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ACHIEVEMENT IN ONLINE AND CAMPUS-BASED CAREER AND TECHNICAL EDUCATION (CTE) COURSES

Angela D. Benson
Scott D. Johnson
Gail D. Taylor
Tod Treat
Olga N. Shinkareva
John Duncan

University of Illinois at Urbana-Champaign,
Urbana-Champaign, Illinois, USA

Community colleges are actively involved in distance-learning programs in Career and Technical Education (CTE). Over 76% of community colleges offer some form of distance learning in CTE. Over the years, only a few isolated studies have compared the effectiveness of distance CTE courses to traditional face-to-face courses. Typically, the findings of previous studies indicate no significant differences between the two methods. This study was designed to address the lack of systematic studies of this question. It also examines how student motivation and learning strategies differ for campus-based and online students. Finally, it investigates how online and campus-based courses differ in terms of course interaction, content organization, student support, and transactional distance (i.e., feelings of closeness to the instructor and the program).

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Address correspondence to Angela D. Benson, University of Illinois at Urbana-Champaign, Urbana-Champaign, IL 61820. E-mail: abenson@uiuc.edu

INTRODUCTION

Community colleges are actively involved in distance learning programs in Career and Technical Education (CTE). Based on data from a recent national survey, 76.3% of community colleges offer some form of distance learning in CTE (Johnson et al., 2003). These community colleges offer CTE at a distance because it helps them reach nontraditional students (83.0%), reduces time constraints for students (82%), increases access to new audiences (79.1%), increases student access to academic courses (77.7%), and increases student access by making courses available at convenient locations (74.8%). The majority of the community colleges participating in the survey (88.6%) reported that they expected moderate to large increases in their distance CTE enrollments. These percentages were consistent across institution locations, regions, and sizes. Much of the expected growth in distance learning is due to the fact that "lifelong learners want greater flexibility to accommodate diverse personal circumstances" (Wonacott, 2001, ¶ 2), which include meeting family and job responsibilities (Zirkle, 2003).

Over the years, isolated studies of CTE courses (e.g., biology, accounting, nursing) comparing the effectiveness of distance courses to traditional face-to-face courses have typically resulted in findings of "no significant difference" (Russell, 2002). There does appear to be an advantage to distance learning courses if one looks beyond learning outcomes. For example, a recent study of baccalaureate nursing students found a significant difference between online and face-to-face students in their degree of "enculturation" or socialization into the field of nursing (Nesler & Hanner, 2001). In that study, the distance students had higher socialization scores than did the campus-based nursing students. This suggests that distance learning courses can contribute to the social or "soft" skills of CTE students.

In general, however, few studies have systematically investigated the effectiveness of postsecondary CTE courses delivered online compared to those delivered face-to-face (Zirkle, 2003). The overall lack of attention in the literature to distance learning in CTE raises several key concerns that must be addressed. First, there are concerns about the isolation of the online student and how that impacts the learning process. Second, because of its growing prevalence, the CTE community needs to know how distance learning impacts student achievement at the postsecondary level. The issue of student achievement is more complex for CTE than for other fields of study because of the importance of developing vocational and technical skills, the need for articulation between secondary and postsecondary programs, and the requirement

that CTE students be able to apply their learning in workplace settings. This study was designed to address these concerns.

Another unique aspect of this study is the examination of the interactions that occur among students and between students and their instructor. Interaction in this study is aligned with the theory of transactional distance, which addresses feelings of closeness between and the instructor and students in a learning environment. Transactional distance is a function of both "dialogue" and "structure" (Moore, 1993). Dialogue in a class is influenced by the course content, the educational philosophy of the instructor, the design of the course, the psychological characteristics of the instructor and the learner, and the characteristics of the communication medium. Course structure relates to the degree of individualization of learning experiences in terms of the course objectives, teaching strategies, and student evaluations. The teaching philosophy, design of the course, and the psychological characteristics of the instructor influence course structure. A learning environment with low structure and high dialogue will yield "close" transactional distance, whereas high structure and low dialogue will result in "remote" transactional distance. Other variables of interest include the students' perceptions of the course organization and the degree of support they receive as students in a course. Examining issues of course interaction, structure, and support will provide additional insight into the nature of online learning for CTE students.

PURPOSE AND RESEARCH QUESTIONS

This study builds on a recent national survey that determined the current status and future trends associated with distance learning in postsecondary career and technical education in the United States (Johnson et al., 2003). The purpose of this study was to investigate the course structures and environments used for online CTE courses and to compare their effectiveness to equivalent campus-based courses in terms of the extent to which the students demonstrated the desired learning outcomes. The following research questions guided the design of this study:

1. **How does student achievement and skill development in online courses compare to campus-based courses?**
2. **How does student motivation and learning strategies differ for campus-based and online students?**
3. **How do online and campus-based courses differ in terms of course interaction, content organization, student support, and transactional distance (i.e., feelings of closeness to the instructor and program)?**

METHOD

A mixed method design was utilized for this research. This design included quasi-experimental studies that compared student achievement in equivalent online and face-to-face courses. It also included qualitative case studies that fully described each of the matched sets of courses. Because the small number of students in the various course samples limits the generalizability of the statistical findings, the statistical analysis was supplemented with detailed qualitative case descriptions of each course.

The population of the study consisted of students who were enrolled in postsecondary CTE courses in 2002 and/or 2003. To yield legitimate findings and to minimize the number of factors that could influence the validity of the study, the following criteria were used for selection of the matched pairs of online and campus-based courses.

- **The courses were recognized as exemplary by the colleges that offered them.**
- **The learning context of the courses addressed specific skill training, as well as knowledge and attitudes for job employment or advancement.**
- **Each pair of courses was developed by the same instructor and was delivered by the same department.**
- **Both versions of the course were taught by the same instructor, or by the instructors who worked together on the course and who used similar teaching approaches.**
- **The learning objectives and requirements of the online and campus-based versions of the course were similar, and each version covered the same content, outcomes, and required the same projects.**
- **The courses were offered during the same time frame, and there were no special conditions or rules established for accepting or assigning students to the online and campus-based versions of the course.**
- **For online courses, the primary interaction between instructor and students, students and students, and students and content was mediated by an online technology.**

Based on the above sampling procedure, five courses at three community colleges with a total of 112 campus students and 81 online students were identified as participants for this study (see Table 1).

Table 1. Listing of participant courses with number of students

Institution	Course name	Course type	
		Campus	Online
Jefferson State Community College (Birmingham, AL)	Embalming II (FSE 202)	17	9
	Advanced Restorative Arts (FSE 214)	9	5
St. Petersburg College (St. Petersburg, FL)	Animal Laboratory Procedures Lab (ATE 2638L)	39	23
	Animal Nursing & Medicine Lab I (ATE 2651L)	34	34
County College of Morris (Randolph, NJ)	Landscape Design and Planning (AGR 211)	13	10
	Total	112	81

Data were initially collected from the students in each matched pair of courses using the motivation section of the Motivated Strategies for Learning Questionnaire (MSLQ) and a pretest at the beginning of the semester. A posttest, the learning strategies section of the MSLQ, and the Course Interaction, Structure, and Support questionnaire (CISS) were administered at the end of the semester. The instruments were administered in both paper-based and online formats.

Data collection also involved the examination of course documentation, including student assignments, results of course exams, and final course grades, as well as the students' projects. Descriptive and procedural course data were also collected from a variety of sources, including the official course description, course syllabus and other course-related documents, demographic enrollment data, and documented interviews with the instructors. The data collection also consisted of on-campus interviews and observations of instructors and students, and a review of the online course. Interview data with the course instructors were collected prior to the start of each course and after the course was completed via telephone and email conversations. Guided interview protocols were used to direct the interviews.

The analysis of the collected quantitative data was conducted as follows. First, descriptive statistics of the students' demographic and aptitude characteristics, as well as pretest and posttest scores, teacher evaluations of course projects, results of final exams, and motivation, learning strategy, and learning environment assessment data were calculated. The differences of these outcomes were then

examined according to the delivery format. Statistical analysis was comprised of descriptive statistics and comparative analysis between matched pairs of the courses. The Mann-Whitney U test was utilized for comparison of pre and posttest results with a level of significance equal to .05 on all statistical analyses.

As prescribed by Merriam (1998), the analysis of the qualitative data began concurrently with data collection, and employed the method of constant comparison. After each site visit, two researchers analyzed the site interview data and observation notes. They clarified any discrepancies in understanding and identified open questions needing resolution. Next, researchers analyzed the collected site documentation and compared it with the interview and observation data. When necessary, follow-up questions were posed to the key informants at each site. The findings were then summarized in a course matrix for each course. The course matrix served as the input for the narrative descriptions of each site.

DESCRIPTION OF RESEARCH SITES

Three different community colleges were involved in this study: Jefferson State Community College (Birmingham, Alabama), St. Petersburg College (Tampa, Florida), and County College of Morris (Randolph, New Jersey). These colleges were selected because they have relatively long histories in distance education, and their online programs have been identified as exemplary by their institutions.

Funeral Service Education at Jefferson State Community College

Two courses from the Funeral Service Education (FSE) program at Jefferson State Community College (JSCC) were included in the study (i.e., Embalming II and Restorative Arts II). This section describes the courses, the students, and the research findings.

Embalming II

The Funeral Service Education program teaches embalming in a sequence of three courses: Embalming I, Embalming II, and Embalming Lab. In Embalming I, students learn the basic skills, aptitudes, and personal qualifications needed to become a professional embalmer, as well as each of the primary phases of embalming. In Embalming II, students learn about specific embalming problems and procedures. Upon completion, students are able to apply acquired knowledge and skills to an embalming case analysis. The Embalming Lab course is conducted at a funeral home local to JSCC. In this course, the

students demonstrate their proficiency with embalming techniques by performing 20 embalmings that are observed and evaluated by a licensed embalmer using an evaluation rubric provided by JSCC.

The classroom version of the embalming sequence was first offered to students in 1969 and the online version in 1999. Students completing the classroom version attend weekly lecture sessions presented in an on-campus classroom. They also attend midterm and final exam review sessions. Students who are completing the online version log in to the course in WebCT® to watch and listen to the streamed recordings of the weekly lectures. They can choose to travel to campus to attend midterm and final review sessions that are presented in a classroom, but it is not mandatory that they do so. To assess learning outcomes, students completing the classroom version complete weekly quizzes as well as midterm and final exams. Students completing the online version do not complete the weekly quizzes. They do, though, travel to the campus to complete the midterm and final exams.

Students completing the classroom version interact with the instructor, other students, program staff, and support personnel every week the course meets during the semester. They can also meet one-on-one with these people on campus during scheduled office hours. Students completing the online version only interact on-campus with the instructor, other students, the program staff, and support personnel at the beginning of the semester orientation, midterm examination, and final examination. These students must drive to campus for one-on-one meetings during scheduled office hours or by appointment. All students have 24/7 access to the instructor, as well as the program coordinator and tutor/technical support person, via email and by telephone during the normal weekday work hours. The online course content does not make use of any synchronous or asynchronous tools to promote collaboration or discussion among the students or among the students and instructor.

Advanced Restorative Arts

Advanced Restorative Arts, or Restorative Arts II, is a continuation of Restorative Arts I. Students who completed Restorative Arts I bring to this course knowledge of general art principles (e.g., anatomical modeling, expression, tools, materials, and use of color and cosmetics) as applied to funeral service. In this course, color theory is emphasized using special cosmetics and lighting. Students are able to demonstrate proper restorative art techniques upon completion of this course.

The classroom version of this course was first offered in 1973 and the online version in 1999. Students completing the classroom version

of the course attend weekly lecture sessions presented in an on-campus classroom. They also attend midterm and final review sessions that are presented in the classroom. Students completing the online version do not have access to the weekly lectures, as they are not made available to them. They may travel to campus to attend optional midterm and final exam review sessions that are presented in a classroom.

To measure learning outcomes, all students take midterm and final exams, and complete a face restoration project called a canon. Students completing the online course travel to campus to complete the midterm and final exams. Students complete their canons at midterm exam time, using the on-campus midterm review as laboratory time to complete the project and get assistance from the instructor. While the canons are graded at midterm, students may redo them by final-exam time and have the canons re-graded in anticipation of receiving a higher score.

Student Characteristics

Table 2 shows the gender and race distributions of the students enrolled in Embalming II and Restorative Arts II during Summer 2003.

Table 2. Gender and race of students enrolled in campus and online formats of Embalming II and Restorative Arts II

	Campus		Online	
	n	%	*n*	%
Embalming II				
Gender				
Male	7	41.2	6	66.7
Female	10	58.8	3	33.3
Race				
Unknown	1	5.9	2	22.2
White	8	47.1	5	55.6
Black	7	41.2	2	22.2
Native	1	5.9	0	0
Restorative Arts II				
Gender				
Male	2	22.2	3	60
Female	7	77.8	2	40
Race				
Unknown	1	11.1	1	20
White	3	33.3	2	40
Black	5	55.6	2	40

The enrollment in the on-campus section of Embalming II (20) exceeded the enrollment in the online section (9). Of the 20 on-campus students, seventeen participated in the study while all nine of the online students participated. For both courses, the on-campus versions had a greater percentage of female students (Embalming II, 58.8%; Restorative Arts II, 77.8%) than the online version (Embalming II, 33.3%; Restorative Arts II, 40%). For both courses, ethnic minorities appear to be better represented in the on-campus versions (Embalming II, 47.1%; Restorative Arts II, 55.6%) than in the online versions (Embalming II, 22.2%; Restorative Arts II, 40%).

A comparison of the workload, course load, and work experience of online and on-campus students yielded no significant difference in either the Embalming II or the Restorative Arts II course (see Table 3). Since all FSE students must hold apprenticeships of a minimum of 30 hours per week, it is not surprising that there is no significant difference in the number of hours that online and on-campus students worked in the funeral-service industry. Likewise, since the FSE program is very structured with the course load that students take each semester, it is not surprising that there is no significant difference in the academic course load of online and on-campus students. Interestingly, there was no significant difference in the number of hours that enrolled students worked in jobs outside the funeral-service industry. This finding is consistent with the evidence that many student apprenticeships were unpaid and needed to be supplemented with additional income. The lack of a difference in the years of experience

Table 3. Work experience and courseload of students enrolled in campus and online formats of Embalming II and Restorative Arts II

	Campus			Online				
	n	**Mean**	***SD***	***n***	**Mean**	***SD***	***U***	***p*-value**
Embalming I								
Hours/week in funeral home	16	37.19	15.01	9	37.44	13.18	68.00	0.642
Hours/week outside funeral home	10	27.60	15.09	5	32.00	13.51	74.00	0.888
Years in funeral service	17	6.06	7.48	9	3.78	2.17	74.50	0.913
Credit hour enrollment	15	11.27	4.85	8	8.75	4.59	59.00	0.339
Restorative Arts II								
Hours/week in funeral home	8	30.50	8.32	5	35.00	10.00	14.50	0.278
Hours/week outside funeral home	4	31.25	11.82	3	33.33	11.55	18.00	0.516
Years in funeral service	7	3.71	3.40	5	4.40	1.95	11.50	0.132
Credit hour enrollment	9	12.89	2.89	4	12.25	2.87	16.00	0.336

Note: Values in bold type are significant at $p > .05$.

in the online and on-campus students may be attributed to the fact that graduation from an accredited funeral-service program is a requirement for licensing in the funeral-service industry. Thus, individuals may work in the industry but once they decide to make a career of it, they enroll in a program.

Comparison of Motivation, Learning Strategies, Course Experience and Achievement

Motivation Differences

Students enrolled in both sections completed a motivation instrument at the start of the course. Table 4 shows the average motivation scores (range = 1–7) in four areas: intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, and test anxiety. For both Embalming II and Restorative Arts II, significant differences were found between online and on-campus students in the areas of self-efficacy and test anxiety. In both courses, online students scored higher on self-efficacy than on-campus students, while campus students scored higher on test anxiety. A significant difference also existed for the task value for Embalming II students, with online students scoring higher than on-campus students. No significant difference was found in the areas of intrinsic goal motivation, extrinsic goal motivation or control of learning beliefs.

Learning Strategy Differences

Students completed a learning strategies and course experience instrument at the end of the course. The learning strategies instrument measured two areas: time and study environment, and effort regulation. As shown in Table 4, the learning strategies average scores (range = 1–7) did not differ significantly. Students in the online and on-campus formats of both courses scored high in both time and study environment and effort regulation.

Course Experience Differences

The CISS instrument measured four areas (range = 1–4): student-student and student-instructor interaction, department and instructor support, course structure, and transactional distance. As shown in Table 4, no significant difference was found between online and on-campus students in either course for any of the four areas of course experience, except for transactional distance in the Restorative Arts II course. In this area, the campus students reported feeling closer to their instructor, program, and college than the online students. Since on-campus students had the opportunity to interact with the course instructor and each other weekly in the classroom—and

Table 4. Motivation, learning strategies, CISS, and achievement scores for campus and online formats of Embalming II and Restorative Arts II

	Campus			Online				
	n	Mean	*SD*	*n*	Mean	*SD*	*U*	*p*-value
Embalming II								
Motivation								
Intrinsic goal orientation	17	5.35	1.21	9	6.19	0.77	49.50	0.143
Extrinsic goal orientation	17	5.54	1.25	9	5.56	0.92	72.50	0.828
Task value	17	5.95	0.82	9	6.57	0.36	40.00	**0.048**
Control of learning	17	5.72	0.91	9	6.39	0.47	43.50	0.073
Self-efficacy	17	5.26	1.03	9	6.17	0.94	37.50	**0.035**
Test anxiety	17	4.98	1.82	9	3.84	1.29	36.50	**0.031**
Learning strategies								
Time & study environment	17	4.99	0.87	9	4.46	0.92	52.50	0.195
Effort regulation	17	5.57	0.90	9	5.50	0.99	74.50	0.913
CISS								
Course interaction	17	3.11	0.31	9	3.99	0.21	71.00	0.760
Course support	17	2.92	0.22	9	2.78	0.20	52.50	0.180
Course structure	17	3.00	0.27	9	2.89	0.43	62.50	0.436
Transactional distance	15	2.13	0.46	8	1.79	0.26	33.00	0.072
Achievement								
Midterm score	17	73.65	10.30	9	83.78	8.17	30.50	**0.013**
Final exam score	17	73.18	10.62	9	78.11	8.40	51.00	0.169
Pretest score	17	30.39	21.10	9	44.44	16.43	47.50	0.116
Posttest score	17	81.21	14.08	9	82.41	9.21	773.50	0.870
Restorative Arts II								
Motivation								
Intrinsic goal orientation	8	5.66	0.95	5	6.20	0.89	12.50	0.270
Extrinsic goal orientation	8	5.00	1.28	5	5.65	1.49	14.00	0.376
Task value	8	5.90	0.94	5	6.70	0.51	8.00	0.074
Control of learning	8	6.00	0.99	5	6.65	7.83	11.00	0.165
Self-efficacy	8	5.22	0.96	5	6.43	1.29	6.00	**0.037**
Test anxiety	8	4.58	1.35	5	3.52	2.34	13.50	**0.034**
Learning strategies								
Time & study environment	9	4.94	1.06	5	4.40	1.20	18.00	−0.601
Effort regulation	9	5.19	1.12	5	5.65	0.86	17.00	−0.742
CISS								
Course interaction	9	3.37	0.36	5	3.03	0.33	12.00	0.155
Course support	9	3.08	0.42	5	2.97	0.24	21.00	0.838
Course structure	9	3.26	0.39	5	3.13	0.51	17.50	0.492
Transactional distance	9	2.48	0.40	5	1.77	0.32	4.50	**0.015**
Achievement								
Project score	9	88.11	6.27	5	89.00	5.48	21.00	0.834
Final exam score	9	83.67	10.36	5	82.80	22.39	16.00	0.383
Pretest score	9	7.42	14.70	5	0.00	0.00	15.00	0.163
Posttest score	9	45.68	17.07	5	53.33	19.88	15.00	0.305

Note: Values in bold type are significant at $p > .05$.

neither online course provided tools for interaction or collaboration—it is not surprising that there was a significant difference in transactional distance. The lack of difference in reported student experiences of department and instructor support and course structure are expected since both versions of both courses have the same structure and support resources.

Student Achievement Differences

Table 4 shows the average students' scores on course assessments. No significant differences were found in the scores of online and on-campus Restorative Arts II students in the pretest, posttest, course project (canon), midterm exam, or final exam. A significant difference was found in the midterm exam scores of the Embalming II online and on-campus students, but not in the pretest, posttest or final exam grades. Whatever edge online students had at midterm was lost by the final exam.

Veterinary Technology at St. Petersburg College

Two courses from the Veterinary Technology program at St. Petersburg College (SPC) were included in the study. The courses were Animal Laboratory Procedures I (ATE 2638L) and the Animal Nursing and Medicine Laboratory I (ATE 2651L). This section describes the courses, the students, and the research findings for the comparison of the online and campus-based courses.

Animal Laboratory Procedures I (ATE 2638L) and Animal Nursing and Medicine Laboratory I (ATE 2651L)

Animal Laboratory Procedures I (ATE 2638L) and Animal Nursing and Medicine Laboratory I (ATE 2651L) are offered in the students' second year. The students tend to be somewhat experienced in the program and the Veterinary Technology (VT) field.

The curriculum in both courses has been built to be highly consistent between the classroom and online versions of each course in the program. Thus, the same outcomes are met regardless of format. The distance courses are taught online using the WebCT® learning management software. The WebCT® course area contains lecture notes and syllabi as text documents and WebPages®, a chat space. It also includes WebBoard, another learning management software product, and electronic grade books. In addition, students are required to register with the Veterinary Information Network (VIN), an online information service for veterinarians. A division of VIN, the Veterinary Support Personnel Network (VSPN), contains areas designed specifically for veterinary technicians, assistants, and practice

managers. Within VIN, students can connect with clinics, ask technical questions of each other and other practitioners, access resources, and look for jobs.

Online students complete proctored midterm and final exams at a location that has been approved by the program director. The exams are mailed to the proctor with instructions that ensure that the student takes the test in a timely matter and then it is returned to SPC. A major emphasis of the program at SPC is to develop clinical skills in an authentic setting. Online students must work a minimum of 20 hours per week in a veterinary facility while enrolled in the VT program. The program has standards to ensure that the clinic has the required equipment and personnel. Staff at the clinic must agree to help the student learn the skills being taught in the course. A licensed veterinarian, who is an American Veterinary Medical Association (AVMA) member, must be willing to observe and evaluate the student's work. In the event that equipment and/or skills are not available at the clinic that employs the student, s/he may arrange to learn and demonstrate that skill at another clinic. In both campus and online courses, skills are assessed for mastery. Development of the skill occurs through repetition until the instructor or clinical staff member certifies that the skill can be performed.

Student Characteristics

As shown in Table 5, the demographic compositions of the online and on-campus cohorts were quite similar. Traditionally, two-thirds of the on-campus students are from out-of-state and one-third of the students are in state. Students in the Animal Technology veterinary technician program are primarily white and female (G. Hancock, personal communication, August 5, 2003). Fewer than 15% of those students who reported their gender and ethnicity were nonwhite across both classes and delivery formats, with no pattern of preference evident. Less than 5% of the students were male. This is not inconsistent with national statistics in health-profession careers (National Center for Education Statistics [NCES], 2002).

Institutional data indicate that students in campus and online classes have similar grade-point averages (see Table 6). However, the data also highlight differences between online and campus students with respect to age and credit hours earned. Online students are 3 to 4 years older than campus students, on average, and have completed 3 to 4 credit hours more than campus students.

In addition, online and on-campus students differ significantly in their amount of work experience in the veterinary field (see Table 7).

Table 5. Gender and race of students enrolled in campus and online formats of Animal Laboratory Procedures I and Animal Nursing and Medicine Lab I

	Campus		Online	
	n	%	*n*	%
Animal Laboratory Procedures I				
Gender				
Unknown	4	10.8	9	37.5
Male	1	2.7	0	0
Female	32	86.5	15	62.5
Race				
Unknown	3	8.1	9	37.5
White	30	81.1	14	58.3
Black	3	8.1	0	0
Asian	0	0	1	4.2
Hispanic	1	2.7	0	0
Animal Nursing & Medicine Lab I				
Gender				
Unknown	2	6.5	16	45.7
Male	0	0	1	2.9
Female	29	93.5	18	51.4
Race				
Unknown	3	9.7	17	48.6
White	25	80.6	16	45.7
Black	2	6.5	0	0
Asian	0	0	1	2.9
Hispanic	1	3.2	1	2.9

Table 6. GPA, earned credit hours, and age of students enrolled in campus and online formats of Animal Laboratory Procedures I and Animal Nursing and Medicine Lab I

	Campus		Online	
	Mean	*SD*	Mean	*SD*
Animal Laboratory Procedures I				
GPA	3.1	0.4	3.3	0.3
Credit Hours Earned	96.3	36.8	99.8	34.1
Age	27.3	6.9	30.2	8.5
Animal Nursing & Medicine Lab I				
GPA	3.1	0.3	3.1	0.5
Credit Hours Earned	95.4	34.1	99.3	33.5
Age	26.9	6.2	31.2	8.5

Students in the online courses work many more hours in veterinary clinics than the students in the campus-based courses. In contrast, the students in the campus-based courses work more hours than the online students in jobs that are unrelated to the veterinary field. Students in the online versions of Animal Laboratory Procedure (ALP) and Animal Nursing and Medicine I (ANM) averaged over 30 hours per week in veterinary clinics, while those students in the campus versions of these courses worked about 16 hours per week in the clinics. At the same time, the campus students spent about 12–15 hours working *outside the field*, while the online students spent very little time working on jobs that were unrelated to their field of study. Taken together, online students spend considerably greater time in clinical settings with fewer employment distractions. Additional time on task in authentic settings may provide online students with additional skills development.

Table 7 shows there was also a significant difference in the number of years spent working in the veterinary field and the number of credit hours taken during the semester. The online students, on average, have about four more years of experience in the veterinary field than the campus students. Student experience in the veterinary field and credit-hour enrollment are not significantly different between online and campus students in this study. On average, the students in the campus program enrolled in nearly twice as many credit hours per semester than online students.

Table 7. Work experience and courseload of students enrolled in campus and online formats of Animal Laboratory Procedures I and Animal Nursing and Medicine Lab I

	Campus			Online				
	n	*Mean*	*SD*	*n*	*Mean*	*SD*	*U*	*p*-value
Animal Laboratory Procedures I								
Hours/week in vet clinic	11	16.00	14.16	11	31.64	11.83	24.50	**0.02**
Hours/week outside vet field	10	12.20	17.97	9	0.00	0.00	27.00	**0.04**
Years in vet field	11	2.64	2.83	11	7.27	4.76	20.00	**0.01**
Credit hour enrollment	11	10.18	3.06	11	6.36	1.57	16.50	**0.00**
Animal Nursing & Medicine Lab I								
Hours/week in vet clinic	9	16.89	16.89	17	33.35	9.64	32.50	**0.02**
Hours/week outside vet field	8	15.00	21.88	15	2.73	4.15	55.00	0.72
Years in vet field	9	2.53	2.88	17	6.79	5.80	26.50	**0.01**
Credit hour enrollment	9	11.00	2.65	16	6.88	1.45	12.50	**0.00**

Note: Values in bold type are significant at $p > .05$.

Comparison of Motivation, Learning Strategies, and Course Experiences

Motivation Differences
As shown in Table 8, student motivation for learning is not significantly different between online and campus formats. Both groups of students indicated high levels of motivation in terms of their goal orientation, the value they placed on the course, their control of learning, and self-efficacy. Both groups of students also indicated considerable test anxiety.

Learning Strategy Differences
Table 8 shows there was little difference in the learning strategies students reported using in their course. The online students in the Animal Laboratory Procedures course did report significantly greater use of learning strategies that address time issues and their study environments. It is unclear if this difference was due to the characteristics of the course or the delivery format.

Course Experience Differences
As with the motivation and learning strategies variables, there was no difference in the online and campus students' perceptions of the interaction that occurred within the course, the overall support and structure of the course, their feelings of closeness to the instructor and the other students, and their perceptions of the overall quality of the teaching and the course (see Table 8).

The structure and processes employed in the VT program at SPC may contribute to the lack of difference in the students' perceptions of interaction, support, structure, and transactional difference in these courses. First, the VT program is highly coordinated with a high degree of standardization in terms of course format and delivery. Second, instructors in the course often rotate through a variety of the courses, which contributes to high familiarity with student experiences in the courses they are not currently teaching. Finally, while a strict cohort is not maintained, student familiarity with each other is evident from a review of the synchronous and asynchronous communication logs. Each of these factors may contribute to a sense of community in the online program that is similar to that of campus programs.

Student Achievement Differences
As shown in Table 9, students in the online Animal Nursing and Medicine Lab course had a statistically higher score on the pretest than the campus students. The online students averaged 63.23% on

Table 8. Motivation, learning strategies, CISS and course quality scores for campus and online formats of Animal Laboratory Procedures I and Animal Nursing and Medince Lab I

	Campus			Online				
	n	***Mean***	***SD***	***n***	***Mean***	***SD***	***U***	***p*-value**
Animal Laboratory Procedures								
Motivation								
Intrinsic goal orientation	11	5.52	0.73	11	6.02	0.68	36.50	0.111
Extrinsic goal orientation	11	4.95	1.15	11	4.80	1.33	56.50	0.792
Task value	11	6.42	0.73	11	6.44	0.83	60.50	1.000
Control of learning	11	5.57	0.87	11	6.14	0.60	35.50	0.098
Self-efficacy	11	5.59	1.19	11	6.25	0.83	40.00	0.176
Test anxiety	11	3.93	1.39	11	1.89	0.97	31.50	0.055
Learning strategies								
Time & study environment	39	5.54	0.99	13	6.23	0.64	153.50	**0.034**
Effort regulation	38	5.34	0.82	14	5.65	0.77	209.00	0.239
CISS								
Course interaction	38	3.20	0.37	14	3.12	0.38	238.50	0.562
Course support	37	2.85	0.35	13	2.77	0.31	215.00	0.566
Course structure	38	3.24	0.35	14	3.18	0.37	250.50	0.743
Transactional distance	39	2.14	0.56	14	2.27	0.55	234.50	0.431
Course Quality								
Quality of the teaching	37	4.65	0.48	14	4.50	0.76	244.50	0.71
Quality of the course	37	4.62	0.49	14	4.57	0.65	257.50	0.97
Animal Nursing & Medicine Lab I								
Motivation								
Intrinsic goal orientation	9	5.75	0.88	17	5.96	0.50	67.00	0.602
Extrinsic goal orientation	8	5.19	1.24	17	5.09	1.35	66.60	0.930
Task value	9	6.44	0.69	17	6.62	0.52	69.50	0.696
Control of learning	9	5.75	0.86	16	5.86	0.61	68.00	0.819
Self-efficacy	9	5.79	1.15	17	6.29	0.57	59.00	0.343
Test anxiety	9	4.60	1.64	17	3.27	1.49	39.00	**0.043**
Learning strategies								
Time & study environment	33	5.51	1.12	20	5.94	0.94	256.00	0.172
Effort regulation	34	5.17	0.99	20	5.53	0.81	263.50	0.170
CISS								
Course interaction	34	3.18	0.38	20	3.06	0.35	284.00	0.310
Course support	32	2.86	0.33	20	2.84	0.23	319.50	0.992
Course structure	34	3.24	0.34	20	3.16	0.34	303.00	0.498
Transactional distance	34	2.23	0.56	20	2.06	0.42	256.00	0.126
Course Quality								
Quality of the teaching	30	4.43	0.73	18	4.39	0.70	257.00	0.76
Quality of the course	30	4.40	0.77	18	4.44	0.62	268.00	0.96

Note: Values in bold type are significant at $p > .05$.

Table 9. Student achievement scores for campus and online formats of Animal Laboratory Procedures I and Animal Nursing and Medicine Lab I

	Campus			Online				
	n	Mean	*SD*	*n*	Mean	*SD*	*U*	*p*-value
Animal Laboratory Procedures								
Project score								
Pre-test score	34	32.75	10.43	23	39.17	19.19	343.00	0.298
Final exam score	24	88.04	9.10	23	81.07	10.08	159.00	**0.013**
Final grade	24	87.84	5.97	23	82.95	14.54	227.00	0.208
Animal Nursing & Medicine Lab I								
Radiological exam	22	88.67	6.42	34	85.16	17.06	359.00	0.801
Nursing exam	22	92.33	9.38	34	90.89	12.39	361.00	0.827
Pretest score	28	55.48	12.71	33	63.23	13.76	322.50	**0.041**
Final exam	13	89.23	6.71	23	85.04	20.70	131.00	0.542
Final grade	22	90.29	7.26	34	88.74	14.44	350.00	0.687

Note: Values in bold type are significant at $p > .05$.

the pretest as compared to 55.48% for the campus students. This suggests that the online students may have entered the course with a higher prior knowledge of course material, possibly due to the fact that they had more years of experience in the veterinary field. However, even though the online students in the Animal Laboratory Procedures course also had more years of experience than the campus students and outperformed the campus students on the pretest, the difference was not significant.

In the Animal Laboratory Procedures course, the campus students (88.04%) significantly outperformed the online students (81.07%) on the final exam (see Table 9). However, these same students did not have significantly different final grades. In the Animal Nursing and Medicine Lab course, the campus and online students performed at statistically similar levels on their two unit tests, their final exam, and their final grades. One confounding factor in these results is the consistently higher standard deviations for the online courses in all performance measures, which indicates a larger spread of scores.

Landscape and Horticultural Technology at County College of Morris

One course from the Landscape and Horticultural Technology (LHT) program at County College of Morris, Landscape Design and Planning I, was included in the study. This section describes the course, the students, and the research findings for the comparison of the online and campus-based course.

Landscape Design and Planning I

The LHT program teaches Landscape Design and Planning in a sequence of two courses: Landscape Design and Planning I, and Landscape Design and Planning II. This two-course sequence is included in the curriculums for the Landscape Management and Design associate degree, and the Landscape Design and Landscape Contract certificates. The classroom version of the Landscape Design and Planning I course included in this study was first offered to students in 1981; the online version was first offered in 2002.

Students completing the classroom version of the course attend twice-weekly labs and once-a-week lectures presented in an on-campus classroom. Students completing the online version review lectures made available to them in a text format and visit instructor-identified Web sites. They can also choose to attend the on-campus lab sessions. Students with more experience in the industry, or more experience with computers and the online environment, tend to participate in the on-campus lab sessions less often than those with less experience. LHT has an open-door policy that provides all students, on-campus and online, access to on-campus facilities.

Students completing the classroom version interact with the instructor in the classroom every week the course meets during the semester. They are also able to meet one-on-one with the instructor on campus during scheduled office hours or by appointment. Students completing the online version do not have the same level of weekly instructor interaction as the on-campus students in terms of immediate access in the classroom or scheduled office hours. These students can, though, choose to attend the weekly on-campus instructor-led lab sessions or schedule an appointment as needed. All students have access to the instructor 24/7 via email, and by telephone during the daytime work hours Monday through Friday.

Students completing the classroom version also interact with other students in the course as well as with other program staff and the college, in general. The classroom students work together to take initial field measurements of the field-study site and develop a client questionnaire. They are encouraged to share their progress with each other for the duration of the course. Students completing the online version have significantly less interaction with other students, both those completing the online course and those in the classroom version. Interactions between the online students occur in an online discussion forum and face-to-face if, and when, they attend the weekly on-campus lab sessions.

Table 10. Gender of students enrolled in campus and online formats of Landscape Design

	Campus		Online	
	n	%	*n*	%
Gender				
Male	5	38.5	4	40.0
Female	8	61.5	6	60.0

Student Characteristics

At the start of the course, students enrolled in the online and on-campus versions of Landscape Design and Planning I were asked to supply demographic information (see Table 10). The number and percentage of females (8, 61.5% on-campus; 6, 60% online) exceeded the number and percentage of males (5, 38.5% on-campus, 40% online) in both the online and on-campus courses. The percent of females in the on-campus course (61.6%) was comparable to the percent in the online course (60%). Overall, the findings suggest that Landscape Design and Planning II is a female-dominated course. No ethnicity data were reported.

Students were also asked to report the amount of time they spent working in the horticulture or agribusiness industry, time spent working outside that industry, the number of years of experience they had in the horticulture/agribusiness industry, and the number of semester hours in which they were enrolled (Table 11). The only significant difference between the online and on-campus students was found in the number of semester hours in which they were enrolled, with on-campus students averaging 11.62 semester hours and online students averaging 5.70 semester hours. Both online and campus students worked inside and outside the horticulture/agribusiness industry, with no significant difference in

Table 11. Work experience and courseload of students enrolled in campus and online formats of Landscape Design

	Campus			Online				
	n	*Mean*	*SD*	*n*	*Mean*	*SD*	*U*	*p*-value
Hours/week in horticulture industry	13	20.69	17.759	10	23.90	24.875	64.000	.950
Hours/week outside industry	11	13.36	10.782	10	15.85	21.082	52.000	.826
Years in industry	12	4.33	2.708	10	5.65	9.860	50.500	.523
Credit hour enrollment	13	11.62	3.927	10	5.70	4.111	20.000	**.004**

Note: Values in bold type are significant at $p > .05$.

the number of hours they worked each week. Students in both courses had comparable years of experience in the horticulture/agribusiness business industry (4.33 years, on-campus; 5.65 years, online). Differences were significant only for credit hour enrollment.

Comparison of Motivation, Learning Strategies, Course Experience and Achievement

Motivation Differences

Table 12 shows the average motivation scores (range = 1–7) in four areas: intrinsic goal orientation, extrinsic goal orientation, task value,

Table 12. Motivation, learning strategies, CISS and achievements scores for campus and online formats of Landscape Design

	Campus			Online				
	n	Mean	*SD*	*n*	Mean	*SD*	*U*	*p*-value
Motivation								
Intrinsic goal orientation	13	5.88	0.83	10	6.10	0.86	56.00	0.574
Extrinsic goal orientation	13	5.50	1.34	10	4.23	1.27	32.00	**0.040**
Task value	13	6.67	0.56	10	6.65	0.48	56.50	0.569
Control of learning	13	5.69	1.00	10	5.83	1.00	62.00	0.850
Self-efficacy	13	6.34	0.59	10	6.30	0.79	61.00	0.803
Test anxiety	13	3.78	1.46	10	3.38	1.11	56.00	0.574
Learning strategies								
Time & study environment	3	4.75	0.98	6	4.96	0.94	7.00	0.604
Effort regulation	3	5.42	1.13	6	5.21	1.18	7.50	0.696
CISS								
Course interaction	3	3.24	0.33	6	3.10	0.39	6.50	0.515
Course support	3	2.81	0.33	6	2.67	0.15	5.50	0.354
Course structure	3	3.39	0.25	6	3.11	0.20	3.50	0.145
Transactional distance	3	3.00	0.00	6	2.00	0.56	1.50	**0.034**
Achievement								
Pretest	12	77.92	10.54	9	78.70	13.17	51.50	0.857
Quiz 1	10	83.99	8.45	10	96.66	5.66	13.00	**0.005**
Quiz 2	12	75.99	27.75	9	86.93	13.08	42.50	0.409
Quiz 3	12	67.50	32.65	7	87.86	3.93	21.50	0.078
Res. design	11	66.00	33.54	9	82.44	31.08	14.50	**0.008**
Final exam	10	88.00	7.42	9	82.22	31.34	34.00	0.367
Final grade	12	70.48	26.62	10	77.03	23.30	45.00	0.323
Lab1	11	88.41	4.91	9	91.11	4.35	34.00	0.229
Lab2	12	87.71	28.65	9	83.33	31.57	37.50	0.220
Lab3	11	92.73	6.47	10	90.00	31.62	29.00	**0.033**
Lab4	11	80.91	40.11	10	90.00	31.62	46.00	0.354
Participation	12	56.67	34.73	10	65.00	34.08	50.00	0.502

Note: Values in bold type are significant at $p > .05$.

control of learning beliefs, self efficacy for learning and performance, and test anxiety. Students' scores in both courses were high in each area with the exception of text anxiety, where both groups scored the lowest. Significant differences in online and on-campus scores were only found in the extrinsic goal orientation measure, with campus students scoring an average of 5.50 and online students scoring an average of 4.23.

Learning Strategy Differences

The learning-strategies instrument measured two areas: time and study environment, and effort regulation. Table 12 shows that online and campus student scores were high in both areas, but there was no significant difference in their scores. It should be noted that the response rates for this scale and the CISS scale discussed in the following section were significantly lower than the response rate for the motivation scale.

Course Experience Differences

The CISS instrument measured four areas (range = 1–4): student-student and student-instructor interaction, department and instructor support, course structure, and transactional distance. Online and on-campus students reported midlevel scores in all four areas, but there was no significant difference in their scores, except for transactional distance (see Table 12). Although there was a significant difference in the mean values of transactional distance, both groups reported feeling low levels of transactional distance. The difference in the transactional distance scores resulted from online students reporting that they held "close" feelings toward their instructor, program, and college, while the campus students reported that they held "very close" feelings. Because the online and campus courses had common structures and support resources, it is not surprising that the course support and course structure measures were not different. Since the course interaction and transactional distance scores were not significantly different, perhaps students have similar experiences of interaction and distance in both the online and on-campus courses. The use of the online discussion forums by online students may have provided the appropriate level of interaction and mediated the physical distance between the students and the instructor. Their access to the weekly on-campus lab sessions may also have contributed to the reported level of interaction and mediated distance. It should be noted that the response rates for this scale and the learning strategy scale discussed earlier were significantly lower than the response rate for the motivation scale.

Student Achievement Differences

Table 12 shows the average students' scores on course assessments. Online and on-campus students had significantly different scores on quiz 1 (96.66 online, 83.99 on-campus), the Residential Design Project (66.00 on-campus; 82.44 online), and Lab 3 (92.73 on-campus; 90.00 online), but no differences on the pretest, quiz 2, quiz 3, final exam, final grade, lab 1, lab 2, lab 4, and class-participation grade.

CONCLUSIONS

Although this study was exploratory in nature, there are several interesting findings that lead to conclusions related to the development of online instructional programs in CTE. The following conclusions are based on the data collected from the three in-depth case studies of CTE online programs in two community colleges. It is noted that these conclusions are tentative and preliminary due to the small sample of online programs examined in this study.

1. **There is no common pattern or model for the delivery of online CTE programs and courses.** The three case studies revealed numerous ways to implement CTE in an online environment. Each of these forms of implementation appeared to be equally successful in helping students achieve the learning objectives. The variety of approaches was particularly evident in the breadth of technologies used, the ways skills are developed, and the means of evaluation. Online CTE programs and courses rely on a variety of technologies that range from standard delivery of content in text form to high fidelity audio and video-streaming media. The acquisition of skills occurred in a variety of ways including online tutorials, hands-on practice in campus labs, and practical experiences through paid employment. Evaluation of student learning took the form of online quizzes and tests, proctored exams at an independent testing site or place of employment, and administration of tests at the college campus.
2. **Online CTE courses do not align with the common view that online courses provide anytime, anyplace, or any pace experiences for students.** Each of the online courses examined in this study was instructor-paced throughout the academic semester, with assignments due at specific points in time. Further, all courses/programs required student employment for a minimum of 20–30 hours per week. Two of the courses included a synchronous

chat component that required students to be available online at the same time each week. Much of the distance-learning literature emphasizes the "anytime, anyplace, any pace" characteristics of online courses. However these community colleges chose course design models that meet their need for skill training rather than models that fully exploit the convenience features of online courses.

3. **Online programs provide unique and flexible options for students.** Because the campus-based and online courses are offered during the same semester, students benefit from the flexibility provided through the dual offerings. For example, the online students have the option of visiting campus to attend live lectures and participate in hands-on lab exercises, while the campus-based students are able to review the same Internet content that is provided to the online students. Giving the online and campus students the option of accessing the course materials in these different formats provides flexibility for students who may have work or family conflicts that interfere with their participation in a course. This flexibility also gives the online students the option of gaining direct access to the instructor and college facilities, such as labs and library resources.
4. **CTE students perform equally well in online and campus courses.** Overall, this study found no difference in the student achievement measures of the online and campus students. This finding is consistent with other research that compared student achievement in online and campus courses (Russell, 2002; Web-Based Education Commission, 2000) and supports the NCES (2000) claim that "distance education is just as effective as traditional education with regard to learners' outcomes" (p. 6). In fact, delivering CTE courses online appears to be an effective way for students to prepare for national board examinations. This study showed that students who completed the online courses were successful, on the first attempt, in passing the national board exam for their regulated profession when the online curricula was tightly aligned with state and national licensing standards.

   Part of the reason for the lack of performance difference in online and campus students may be that the online CTE courses do not rely on the technology to teach the skills. Each of the courses examined in this study utilized workplace experience as a key component of student learning and skill development. Workplace experiences, when integrated into online or campus-based courses and programs, create opportunities for

students to develop skills through contextualized hands-on learning (Casella & Brougham, 1995). Although online simulations have been identified as one method for providing online skill training in CTE (Johnson et al., 2003), none of the courses in this study used online simulations where students could learn and practice their skills virtually. While simulations were used in these courses, they were done in a campus lab environment or in an actual work setting. It is unclear if the lack of online simulations in CTE courses is due to the lack of availability of quality simulations that can be delivered over the Internet, or because online simulations are not effective for skill training. It is also possible that online simulations are too resource intensive in terms of cost and required support infrastructure.

5. **Students enrolled in online CTE courses appear to be as motivated and satisfied as students enrolled in on-campus CTE courses.** Overall, this study found no difference in the student-motivation measures of the online and campus students (i.e., extrinsic goal orientation, test anxiety, self-efficacy, and task value). The results also suggest that the persistence of students in the online programs is comparable to their on-campus counterparts. This is an indication that the courses and programs assessed in this study are meeting the learning needs of both campus and online students.

   CTE students in the online and on-campus courses also experience comparable feelings of closeness to their instructors. Overall, there was no difference in perceptions of transactional distance (i.e., feelings of closeness to the instructor) for online and campus students. The fact that online students' feelings of closeness to their instructors, program, and college are equivalent to the feelings of the campus students is particularly encouraging for community colleges concerned about establishing and maintaining connections to their graduates. The online course instructors included in this study used online technologies, such as email, and more traditional technologies, like the telephone, to connect with their students.

6. **Online CTE courses extend the serving area of their home institutions by allowing students to enroll in programs of interest that are not local to them.** Each of the courses included in this study enrolled students who lived outside of the district served by the community college. In fact, many of the students lived outside the boundaries of the state where the college resides. This is consistent with the finding that increasing access to new audiences is a primary reason that community colleges

offer CTE courses at a distance (Johnson et al., 2003). This suggests that community colleges can use online courses as a strategy to attract a critical mass of students to specific skill areas that are currently under-enrolled, or to fields where there is high demand for new employees. Lifting the distance barrier of campus courses opens the program to a new and previously inaccessible pool of student candidates.

REFERENCES

Casella, D. & Brougham, C. (1995). Work works: Student jobs open front doors to careers. *Journal of Career Planning and Employment*, *55*(4), 24–27.

Johnson, S. D., Benson, A. D., Duncan, J., Shinkareva, O. N., Taylor, G. D., & Treat, T. (2003, October). *Distance learning in postsecondary career and technical education*. Minneapolis, MN: National Research Center for Career and Technical Education.

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. (2nd ed.). San Francisco, CA: Jossey-Bass.

Moore, M. G. (1993). Theory of transactional distance. In D. Keegan (Ed.). *Theoretical principles of distance education* (pp. 22–38). London, NY: Routledge.

National Center for Education Statistics. (2000). *Distance education at postsecondary education institutions: 1997–1998* (NCES Publication No. 2000-013). Washington, DC: U.S. Government Printing Office.

National Center for Educational Statistics. (2002). *Integrated postsecondary education data system "completions" survey.* Washington, DC: U.S. Department of Education.

Nesler, M. S. & Hanner, M. B. (2001). Professional socialization of baccalaureate nursing students: Can students in distance nursing programs become socialized? *Journal of Nursing Education*, *40*(7), 293–302.

Russell, T. (2002). The no significant difference phenomenon. Retrieved September 17, 2002 from the http://teleeducation.nb.ca/nosignificantdifference/

Web-based Education Commission. (2000). *The power of the Internet for learning: Moving from promise to practice.* Washington, DC: Author.

Wonacott, M. E. (2001). *Implications of distance education for CTE* (ERIC Digest No. 227). Columbus, OH: ERIC Clearinghouse on Adult, Career, and Vocational Education. Retrieved December 10, 2003 from http://www.cete.org/acve/docs.dig227.pdf

Zirkle, C. (2003). Distance and career and technical education: A review of the research literature. *Journal of Vocational Education Research*, *28*(2), 161–181.