderate the effect of instructional mode on performance on total quiz scores ($F_{Interaction} = .726$, df = 2, 69, p = .487) (Table 4-4). After adjusting total quiz scores for the effects of course study time, there were no significant relationships between the main effects of instructional mode and total quiz scores ($F_{mode\ of\ instruction} = 3.02$, df = 2, 69, p = .087). However, the main effect of course study time did significantly relate to total quiz scores ($F_{Time} = 4.78$ df = 2, 69, p = .011). Students studying between 1236 and 2620 minutes performed significantly lower on the quizzes than did students studying more than 2621 minutes (Table 4-5). However, there were no significant differences in scores of students studying 1235 minutes or less and those studying 1236 to 2620 minutes, or those studying 1235 minutes or less and those studying more than 2621 minutes.

Table 4-5. Mean total quiz scores by course study time in OHLD 110.

Course Study Time	Unadjusted Means*	Adjusted Mean Score**
Total Quiz Scores		
1235 Minutes or Less	74.26AB	74.60
1236 Minutes to 2620 Minutes	75.60A	74.65
More than 2621 minutes	89.33 B	90.58

* Mean scores with the same letters beside them are not significantly different as determined by Duncan's Multiple Range Test.

**Scores have been adjusted to remove the effects of type of instruction upon the relationship.

Career Paper Scores

Course study time did not moderate the effect of instructional mode on performance on the career paper scores ($F_{Interaction} = 1.21 df = 2, 69, p = .304$) (Table 4-6). After adjusting career paper scores for the effects of course study time, the main effect of instructional mode did not relate to career paper scores after adjustments ($F_{mode\ of\ instruction} = .530$, df = 2, 69, p = .469), and the main effects of course study time did not significantly relate to career paper scores ($F_{Time} = .592$ df = 2, 69, p = .556).

Topic Paper Scores

Course study time did not moderate the effect of instructional mode on performance on the topic paper score ($F_{Interaction} = .301$ df = 2, 69, p = .741) (Table 4-6). After adjusting topic paper scores for the effects of course study

Table 4-6. The moderating effect of course study time upon the relationship between instructional mode and career paper scores, topic paper scores, and final semester grades in OHLD 110.

Source	df	SS	MS	F	P
Career Paper Scores					
Combined Main Effects	3	711.77	237.26	.571	.636
Instructional Mode	1	219.89	219.89	.530	.469
Time	2	491.89	245.94	.592	.556
IM – Time Interaction	2	1005.58	502.79	1.21	.304
Model	5	1717.36	343.47	.827	.535
Residual	69	28646.19	415.16		
Total	74	30363.55	410.32		
Topic Paper Scores					
Combined Main Effects	3	2936.94	978.98	1.65	.265
Instructional Mode	1	1276.68	1276.67	1.76	.189
Time	2	1660.28	830.14	1.15	.324
IM – Time Interaction	2	436.19	218.09	.301	.741
Model	5	3373.13	674.63	.932	.466
Residual	69	49966.02	724.145		
Total	74	53339.14	720.80		
Final Semester Grade					
Combined Main Effects	3	344.08	114.70	1.82	.151
Instructional Mode	1	21.81	21.81	.346	.558
Time	2	322.28	161.14	2.56	.085
IM – Time Interaction	2	117.01	58.51	.929	.400
Model	5	461.10	92.22	1.46	.213
Residual	69	4346.86	63.00		
Total	74	4807.96	64.97		

time, the main effect of mode of instruction did not significantly relate to topic paper scores ($F_{\text{mode of instruction}} = 1.76$, df = 2, 69, p = .189), and the main effects of time spent studying outside of class did not significantly relate to topic paper scores ($F_{\text{Time}} = 1.15$ df = 2, 69, p = .324).

Final Semester Grade

Course study time did not moderate the effect of instructional mode on performance on the final semester grades ($F_{\text{Interaction}} = .929$, df = 2, 69, p = .400) (Table 4-6). After adjusting the final semester grades for the effects of course study time, instructional mode did not significantly relate to final semester grades ($F_{\text{mode of instruction}} = .346$, df = 2, 69, p = .558), and the main effects of time spent studying outside of class did not significantly relate to final semester grades ($F_{\text{Time}} = 2.56$ df = 2, 69, p = .085).

This study found that course study time did not moderate the effect of instructional mode on student performance, therefore, it can be concluded that CAI requires as much course study time as TI. These findings are inconsistent with other studies, which found that students perceived CAI as being more time consuming than TI (Carew et al., 1997; Richardson 1997). This study did find significant differences between course study time and student performance on total quiz scores. It should be no surprise that students who study more perform better than students who study less.

Course Study Time and Student Attitudes Toward the Course

To obtain accurate information on the SAIS survey, students were not asked to identify themselves; therefore, the moderating effects of course study time upon student attitudes toward the course could not be determined.

Objective 4

The fourth objective of this study was to determine the potential moderating effects of gender and student major upon the relationship between instructional mode and performance and instructional mode and attitude toward the course. To facilitate analyses, student major was broken down into two categories: OHLD and others. Instructional mode, the six performance assessments and attitude toward the course were the same variables described earlier in this chapter.

Student Gender and Performance

Total Lecture Exam Scores

Gender did not moderate the effect of instructional mode on performance on total lecture exam scores ($F_{Interaction} = .21$, df = 1, 71, p = .648) (Table 4-7). After adjusting the total lecture exam scores for the effects of gender, instructional mode did not significantly relate to total lecture exam scores ($F_{mode\ of\ instruction} = .43$, df = 1, 71, p = .514). The main effect of gender did not significantly relate to total lecture exam scores ($F_{Gender} = .36$ df = 1, 71, p = .553).

Table 4-7. The moderating effect of student gender upon the relationship between instructional mode and total lecture exam scores, total plant identification exam scores, and total quiz scores in OHLD 110.

Source	df	SS	MS	F	p
Total Lecture Exam Scores					
Combined Main Effects	2	49.77	24.89	.39	.676
Instructional Mode (IM)	1	27.26	27.26	.43	.514
Gender	1	22.52	22.52	.36	.553
IM – Gender Interaction	1	13.34	13.34	.21	.648
Model	3	63.11	21.04	.33	.802
Residual	71	4491.63	63.26		
Total	74	4554.74	61.55		
Total Plant ID Exam Scores					
Combined Main Effects	2	1924.01	962.01	3.85	.026
Instructional Mode (IM)	1	463.67	463.67	1.85	.178
Gender	1	1460.34	1460.34	5.84	.018
IM – Gender Interaction	1	.303	.303	.001	.972
Model	3	1924.31	641.44	2.57	.061
Residual	71	17754.37	250.06		
Total	74	19678.69	265.93		
Total Quiz Scores					
Combined Main Effects	2	705.91	352.95	1.39	.255
Instructional Mode (IM)	1	684.12	684.12	2.70	.105
Gender	1	21.79	21.79	.09	.770
IM – Gender Interaction	1	130.00	130.00	.51	.476
Model	3	835.91	278.64	1.10	.355
Residual	71	17986.48	253.33		
Total	74	18822.39	254.36		

Total Plant Identification Exams

Gender did not moderate the effect of instructional mode upon total plant identification exams ($F_{Interaction} = .001$, df = 1, 71, p = .972) (Table 4-7). After adjusting total plant identification exam scores for the effects of gender, instructional mode did not significantly relate to total lecture exam scores ($F_{mode\ of\ instruction} = 1.85$, df = 1, 71, p = .178). However, the main effect of gender did significantly relate to total plant identification exam scores ($F_{Gender} = 5.84$ df = 1, 71, p = .018). The adjusted means for total plant identification exam scores for females was 88.66 and 79.57 for males (Table 4-8).

Total Quiz Scores

Gender did not moderate the effect of instructional mode on performance on total quiz scores ($F_{Interaction} = .51$, df = 1, 71, p = .476) (Table 4-7). After adjusting total quiz scores for the effects of gender, instructional mode did not significantly relate to performance on total quiz scores ($F_{mode\ of\ instruction} = .2.70$, df = 1, 71, p = .105). The main effect of gender did not

Table 4-8. Mean scores for total plant identification exams by gender.

Gender	Unadjusted Means*	Adjusted Mean Score**
Female	88.89	88.66
Male	79.43	79.57

*Means are significantly different at the .050 level.

**Scores have been adjusted to remove the effects of type of instruction upon the relationship.

significantly relate to total quiz scores ($F_{Gender} = .09$ df = 1, 71, p = .770).

Career Paper Scores

Gender did not moderate the effect of instructional mode on performance on career paper scores ($F_{Interaction} = .09$, df = 1, 71, p = .768) (Table 4-9). After adjusting career paper scores for the effects of gender, instructional mode did not significantly relate to performance on career paper scores ($F_{mode\ of\ instruction} = .53$, df = 1, 71, p = .472). The main effect of gender did not significantly relate to career paper scores ($F_{Gender} = .64$ df = 1, 71, p = .425).

Topic Paper Scores

Gender did not moderate the effect of instructional mode on performance on topic paper scores ($F_{Interaction} = .05$, df = 1, 71, p = .824) (Table 4-9). After adjusting topic paper scores for the effects of gender, instructional mode did not significantly relate to performance on topic paper scores ($F_{mode\ of\ instruction} = 1.76$, df = 1, 71, p = .189). The main effect of gender did not significantly relate to topic paper scores ($F_{Gender} = .57$ df = 1, 71, p = .453).

Final Semester Grade

Gender did not moderate the effect of instructional mode on performance on final semester grades ($F_{Interaction} = .17$, df = 1, 71, p = .678) (Table 4-9). After adjusting final semester grades for the effects of gender,

Table 4-9. The moderating effect of student gender upon the relationship between instructional mode and career paper scores, topic paper scores, and final semester grades in OHLD 110.

Source	df	SS	MS	F	p
Career Paper Scores					
Combined Main Effects	2	490.17	245.08	.58	.561
Instructional Mode (IM)	1	219.89	219.89	.52	.472
Gender	1	270.28	270.28	.64	.425
IM – Gender Interaction	1	36.75	36.75	.09	.768
Model	3	526.92	175.64	.42	.741
Residual	71	29836.63	420.23		
Total	74	30363.55	410.32		
Topic Paper Scores					
Combined Main Effects	2	1690.69	845.35	1.16	.318
Instructional Mode (IM)	1	1276.67	1276.67	1.76	.189
Gender	1	414.02	414.02	.57	.453
IM – Gender Interaction	1	36.25	36.25	.05	.824
Model	3	1726.94	575.65	.79	.502
Residual	71	51612.20	726.93		
Total	74	53339.14	720.80		
Final Semester Grade					
Combined Main Effects	2	166.80	83.40	1.28	.285
Instructional Mode (IM)	1	21.81	21.81	.33	.565
Gender	1	144.99	144.99	2.22	.140
IM – Gender Interaction	1	11.37	11.37	.17	.678
Model	3	178.17	59.39	.91	.440
Residual	71	4629.79	65.21		
Total	74	4807.96	64.97		

instructional mode did not significantly relate to performance on final semester grades ($F_{\text{mode of instruction}} = .33$, df = 1, 71, p = .565). The main effect of gender did not significantly relate to final semester grades ($F_{\text{Gender}} = 2.22$ df = 1, 71, p = .140).

This study found that gender did not moderate the effect of instructional mode on any of the six performance assessments. However, female students did perform significantly better on total plant identification exams. To further our understanding of the relationship between gender and student performance on plant identification exams, more research is recommended.

Student Gender and Attitudes Toward the Course

To obtain accurate information on the SAIS survey, students were not asked to identify themselves; therefore, the moderating effects of gender upon student attitudes toward the course could not be determined.

Student Major and Performance

Total Lecture Exams

The first model examined the interactions of major and instructional mode upon total lecture exam scores. This study found that major did not moderate the effect of instructional mode upon total lecture exam scores ($F_{\text{Interaction}} = .002$, df = 1, 71, p = .963) (Table 4-10). The main effect of major did not moderate the effect of instructional mode on performance on total lecture

Table 4-10. The moderating effects of student major upon the relationship between instructional mode and total lecture exam scores, plant identification exam scores, and quiz scores in OHLD 110.

Source	df	SS	MS	F	p
Total Lecture Exam Scores					
Combined Main Effects	2	362.47	181.23	3.07	.053
Instructional Mode	1	27.26	27.26	.46	.499
Major	1	335.21	335.21	5.68	.020
IM – Major Interaction	1	.131	.131	.002	.963
Model	3	362.60	120.87	2.05	.115
Residual	71	4192.14	59.04		
Total	74	4554.74	61.55		
Plant ID Exam Scores					
Combined Main Effects	2	1254.78	627.39	2.42	.096
Instructional Mode	1	463.67	463.67	1.79	.185
Major	1	791.11	791.11	3.06	.085
IM – Major Interaction	1	39.36	39.36	.15	.698
Model	3	1294.14	431.38	1.67	.182
Residual	71	18384.55	258.94		
Total	74	19678.69	265.93		
Total Quiz Scores					
Combined Main Effects	2	1181.44	590.72	2.38	.100
Instructional Mode	1	684.12	684.12	2.76	.101
Major	1	497.32	497.32	2.00	.161
IM – Major Interaction	1	13.97	13.97	.06	.813
Model	3	1195.40	398.47	1.61	.196
Residual	71	17626.99	248.27		
Total	74	18822.39	254.36		

exam scores ($F_{\text{mode of instruction}} = .46$, df = 1, 71, p = .499). However, the main effect of major did significantly relate to total lecture exam scores ($F_{\text{major}} = 5.68$ df = 1, 71, p = .020). The adjusted means for lecture exam scores for OHLD majors was 77.43 and 81.83 for others (Table 4-11).

Total Plant Identification Scores

Major did not moderate the effect of instructional mode upon performance on plant identification exam scores ($F_{\text{Interaction}} = .15$, df = 1, 71, p = .698) (Table 4-10). After adjusting plant identification exam scores for the effects of major, the main effect of instructional mode did not significantly relate to performance on plant identification exams ($F_{\text{mode of instruction}} = .1.79$, df = 1, 71, p = .185). The main effect of major did not significantly relate to total plant identification exam scores ($F_{\text{major}} = 3.06$ df = 1, 71, p = .085).

Total Quiz Scores

Major did not moderate the effect of instructional mode upon performance on total quiz scores ($F_{\text{Interaction}} = .06$, df = 1, 71, p = .813) (Table

Table 4-11. Mean scores for total lecture exams by student major.

Student Major	Unadjusted Means*	Adjusted Mean Score**
OHLD	77.71	77.43
Other	81.49	81.83

*Mean scores are significantly different at the 0.05 level.

**Scores have been adjusted to remove the effects of type of instruction upon the relationship.

4-10). After adjusting total quiz scores for the effects of major, the main effect of instructional mode did not significantly relate to performance on total quiz scores ($F_{\text{mode of instruction}} = 2.76$, df = 1, 71, p = .101). The main effect of major did not significantly relate to total quiz scores ($F_{\text{major}} = 2.00$ df = 1, 71, p = .161).

Career Paper Scores

Major did not moderate the effect of instructional mode upon performance on career paper scores ($F_{\text{Interaction}} = .00$, df = 1, 71, p = .988) (Table 4-12). After adjusting career paper scores for the effects of major, the main effect of instructional mode did not significantly relate to performance on career paper scores ($F_{\text{mode of instruction}} = .53$, df = 1, 71, p = .469). The main effect of major did not significantly relate to career paper scores ($F_{\text{major}} = 1.57$ df = 1, 71, p = .214).

Topic Paper Scores

Major did not moderate the effect of instructional mode upon performance on topic paper scores ($F_{\text{Interaction}} = .32$, df = 1, 71, p = .576) (Table 4-12). After adjusting topic paper scores for the effects of major, the main effect of instructional mode did not significantly relate to performance on topic paper scores ($F_{\text{mode of instruction}} = 1.75$, df = 1, 71, p = .190). The main effect of major did not significantly relate to topic paper scores ($F_{\text{major}} = .15$, df = 1, 71, p = .700).

Table 4-12. The moderating effect of student major upon the relationship between instructional mode and career paper scores, topic paper scores, and final semester grade in OHLD 110.

Source	df	SS	MS	F	p
Career Paper Scores					
Combined Main Effects	2	873.56	436.78	1.05	.355
Instructional Mode	1	219.89	219.89	.53	.469
Major	1	653.72	653.67	1.57	.214
IM – Major Interaction	1	9.324E-02	9.324E-02	.000	.988
Model	3	873.65	291.22	.70	.554
Residual	71	29489.90	415.35		
Total	74	30363.55	410.32		
Topic Paper Scores					
Combined Main Effects	2	1386.08	693.04	.95	.391
Instructional Mode	1	1276.67	1276.67	1.75	.190
Major	1	109.42	109.42	.15	.700
IM – Major Interaction	1	230.41	230.41	.32	.576
Model	3	1616.49	538.83	.74	.532
Residual	71	51722.65	728.49		
Total	74	53339.14	720.80		
Final Semester Grade					
Combined Main Effects	2	278.94	139.47	2.19	.120
Instructional Mode	1	21.81	21.81	.34	.561
Major	1	257.13	257.13	4.03	.048
IM – Major Interaction	1	1.120E-04	1.120E-04	.000	.999
Model	3	278.94	92.98	1.46	.233
Residual	71	4529.02	63.79		
Total	74	4807.96	64.97		

Final Semester Grades

Major did not moderate the effect of instructional mode upon final semester grades ($F_{Interaction} = .000$, df = 1, 71, p = .999) (Table 4-12). After adjusting the final semester grades for the effects of major, instructional mode did not significantly relate to performance on final semester grades ($F_{mode\ of\ instruction} = .34$, df = 1, 71, p = .561). However, the main effect of major did significantly relate to final semester grades ($F_{major} = 4.03$ df = 1, 71, p = .048) (Table 4-16). The adjusted means for final semester grades were 60.27 for OHLD majors and 64.13 for others (Table 4-13).

This study found that student major did not moderate the effect of instructional mode upon student performance. However, this study did find that OHLD students achieved significantly lower lecture exam scores and final semester grades than students in other majors. In a college nutrition class, Carew et al. (1997) found that students who were required to take the course had lower overall scores than students who took the course as an elective.

Table 4-13. Mean scores based on a 0-75 point scale for total final semester grades by major.

Student Major	Unadjusted Means*	Adjusted Mean Score**
OHLD	60.52	60.27
Other	63.83	64.13

*Mean scores are significantly different at the 0.05 level.

**Scores have been adjusted to remove the effects of type of instruction upon the relationship.

These findings are consistent with the findings of this study in which 54.7% of the students were taking the course because it was required. Also, it may be that OHLD students assumed they knew the course material; therefore, they studied less—many of them had taken horticulture courses prior to this course—which may have resulted in lower exam scores and final semester grades.

Student Major and Attitudes Toward the Course

To obtain accurate information on the SAIS survey, students were not asked to identify themselves; therefore, the moderating effects of major upon student attitudes toward the course could not be determined.

Objective 5

The fifth objective of the study was to determine the change in student attitudes toward computers and CAI. A pre-test and posttest survey was administered on the first and last day of class to determine changes in student attitudes. The survey consisted of three subscales. The first subscale measured student comfort with computers. The mean scores for the pre-test (25.26) and the posttest (26.40) were greater than the midpoint (20), which indicated a positive attitude toward computers (Table 4-14). The second subscale measured student attitudes toward computer use. The pre-test mean score (37.66) and the posttest mean score (38.49) was above the midpoint (27.5) indicating a positive attitude. The third scale measured student attitudes

Table 4-14. Scores for student attitudes toward computers in OHLD 110.

Attitudinal Scale Pre-test and Posttest	Range Possible	 Actual	Midpoint	Respondents Mean*	 s.d.
Student Comfort With Computers					
Pre-test	8–32	12–32	20	25.26	5.00
Posttest	8–32	8–32	20	26.40	5.90
Student Attitudes Toward Computer Usefulness					
Pre-test	11–44	29–44	27.5	37.66	4.19
Posttest	11–44	27–44	27.5	38.49	4.40
Student Attitudes Toward CAI					
Pre-test	8–32	8–32	20	26.77	3.80
Posttest	8–32	18–31	20	26.80	3.19

* A mean score greater than the midpoint indicated a positive attitude. A mean score below than the midpoint indicated a negative attitude.

toward CAI. The means of both the pre-test (26.77) and the posttest (26.80) were greater than the midpoint (20), which indicated a positive attitude toward CAI. No significant differences were found between changes in student attitudes (Table 4-15).

The means for student comfort with computers approached significance (.059), indicating students may become slightly more comfortable using computers over the course of the semester. Barnes et al. (1999) found that student confidence increased slightly as students gained computer experience. Means may not have been significant since students did not receive specific instruction on how to use computers, and the students were not required to use technical computer skills.

No significant differences might also be explained by how the students rated their computer skills prior to the course. Robertson and Stanforth (1999) found that students who rated themselves as skilled computer users felt more at ease when using computers. The majority of the students in this study (64%) rated themselves as competent computer users or higher, and only 8% of the students considered themselves novice computer users. Also, CAI for this course did not require students to use technical computer skills, and since many students possessed the skills needed to participate in CAI, no significant changes in attitude occurred.

Computer ownership may also help explain why there were no significant differences. Walters and Necessary (1996) found increased positive

Table 4-15. Statistical analysis comparing the relationship between CAI and changes in student attitudes towards computers in OHLD 110.

Student Attitude Pretest and Posttest	N	Mean	s.d.	df	t	p
Computer Comfort						
Pre Computer Comfort	35	25.26	5.00	34	-1.95	.059
Post Computer Comfort	35	26.40	5.90			
Computer Use						
Pre Computer Use	35	37.66	4.19	34	-1.17	.252
Post Computer Use	35	38.49	4.40			
Attitude Toward CAI						
Pre Attitude Toward CAI	35	26.77	3.80	34	-.046	.964
Post Attitude Toward CAI	35	26.80	3.19			

attitudes among students who had prior knowledge of computers. In this study, the majority of the students (84%) owned a personal computer and 78.7% of the students had Internet access at home, which may have resulted in no significant differences.

No significant differences were found in student attitudes toward computer usefulness. Students commented that the plant identification website was tedious when accessing it from slower computers, and they often encountered network problems when accessing CourseInfo, all of which may have prevented a significant increase in student attitudes toward computer comfort. Some students felt that putting better pictures of the plants on the website would have made the site more useful.

Differences in student attitudes toward CAI were not significant. The means for the pretest (26.77) and the posttest (26.80) were almost equal. This may be largely attributed to the large number of students who had participated in CAI prior to this study (72%). Student attitudes toward CAI may not have changed throughout the semester since it was not new to them.

Although no significant differences were found, CAI students had a perceived notion that CAI was better. Butler and Mautz (1996) found that while the statistical data indicated no significant differences in student performance, students believed they learned better with CAI. Carew et al. (1997) also found that students believed CAI was a benefit to them and that CAI helped improve their grade. In this study, students commented that "having the

CourseInfo...was a big help," and "using CourseInfo is a definite plus in this course."

Students also had the perception that CAI helped them perform better. One student said "I think that my grades are a lot better since I have CourseInfo to get notes and communicate more with my instructor." Other students believed that the PowerPoint lectures allowed them to "better understand the material and ask more questions." Students also believed that the visual component of PowerPoint allowed them to learn better.

Students also liked using email to communicate with the instructor. Many students said they communicated more with the instructor because of email, and they liked using email because it "was less restrictive." One student commented that using email helped her get to know the instructor better. Students also enjoyed communicating with their classmates through email.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

This study found that CAI is as effective as TI in an introductory-level college horticulture class. No significant differences were found between instructional mode and student performance and instructional mode and student attitudes toward the course. This study found that course study time, gender, and major did not have a moderating effect on instructional mode, and no significant changes were found in student attitudes toward computers and CAI.

While this study found no significant differences between instructional mode and student performance, CAI students did have a perceived notion that CAI was beneficial to their learning. Students indicated that the PowerPoint presentations permitted them to concentrate more on the instructor and less on note taking. Students also believed that having access to the course materials via CourseInfo helped them achieve better grades. Students liked having immediate feedback through online quizzes, which they believed helped them prepare for exams.

This research found that CAI students who relied largely on the plant identification website achieved lower scores on plant identification exams than students who studied the plants in their natural setting. Students commented that the images on the website did not accurately reflect the current growth

stage of the plant in its natural setting. Students who studied the plants in their natural setting had the added advantage of using their sense of touch and smell to help them identify the plants.

Plant identification is a large part of horticulture education and further research into the effectiveness of teaching plant identification via CAI is recommended. A recommended study would be to teach three sections of plant identification using different instructional modes including CAI, TI, and web-based instruction. The study could be divided into several units in which a different group of plants (e.g., annuals, perennials, shrubs, and trees) is taught during each unit.

CAI students indicated they preferred PowerPoint lectures to traditional lectures because of the visual component of PowerPoint. CAI students enjoyed communicating with the instructor and collaborating with other students via email. Communicating through email offered students a non-threatening and non-intrusive environment in which they could communicate at any time and from any place. However, despite the students' preference for communicating via email, several students failed to check their email on a regular basis, and some students failed to thoroughly read their email, which, in some cases, resulted in poor exam scores.

To fully understand the potential of utilizing email as a collaboration and communication tool in the classroom, more research is recommended. A study could be conducted in which students are given assignments that require them

to collaborate via several communication tools including email, discussion boards, and chat rooms.

This research found that differences in course study time between CAI and TI were not significant. CAI students spent about the same amount of time studying as TI students. While course study time did not have a moderating effect on instructional mode and student performance, significant differences did exist between course study time and total quiz scores. Students who studied the most (more than 2621 minutes) achieved significantly higher quiz scores than students who studied less than 2621 minutes (less than 2620 minutes).

This study found that gender and major did not have a moderating effect on instructional mode. Significant differences were found, however, between males and females and performance on plant identification exams ($p = .018$). More research is recommended to understand the role that gender plays, if any, in how students learn plant identification. Also, this study found that Ornamental Horticulture and Landscape Design majors (OHLD) achieved significantly lower lecture exam scores and final grades than other majors. Additional research is also recommended to determine why OHLD students achieved lower lecture exam scores than other majors.

This study found that student attitudes toward computers and CAI did not change significantly throughout the semester. However, changes in students' comfort with computers did approach statistical significance (p=.

059). Student attitudes toward CAI were not significant. Most of the students (72%) in the class had participated in CAI before, which probably explains why their attitudes did not improve significantly throughout the semester.

To understand how educators can help students develop computer skills that prepare them for the workplace, more research is recommended in this area. A recommended study would require students to use more advanced technical computer skills. For example, students could be required to post research reports to a course website using HTML programming, which would also require the student to use scanners, digital cameras, and imaging software. Another recommended study is to check the backgrounds of students to determine their level of computer use in high school and then relate that information to their performance in college classes.

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LITERATURE CITED

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APPENDICES

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APPENDIX A

STUDENT ASSESSMENT OF INSTRUCTION SYSTEM SURVEY

STUDENT ASSESSMENT OF INSTRUCTION SYSTEM

THE UNIVERSITY OF TENNESSEE
OFFICE OF INSTITUTIONAL RESEARCH AND ASSESSMENT
208 CONFERENCE CENTER BLDG., 4122
974-4373

FORM **A**

DEPARTMENT: _____
INSTRUCTOR: _____
COURSE NUMBER: _____
SECTION NUMBER: _____

Use a No. 2 pencil ONLY.
Make no stray marks on this form.
Make solid marks that fill the response completely.
CORRECT: ● INCORRECT: ✓ X ◒ ⊘

DIRECTIONS: COMPLETION OF THIS QUESTIONNAIRE IS VOLUNTARY. YOU ARE FREE TO LEAVE SOME OR ALL ITEMS UNANSWERED.

	Excellent	Very Good	Good	Fair	Poor	Very Poor
1. THE COURSE AS A WHOLE WAS:	E	VG	G	F	P	VP
2. THE COURSE CONTENT WAS:	E	VG	G	F	P	VP
3. THE INSTRUCTOR'S CONTRIBUTION TO THE COURSE WAS:	E	VG	G	F	P	VP
4. THE INSTRUCTOR'S EFFECTIVENESS IN TEACHING THE SUBJECT MATTER WAS:	E	VG	G	F	P	VP
5. COURSE ORGANIZATION WAS:	E	VG	G	F	P	VP
6. CLARITY OF INSTRUCTOR'S VOICE WAS:	E	VG	G	F	P	VP
7. EXPLANATIONS BY INSTRUCTOR WERE:	E	VG	G	F	P	VP
8. INSTRUCTOR'S ABILITY TO PRESENT ALTERNATIVE EXPLANATIONS WHEN NEEDED WAS:	E	VG	G	F	P	VP
9. INSTRUCTOR'S USE OF EXAMPLES AND ILLUSTRATIONS WAS:	E	VG	G	F	P	VP
10. QUALITY OF QUESTIONS OR PROBLEMS RAISED BY THE INSTRUCTOR WAS:	E	VG	G	F	P	VP
11. STUDENT CONFIDENCE IN INSTRUCTOR'S KNOWLEDGE WAS:	E	VG	G	F	P	VP
12. INSTRUCTOR'S ENTHUSIASM WAS:	E	VG	G	F	P	VP
13. ENCOURAGEMENT GIVEN STUDENTS TO EXPRESS THEMSELVES WAS:	E	VG	G	F	P	VP
14. ANSWERS TO STUDENT QUESTIONS WERE:	E	VG	G	F	P	VP
15. AVAILABILITY OF EXTRA HELP WHEN NEEDED WAS:	E	VG	G	F	P	VP
16. USE OF CLASS TIME WAS:	E	VG	G	F	P	VP
17. INSTRUCTOR'S INTEREST IN WHETHER STUDENTS LEARNED WAS:	E	VG	G	F	P	VP
18. AMOUNT YOU LEARNED IN THE COURSE WAS:	E	VG	G	F	P	VP
19. RELEVANCE AND USEFULNESS OF COURSE CONTENT WERE:	E	VG	G	F	P	VP
20. EVALUATIVE AND GRADING TECHNIQUES (TESTS, PAPERS, PROJECTS, ETC.) WERE:	E	VG	G	F	P	VP
21. REASONABLENESS OF ASSIGNED WORK WAS:	E	VG	G	F	P	VP
22. CLARITY OF STUDENT RESPONSIBILITIES AND REQUIREMENTS WAS:	E	VG	G	F	P	VP

RELATIVE TO OTHER COLLEGE COURSES YOU HAVE TAKEN	MUCH HIGHER			AVERAGE			MUCH LOWER
23. DO YOU EXPECT YOUR GRADE IN THIS COURSE TO BE:	6	5	4	3	2	1	0
24. THE INTELLECTUAL CHALLENGE PRESENTED WAS:	6	5	4	3	2	1	0
25. THE AMOUNT OF EFFORT YOU PUT INTO THIS COURSE WAS:	6	5	4	3	2	1	0
26. THE AMOUNT OF EFFORT TO SUCCEED IN THIS COURSE WAS:	6	5	4	3	2	1	0
27. YOUR INVOLVEMENT IN THIS COURSE (DOING ASSIGNMENTS, ATTENDING CLASSES, ETC.) WAS:	6	5	4	3	2	1	0

28. ON AVERAGE, HOW MANY HOURS PER WEEK HAVE YOU SPENT ON THIS COURSE, INCLUDING ATTENDING CLASSES, DOING READINGS, REVIEWING NOTES, WRITING PAPERS, AND ANY OTHER RELATED COURSE WORK?

29. FROM THE TOTAL AVERAGE HOURS ABOVE, HOW MANY DO YOU CONSIDER WERE VALUABLE IN ADVANCING YOUR EDUCATION?

○ UNDER 2	○ 6 - 7	○ 12 - 13	○ 18 - 19	
○ 2 - 3	○ 8 - 9	○ 14 - 15	○ 20 - 21	
○ 4 - 5	○ 10 - 11	○ 16 - 17	○ 22 OR MORE	

30. THE GRADE I EXPECT IN THIS COURSE IS:

○ A	○ D
○ B+	○ F
○ B	○ SATISFACTORY
○ C+	○ NO CREDIT
○ C	○ OTHER

31. IN REGARD TO YOUR ACADEMIC PROGRAM, THIS COURSE IS:
- ○ IN MY MAJOR
- ○ IN MY MINOR
- ○ A DISTRIBUTION REQUIREMENT
- ○ AN ELECTIVE
- ○ OTHER

32. MY CLASS IS:
- ○ FRESHMAN
- ○ SOPHOMORE
- ○ JUNIOR
- ○ SENIOR
- ○ GRADUATE
- ○ OTHER

33. WHEN REGISTERING, WAS THIS A COURSE YOU WANTED TO TAKE?
- ○ YES
- ○ NO
- ○ NEUTRAL

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APPENDIX B

COURSE STUDY TIME SHEET

Bi-weekly Time Sheet

Name:

Week #				Week #			
Date	**Day**	**Time started**	**Time ended**	**Date**	**Day**	**Time started**	**Time ended**
/	Tuesday	:	:	/	Tuesday	:	:
		:	:			:	:
		:	:			:	:
		:	:			:	:
/	Wednesday	:	:	/	Wednesday	:	:
		:	:			:	:
		:	:			:	:
		:	:			:	:
/	Thursday	:	:	/	Thursday	:	:
		:	:			:	:
		:	:			:	:
		:	:			:	:
/	Friday	:	:	/	Friday	:	:
		:	:			:	:
		:	:			:	:
		:	:			:	:
/	Saturday	:	:	/	Saturday	:	:
		:	:			:	:
		:	:			:	:
		:	:			:	:
/	Sunday	:	:	/	Sunday	:	:
		:	:			:	:
		:	:			:	:
		:	:			:	:
/	Monday	:	:	/	Monday	:	:
		:	:			:	:
		:	:			:	:

APPENDIX C

DEMOGRAPHIC SURVEY

Last Four Digits of Social Security Number ____ ____ ____ ____

Introduction to Ornamental Horticulture Survey

1. Sex (circle one): M F

2. Ethnic origin:
   a. Caucasian
   b. Asian
   c. African American
   d. Hispanic
   e. Other_____

3. Age_____

4. Major_____

5. Why are you enrolled in this course?

   a. Required
   b. Elective
   c. Other_____

6. Is this your first degree?

   Yes No

7. What is your current GPA? _____

8. Are you a transfer student?

   Yes No

9. Are you employed?

   Yes No

10. What is your employment status?

    Part-time Full-time

11. Do you own a computer at home?

    Yes No

12. Do you have Internet access at home?

    Yes No

13. Have you ever participated in a course that uses computers for instruction?

    Yes No

14. Have you used CourseInfo before?

    Yes No

15. Where do you use computers the most?

    Home Work
    School

16. Where do you access the Internet most?

    Home Work
    School

17. How would you rate yourself as a computer user?

    a. Novice
    b. Advanced Beginner
    c. Competent Performer
    d. Proficient Performer
    e. Expert Performer

Thank You!

APPENDIX D

STUDENT ATTITUDES TOWARD COMPUTERS AND CAI SURVEY

Pretest Questionnaire

Enter the last four digits of your social security number___ ___ ___ ___

Circle the number that best completes the following statements:		**Disagree**	**Somewhat Disagree**	**Somewhat Agree**	**Agree**
1.	If I can use the Internet, I will be productive.	1	2	3	4
2.	I feel comfortable about my ability to work with computer technologies.	1	2	3	4
3.	Knowing how to use computer technologies will not be helpful in my future classes.	1	2	3	4
4.	CAI may help me better understand concepts covered in the course.	1	2	3	4
5.	I don't have any use for computer technologies on a day-to-day basis.	1	2	3	4
6.	CAI may motivate me to learn the course content.	1	2	3	4
7.	I do not think that computer technologies will be useful to me in my profession.	1	2	3	4
8.	CAI may help me study more effectively for exams.	1	2	3	4
9.	I am confident about my ability to do well in a course that requires me to use computer technologies.	1	2	3	4
10.	Using computer technologies to communicate with others over the Internet can help me to be more effective in my classes.	1	2	3	4

Circle the number that best completes the following statements:	**Disagree**	**Somewhat Disagree**	**Somewhat Agree**	**Agree**
11. Anything that computer technologies can be used for, I can do just as well some other way.	1	2	3	4
12. Using CAI in the course may improve my learning skills in other courses.	1	2	3	4
13. I feel at ease learning about computer technologies.	1	2	3	4
14. Using CAI may help me earn a better grade in the course.	1	2	3	4
15. Using computer technologies in my classes will only mean more work for me.	1	2	3	4
16. With the use of computer technologies, I can create materials to enhance my performance in the classroom.	1	2	3	4
17. I could use the Internet to access many types of information sources for my coursework.	1	2	3	4
18. It is convenient to use CAI on campus.	1	2	3	4
19. Computer technologies can be used to assist me in organizing my work.	1	2	3	4
20. I don't see how I can use computer technologies to learn new skills.	1	2	3	4
21. I appreciate the opportunity to learn how to use CAI.	1	2	3	4

Circle the number that best completes the following statements:	**Disagree**	**Somewhat Disagree**	**Somewhat Agree**	**Agree**
22. I am not the type to do well with computer technologies.	1	2	3	4
23. I will enjoy using CAI in this course.	1	2	3	4
24. I am anxious about computers because I don't know what to do if something goes wrong.	1	2	3	4
25. The thought of using computer technologies frightens me.	1	2	3	4
26. I do not feel threatened by the impact of computer technologies.	1	2	3	4
27. Computer technologies are confusing to me.	1	2	3	4

Thank you!

Posttest Questionnaire

Enter the last four digits of your social security number___ ___ ___ ___

Circle the number that best completes the following statements:		**Disagree**	**Somewhat Disagree**	**Somewhat Agree**	**Agree**
1.	If I can use the Internet, I will be productive.	1	2	3	4
2.	I feel comfortable about my ability to work with computer technologies.	1	2	3	4
3.	Knowing how to use computer technologies will not be helpful in my future classes.	1	2	3	4
4.	CAI helped me better understand concepts covered in this course.	1	2	3	4
5.	I don't have any use for computer technologies on a day-to-day basis.	1	2	3	4
6.	CAI motivated me to learn the course content.	1	2	3	4
7.	I do not think that computer technologies will be useful to me in my profession.	1	2	3	4
8.	CAI helped me study more effectively for exams.	1	2	3	4
9.	I am confident about my ability to do well in a course that requires me to use computer technologies.	1	2	3	4
10.	Using computer technologies to communicate with others over the Internet has helped me to be more effective in my classes.	1	2	3	4

Circle the number that best completes the following statements:	**Disagree**	**Somewhat Disagree**	**Somewhat Agree**	**Agree**
11. Anything that computer technologies can be used for, I can do just as well some other way.	1	2	3	4
12. Using CAI in this course has improved my learning skills in other courses.	1	2	3	4
13. I feel at ease learning about computer technologies.	1	2	3	4
14. Using CAI helped me earn a better grade in this course.	1	2	3	4
15. Using computer technologies in my classes will only mean more work for me.	1	2	3	4
16. With the use of computer technologies, I can create materials to enhance my performance in the classroom.	1	2	3	4
17. I could use the Internet to access many types of information sources for my coursework.	1	2	3	4
18. It was convenient to use CAI on campus.	1	2	3	4
19. Computer technologies can be used to assist me in organizing my work.	1	2	3	4
20. I don't see how I can use computer technologies to learn new skills.	1	2	3	4
21. I appreciated the opportunity to learn how to use CAI.	1	2	3	4

Circle the number that best completes the following statements:	**Disagree**	**Somewhat Disagree**	**Somewhat Agree**	**Agree**
22. I am not the type to do well with computer technologies.	1	2	3	4
23. I enjoyed using CAI in this course.	1	2	3	4
24. I am anxious about computers because I don't know what to do if something goes wrong.	1	2	3	4
25. The thought of using computer technologies frightens me.	1	2	3	4
26. I do not feel threatened by the impact of computer technologies.	1	2	3	4
27. Computer technologies are confusing to me.	1	2	3	4

Thank you!

VITA

Linda M. Seals was born in Greensburg, Indiana on August 25, 1960. She attended public school in Columbus, Indiana where she graduated from Columbus East Sr. High School in 1978. She managed restaurants until 1984 when she moved to Cincinnati, Ohio to accept a position in retail management. While employed as a retail manager, she lived in several Midwest cities including Lima, Ohio, Detroit, Michigan, and Chicago, Illinois.

In 1990, Linda moved to Knoxville, Tennessee where she began working as a cabinetmaker. She attended Pellissippi State Community College until 1996 when she transferred to the University of Tennessee. She received a Bachelor of Science degree in May 1999, majoring in Ornamental Horticulture and Landscape Design. In May 1999, she entered the graduate program at the University of Tennessee. Linda taught undergraduate horticulture classes while earning a Master of Science degree in Ornamental Horticulture and Landscape Design. After graduation, she hopes to gain full-time employment where she can use her teaching and horticulture skills in public horticulture.

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