PHARMACOLOGY COURSE OUTCOMES:

INTERNET DELIVERY VERSUS TRADITONAL CLASSROOM DELIVERY

by

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A Research Paper

Submitted in Partial Fulfillment of the
Requirements for the
Master of Science Degree in
Training and Development

Approved for completion of 4 Semester Credits
TRHRD-735 Field Problem in Training and Development

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August, 2001

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ABSTRACT

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Pharmacology Course Outcomes: Internet Delivery Versus Traditional Classroom Delivery
(Title)

Training and Development	Dr. Joseph Benkowski	August/2001	35
(Graduate Major)	(Research Advisor)	(Month/Year)	(No. of Pages)

Publication Manual of the American Psychological Association
(Name of Style Manual Used in this Study)

Educators are taking advantage of the Internet as an alternative delivery option. The purpose of the project was to modify a Pharmacology for Allied Health course for Internet delivery and to compare the outcomes of students who took the Internet course to the outcomes of students who had taken the course in a traditional classroom setting. Students in the Internet course did not attend scheduled class meetings, but accessed lecture notes on the Internet, and were required to participate in an asynchronous discussion forum each week. Attainment of the competencies was demonstrated by successful completion of a 20-question objective quiz each week that was given to both student groups in similar proctored settings. Analysis of the quiz scores demonstrated that there was no significant difference in outcomes between the two student groups thus demonstrating that the Internet is an effective delivery option for this course.

ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION

Introduction

      To eliminate the constraints of time and place, educators have accessed the Internet as a means of delivering educational offerings to students in remote locations. As the technological and accessibility constraints are eliminated, there has been a dramatic increase in the number and variety of courses that are available on-line. Likewise, many educational administrators realize the potential of Internet courses to reach markets that were heretofore beyond reach and are encouraging the development of more Internet courses. The trend is evident in all levels of education including technical education where emphasis has been placed on the development of Internet courses to reach populations in rural areas.

      While it is possible to deliver instruction via the Internet, there is reason to question how the method of delivery affects learning outcomes. This study will attempt to address the concern about the effectiveness of Internet-delivered courses by comparing the outcomes of a course delivered on-line to the same coursed delivered in a traditional classroom setting. This chapter will present the problem statement, objectives, and significance of the study and define the terms used throughout the study.

      Lakeshore Technical College is one of sixteen technical colleges in the Wisconsin Technical College System. The mission of Lakeshore Technical College is to provide quality and accessible learning opportunities for initial and continued employment that are consistent with identified student and community needs. With the goal of improving course accessibility, faculty at Lakeshore Technical College have been actively perusing the development of Internet courses

for the past three years and there are currently eleven Internet courses listed in the college catalogue with others in the development phase. The expectation is that in time, most of the courses offered at the college will incorporate some level of Internet enhancement. Recently, Lakeshore Technical College contracted with Jones Knowledge to provide a consistent learning platform for all of its Internet courses so that students do not need to learn to navigate a different learning platform every time they take an Internet course.

One of the occupational programs offered at Lakeshore Technical College is the Medical Assistant Program, a one-year, technical degree program that is shared with Fox Valley Technical College, approximately 60 miles away. Students in the Medical Assistant Program take courses in general education, business administration, and health care to prepare for a career primarily in ambulatory care settings. Students at the Fox Valley site take the general education and business administration courses at Fox Valley Technical College; however, the health-care classes are telecasted using live interactive television technology. The most recent development in live television technology was the development of the Wisconsin Technical College Network (WTCN) which links all of the Wisconsin technical colleges. In 1998, the Medical Assistant Program courses began using the WTCN to transmit classes to Fox Valley Technical College.

All curricula for the Medical Assisting Program have been developed to meet both national and community standards. The American Association of Medical Assistants (AAMA) has developed entry-level competencies for Medical Assistant education and has set standards for accreditation of Medical Assistant educational programs. The Medical Assistant Program at Lakeshore Technical College has met all accreditation requirements and is accredited by the Commission of Accreditation of Allied Health Education Programs (CAAHEP) on recommendation of the Committee on Accreditation for Medical Assistant Education. Only CAAHEP-accredited Medical Assisting Program graduates are eligible to sit for a national

certification exam and graduates of the Medical Assisting Program at Lakeshore Technical College have consistently enjoyed a pass-rate on the certification exam that exceeds the national average.

To identify community needs, a Developing a Curriculum (DACUM) study was performed with local employers in 1995 and community-specific Medical Assistant Program competencies for Lakeshore Technical College were generated. An Advisory Committee comprised of employed Medical Assistants, Medical Assistant employers, Medical Assistant faculty and staff members meets semi-annually to provide on-going feedback and make recommendations for future program development. The AAMA, the DACUM study, and the Advisory Board indicated a need for the Medical Assistant student to develop knowledge of basic Pharmacology.

Pharmacology is defined by Rice (1999) as "The study of drugs; the science that is concerned with history, origin, sources, physical, and chemical properties, and the uses of drugs and their effects on living organisms." Application of pharmacology principles to prepare and administer oral and parenteral medications is one of the Entry-Level competencies for the Medical Assistant established by the AAMA and supported by the DACUM study. Upon recommendation of the Advisory Committee, the Pharmacology for Allied Health course was developed as a program requirement in 1996.

Pharmacology for Allied Health is a two-credit, 54-hour course, which develops the knowledge of pharmacology and administration of medications for Medical Assistants and other allied health care professionals. The course includes pharmacodynamics, dosage calculations, routine responsibilities, administration techniques and handling prescriptions and refills. Because medication administration includes psychomotor skill development, one credit is assigned as a laboratory credit and competency is demonstrated in a laboratory setting. However, to safely administer medications, the health-care worker must also have cognitive knowledge about the medications being administered, thus the students meet for a one-hour a week lecture session

which was simultaneously transmitted to students at the Fox Valley site. The lecture portion of the course consists of 14 modules, which are completed at the rate of one module per week during the 14-week semester. A PowerPoint presentation was developed for each module and corresponded to the textbook reading assignment for that module; competency was demonstrated by successful completion of a 20-question quiz.

Problem Statement

Because there has been increased reliance on the WTCN to transmit courses between the technical colleges and a finite number of classes that can be transmitted at a given time, scheduling of Medical Assistant classes on the network became problematic. In addition, students in other health programs at the college were interested in the course, but were unable to enroll because the times it was offered conflicted with other courses in their program schedule.

A solution to the scheduling dilemma was the development of the lecture portion of the Pharmacology for Allied Health course as an Internet course. It was believed that circumventing the constraints of time and place would make the course more accessible and a more viable option for students in other program areas to use as an elective. Because the potential effect of Internet delivery on course quality and student outcomes has not been addressed at the college, faculty members were concerned about the impact of the change in delivery methods.

Purpose of the Study

The study will include the development of the Internet course using the Jones Knowledge learning platform and compare the outcomes of the students who take the course on-line to the outcomes of the students who attended class in a traditional classroom setting.

Research Objectives

The objectives of this study are:

1. Develop an on-line Pharmacology course using the Jones Knowledge learning platform.

2. Determine the effectiveness of the course by determining if there is a difference in the outcomes between the students who complete the on-line course and the students who attended class in a traditional classroom setting.

Significance of the Study

This study will be the first evaluative study of the effectiveness of Internet courses at Lakeshore Technical College. If it can be demonstrated that the Internet is a cost-effective method of course delivery without compromising course quality, then results of the study will support requests for increased funding for the development of more Internet courses. Results of the study will also be valuable as an institutional effectiveness measure for the Medical Assistant Program and to provide a benchmark for the evaluation of other Internet courses at the college. Finally, the study results will be helpful in program marketing activities as many students are attracted to the convenience of Internet courses and would find reassurance knowing that Internet delivery does not compromise course outcomes.

Limitations

The limitations of this study are:

1. The results of this study are limited to Lakeshore Technical College.

2. Effectiveness is determined by the measurement of outcomes only. Other elements of effectiveness, such as student satisfaction, will not be evaluated.

 3. The study will not include the effect of the change to Internet delivery on the numbers of students who are enrolled in the course.

 4. Unlike many other Internet courses, students in the Pharmacology course will have regular contact with each other and with the instructor in other traditional classroom settings while taking the on-line course.

Assumptions

The assumptions of this study are:

1. Lakeshore Technical College will continue to offer the Pharmacology course for the duration of the study and there will be students enrolled in the course.

2. The Pharmacology course will continue to be a required course in the Medical Assistant Program.

3. Lakeshore Technical College will continue to use the Jones Knowledge learning platform for delivery of the Pharmacology Internet course.

Definitions

Pharmacology is defined by Rice (1999) as "The study of drugs; the science that is concerned with history, origin, sources, physical, and chemical properties, and the uses of drugs and their effects on living organisms." In the Pharmacology for Allied Health course students learn basic pharmacology and medication administration techniques.

Medical Assistants perform routine administrative and clinical tasks to keep health care delivery settings running smoothly (http://www.aama-ntl.org/ed/ma.html). The purpose of the American Association of Medical Assistants (AAMA) is to "Promote the professional identity and stature of its members and the medical assisting profession through education and credentialing." (http://www.aama-ntl.org/index.html).

A DACUM study employs a structured group interview technique to develop competencies that are relevant for an identified occupational area such as Medical Assisting. Participants in a DACUM study are content experts or business and industry incumbent workers who examine the tasks of the occupation. A completed DACUM chart for an occupation includes eight to ten Job Duty Areas, which are broken down into 50 to 200 Job Tasks (Woodhull).

All courses taught at Lakeshore Technical College must be performance-based and in the Wisconsin Instructional Design System (WIDS) format. Performance-based instruction in the WIDS model links what is taught to the skills that learners will actually apply in their jobs (Niel and Mashburn, 1997). Neil and Mashburn define WIDS curricula as focusing on the "Development of course outcomes which identify performance expectations for learners; development of performance assessment strategies; creation of a learning plan, and lesson plans."

Competencies in the WIDS model "provide an organizing framework for planning and implementing a learning experience; they provide a framework for learners to organize their plans for successfully completing a course; and they document the skills of your learners for employers." (Neil and Mashburn, 1997). Competencies are derived from job tasks and may originate in the task list generated by the DACUM study.

A learning platform or course management system is software designed to provide a template or shell for the presentation of course material on the Internet. Some institutions have in-house program developers who design a learning platform for the institution; however, there are several sources for the purchase of a learning platform. One such company is Jones Knowledge.com. which is used by Lakeshore Technical College. Jones Knowledge has entitled the learning platform "e-education."

CHAPTER 2

REVIEW OF LITERATURE

Problem Statement

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technical colleges and a finite number of classes that can be transmitted at a given time, scheduling

of Medical Assistant classes on the network was problematic. In addition, students in other health

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Internet course using the Jones Knowledge learning platform and compare the outcomes of the

students who take the course on-line to the outcomes of the students who attended class in a

traditional classroom setting.

Internet Course Development

The Web Page for JonesKnowledge.com claims a history of innovation and leadership in

on-line education. The focus of the company is "finding ways to use emerging technologies to

support educators, administrators, corporate trainers and lifelong learners.

(http://www.jonesknowledge.com/press/) The e-education learning platform developed by Jones

Knowledge.com provides a "robust yet flexible system for delivering courses on-line." (Jones

Knowledge) Because the e-education platform was specifically designed to complement

curriculum developed in the WIDS format, and because it is customizable to the institution,

Lakeshore Technical College adopted the e-education learning platform in the fall of 2000.

The e-education platform presents as multiple "pages" that can be selected by clicking on an icon on the navigation or "Nav. Bar" which always appears on the left side of the split-screen computer monitor. After logging into the home page, the student views the announcements page that can be created by the instructor and modified at any time. The student can then proceed to any of the pages in the course. The "Learning Plans" page contains all assignments, or "Learning Activities" for the course, and links the student to the PowerPoint presentations. The "Discussion" page opens a separate window and directs the student to the discussion question for each week. Students are able to respond to questions asked by the instructor or another student, or ask a new question. In an effort to provide a means for students to know each other, there is a "Profile" page in which students can respond to questions about themselves and can read about each other. A "Chat" page allows for synchronous conversations between students and the instructor provided that more than one person has accessed the page at the same time. The instructor is provided access to a "Tools" page that facilitates data entry. The instructor or instructional assistant is able to modify the content of the course pages thus customizing the platform to the specific course. The "Tools" page is inaccessible to students.

There are several considerations that are specific to the design of courses for Internet delivery. Muffoletto (1997) discussed the process of developing a course on the Internet and noted the importance of providing opportunities for development of student exploration and inquiry. Some reflective questions considered by Muffoletto included:

How is knowledge constructed in this form of teaching/learning?

How is knowledge affected by the delivery form?

What level of transferability will exist as a result of the form?

What would be the most optimum learning environment for my students?

How do I not give the impression that knowledge in this class is fixed?

How will this design reflect my philosophical position concerning the teaching and learning process?

Muffoletto concludes that the time-consuming nature of Internet course development creates the need for a new paradigm related to the needs and demands of students and faculty involved in Internet courses.

Pollack (1998) affirmed the time consuming nature of Internet course construction. Course planning guidelines recommended by University Online Publishing, a distance learning platform, include:

1. Determine the appropriate instructional technologies to use in the course.

2. Determine the appropriate structure for the course.

3. Plan the screens.

4. Author the content of the course.

Pollack notes that "The course design must be carefully managed and must maintain a balance between structure and flexibility."

A multiple case study by Benson Soong, Chuan Chan, Chai Chua, and Fong Loh (2001) evaluated the critical success factors for on-line recourses. The researchers verified that factors relating to technical competency, mindset, level of collaboration and level of technical support are essential to the success of a student in an on-line course. Human factors included the investment of time and effort by faculty and the necessity of motivating students to practice time-management skills, especially at the beginning of a course. Both students and faculty must possess a level of technical competency when embarking in an Internet course, and both must possess a "constructivist" mindset. To encourage high levels of collaboration, rewarding on-line discussions with grades would be helpful. Finally, the infrastructure must be perceived as user-friendly and

useful. Technical support must be available for both instructors and students throughout the course. Courses developed for on-line delivery must consider all of the critical factors.

A study by Bhuripanyo (1997) evaluated student perceptions after completing an Internet course and made the following recommendations for Internet course development:

1. Internet courses should be pilot-tested before delivery to targeted students.

2. Modification to the learning platform may be needed to improve course delivery.

Bhuripanyo emphasizes that training is needed to familiarize students with the learning platform and computer operations.

Internet Course Outcomes

Many studies of the outcomes of distance education focus on the impact of television as a course delivery method. For example, a study performed by Keck (1992) compared outcomes between graduate students in a remote-site who attended class via television technologies and those who attended in a traditional classroom or a television studio. The outcomes that were assessed included four examination scores as well as the total percentage correct across all exams, the final course grades, and the graduating grade point averages (GPA). All analyses were conducted using t-tests at a significance level of .05.

The results demonstrated no significant difference for two of the four examination scores, final course grade, or graduating GPA. While Keck (1992) found a significant difference for two exam grades and the total percent correct ($P=.005$, $P=.001$, $P=.01$), further analysis (R^2) suggested that the effect of the teaching modality on learning outcomes was negligible. Overall, the study concluded that students taking a telecourse are not disadvantaged since graduating grade point averages did not differ.

Likewise, Daly, McClelland, and Yang (1994) investigated the differences in academic achievement as demonstrated on exam scores and course grades between degree-completion

nursing students who attended courses in a traditional classroom and students who attended class in satellite settings via telecommunication technologies. Analyses of covariance were performed to control concomitant variables and T-tests were used when variables did not operate concurrently. In every instance, there was no significant difference between the scores of the student groups. Daly et al. concluded that the method of delivery did not seem to affect learning outcomes.

A similar study was performed by Leasure, Davis, and Thievon (2000), but instead of using television technology as a variable, the team compared the outcomes of students taking a course in a traditional classroom with the outcomes of students taking the same course via a World Wide Web-delivered option. Two sections of a course were offered and students were allowed to choose the section that employed the preferred delivery method. Leasure et al. were interested in comparing the outcomes of the two sections as measured by exam scores and final course grades and examining the reasons that the students cited for choosing a particular delivery modality.

Chi-square and t-tests were conducted to demonstrate that the two student groups did not differ significantly in demographic or academic characteristics that would have influenced the outcome measures. T-tests were used to compare exam scores and final course grades. Overall, there was no significant difference in examination grades or final course grade between the two student sections (t= -.96, P= .343). Reasons for choosing a traditionally delivered course fell into one of four categories:

- Perception of increased interaction,
- Decreased opportunity to procrastinate,
- Immediate feedback, or
- More meaningful learning activities.

Cost, convenience, and flexibility, as well as confidence using a computer were reasons cited by students for choosing the Internet-delivered section (Leasure et al., 2000).

Rodrigues (1999) took a somewhat different approach towards evaluation of a WWW-delivered course. A traditionally delivered course was modified and selected modules of the course were delivered on-line. The on-line discussions, course evaluations, and transcripts of a group interview of three students were analyzed to determine student experiences and perceptions.

While the students indicated that there were no perceived differences between the two versions of the course, Rodrigues noted subtle changes in student behavior. For example, Rodrigues comments that while on-line, "Students comments were richer, fuller and more reflective because they had opportunities to deliberate, phrase and actively construct their response" (Rodrigues, 1999). A shift in the role of the instructor occurred as students assumed leadership for on-line discussions and resulted in more lengthy discussions than anticipated. The students commented favorably on the asynchronous nature of the WWW- delivered portion of the course, but technology problems tempered enthusiasm.

<u>Summary</u>

The literature related to Internet course development appears to address the both epistemological issues as well as the practical, "How-to" issues. Faculties who wish to develop or modify courses for Internet delivery must consider both during the course-construction process. Much of the literature supports the notion that Internet course construction is time-consuming. Philosophical concerns should be addressed early in the process so that decisions about platform selection can support the philosophical framework about teaching and learning. Once selected, the developers of learning platforms provide training manuals to guide Internet course developers in the step-by-step process of entering data onto the World Wide Web.

Research has affirmed the belief that the course quality is not compromised by methods of distance delivery. The quantitative studies using statistical measures to compare outcomes failed to demonstrate any significant difference in outcomes between a course delivered in a traditional classroom setting and a course delivered using distance learning technology. The findings were consistent with the student perceptions identified in the qualitative study. If the research continues to be unable to identify a negative impact on course quality as a result of incorporating distance technology, then educators should feel secure in pursuing alternatives to traditional classroom delivery methods.

CHAPTER 3

RESEARCH METHODS

<u>Introduction</u>

The Medical Assistant Program faculty at Lakeshore Technical College were interested in adapting the Pharmacology for Allied Health course for Internet delivery to increase accessibility but concern was expressed about the impact of the change on course quality and student outcomes. The project objectives included the development of the Internet course using the Jones Knowledge learning platform and a comparison of the outcomes of the students who took the course on-line to the outcomes of the students who attended class in a traditional classroom setting. This chapter will detail the population, research design, data collection and recording methods, and statistical analysis of the data.

<u>Population</u>

There were a total of 42 students who completed the Pharmacology for Allied Health course in a traditional classroom setting during the 1999-2000 school year. Since there are several course prerequisites, only Medical Assistant students in the last semester of the program were eligible to take the course. The students were from both the Lakeshore and Fox Valley campuses.

The first on-line section of the Pharmacology for Allied Health course was offered in the fall of 2000. The students were all second-semester Medical Assistant students from both campuses. A second section was offered in the spring of 2001 and consisted of only Lakeshore campus students as the program was not offered at the Fox Valley campus. A total of 30 students completed the course in the 2000-2001 school year.

Research Design

During the time of the study, there were no changes to the curriculum; the competencies

and learning objectives for each module remained the same. All students used the same textbook,

and both groups had access to the same PowerPoint presentations that corresponded to specific

chapters in the textbook. All students were required to complete the same laboratory activities in

the Auto-Tutorial Labs on both campuses.

During the 1999-2000 school year, the students in the Pharmacology course met for one

55-minute session per week during the 14-week semester. The first twenty minutes of the class

consisted of completion of the weekly quiz and a brief quiz review to provide immediate feedback.

The remaining 35 minutes consisted of lecture and discussion supplemented with the PowerPoint

presentation. Copies of the PowerPoint presentations were available in the course packet

purchased at the beginning of the semester. Students were expected to complete the reading

assignments and a self-test before coming to class the next week. The instructor was available

during office hours, and via E-mail and voice mail between class sessions, and the students met as

a group with the same instructor two other times a week for another class.

Students in the Internet course did not meet regularly for the Pharmacology course after the

initial orientation session, but continued the same BI-weekly meetings with the instructor for the

other class. The orientation sessions were held in a computer classroom in which each student

could access the course along with the instructor and learn to navigate the e-education learning

platform. After the orientation session, students were free to use any computer with Internet

capabilities to access course materials.

In the Jones Knowledge e-education learning platform, the students were able to view and

print the PowerPoint presentations at any time. The only change to the PowerPoint presentations

was an attempt to imbed sound files so that the students could hear pronunciation of the drug names.

Class discussions were facilitated by the on-line discussion feature of the e-education platform. The instructor keyed open-ended questions related to the weekly topic into the discussion page, and the students were required to respond to the question, ask a question, or react to another response at least once during the week. To encourage discussion, between one and three points of extra credit were added to the weekly quiz score depending on the quality of the response. Simply agreeing or disagreeing with a response was worth one point, responses that showed evidence of critical thinking received two points and responses that asked new questions, or referenced resources not included in the syllabus received three points.

Data Collection and Recording

To facilitate comparison between the student groups, the same weekly quizzes were given to both groups, and time was used during another class period to allow the students in the Internet course to complete the pen and paper quizzes. The quizzes were combinations of multiple choice, true and false, matching and short answer questions that were designed to validate attainment of the cognitive competencies. Validation and reliability testing of the quizzes had been done prior to the 1999 school year and minor modifications had been made at that time. All students who missed a quiz were allowed to complete the quiz in a proctored testing environment within a week of the scheduled quiz without penalty. Students were allowed to view the corrected quiz, but did not retain possession.

A Microsoft Excel spreadsheet was created to record quiz grades. The percentage quiz scores were entered into the spreadsheet every week and the software was programmed to compute the average for each student. Two spreadsheets were maintained for the students in the Internet group; one spreadsheet contained the grades with the extra credit for discussions and was used for

calculating the grade that was recorded in the permanent student record. The other spreadsheet

contained the raw grade without the extra credit points and was used for the comparison study.

Statistical Analysis of Data

      Table 1 shows the individual student quiz scores for each of the 14 weekly quizzes given to

students in the Internet-delivered course. Individual student names have been eliminated from

each row.

Table 1

Quiz Grades: Internet-Delivered Course

1	2	3	4	5	6	7	8	9	10	11	12	13	14	Average Grade
55	88	60	70	103	80	82	100	85	95	83	70	70	85	80.43
95	100	75	91	95	98	62	96	97	95	103	101	102	85	92.50
85	81	80	81	38	80	16	96	80	55	55	80	65	80	69.43
100	95	96	81	73	104	95	101	85	90	91	85	77	85	89.86
100	102	95	101	103	100	82	100	90	105	98	101	87		97.23
90	98	95	85	80	104	66	95	94	90	88	85	77	95	88.71
95	90	84	91	73	90	66	86	77	85	78	90	89	70	83.14
75	95	43	75	88	83	87	100	70	95	90	95	90	85	83.64
100	85	95	95	65	94	95	91	89	75	96	65	102	95	88.71
95	102	95	80	101	95	97	95	80	100	98	95	90	80	93.07
95	100	91	70	103	93	67	100	85	90	93	85	97	90	89.93
35	88	56	85	85	80	81	95	60	80	63	65	75	35	70.21
70	97	70	90	101	102	87	95	80	85	88	80	70	80	85.36
95	100	79	80	93	100	72	96	89	90	94	91	95	85	89.93
85	95	53	95	90	90	92	101	85	100	90	90	85	90	88.64
92	98	85	70	83	88	77	91	90	75	78	91	67	55	81.43
95	95	80	85	91	97	87	101	95	105	93	95	97	90	93.29
70	98	70	80	70	94	66	95	80	80	78	85	90	80	81.14
100	102	91	101	80	102	102	101	99	85	93	81	97	90	94.57
90	102	101	91	71	101	95	101	90	95	100	95	100	95	94.79
85	102	87	66	66	97	46	81	63	75	93	95	95	75	80.43
100	102	95	91	63	102	102	101	99	100	98	86	102	100	95.79
92	102	65	76	53	92	87	83	86	75	83	70	65	75	78.86
94	100	85	86	88	92	62	98	80	85	78	85	95	90	87.00
102	102	96	90	91	99	98	101	97	100		95	100	100	97.77
100	102	96	101	88	102	77	103	90	95	93	65	100	95	93.36
84	100	100	96	83	100	86	103	86	82	86	87	80	79	89.43
100	100	75	75	101	88	51	98	83	90	70	80	80	85	84.00
97	105	90	85	78	94	67	81	72	70	75	67	85	79	81.79
98	95	70	85	91	96	87	98	86	100	103	95	100	90	92.43
86.13	94.29	79.23	82.32	80.42	91.71	75.61	93.26	82.29	85.55	84.67	82.65	85.06	81.07	87.23

Table 2 shows the individual student quiz scores for each of the 14 weekly quizzes given to students in the traditional classroom courses. Individual names have been eliminated.

Table 2

Quiz Grades: Traditional Course

1	2	3	4	5	6	7	8	9	10	11	12	13	14	Average Grade
30	90	65	45	103	71	26	94	89	60	73	113	74	119	**75.14**
80	62	95	71	86	92	32	91	95	90	93	51	86	76	**78.57**
100	90	93	75	95	91	92	101	95	95	83	95	80	95	**91.43**
85	95	59	45	66	85	37	86	70	85	87	100	107	107	**79.57**
85	92	58	45	78	101	57	81	90	60	83	85	103	82	**78.57**
85	80	85	79	95	102	42	81	80	75	78	107	107	95	**85.07**
90	96	102	81	99	96	97	96	90	100	87	85	85	90	**92.43**
95	97	71	76	96	95	71	95	90	70	85	98	94	112	**88.93**
90	93	85	101	60	85	34	91	78	62	88	48	55	85	**75.36**
96	100	100	95	100	101	86	101	100	94	94	84	93	0	**88.86**
89	93	95	88	91	86	34	101	50	66	80	70	85	75	**78.79**
95	100	90	88	65	97	60	96	78	99	94	89	90	90	**87.93**
95	98	95	96	91	98	86	96	90	0	88	78	90	85	**84.71**
90	102	100	101	102	102	102	101	93	108	104	98	100	0	**93.07**
89	98	80	80	76	90	28	91	74	65	95	68	90	75	**78.50**
97	98	85	70	79	100	82	90	96	105	82	86	95	80	**88.93**
88	93	95	81	48	102	38	100	56	51	93	98	52	60	**75.36**
92	93	95	71	98	95	76	96	87	105	93	96	96	85	**91.29**
93	95	95	80	72	75	26	86	99	75	76	95	85	100	**82.29**
95	95	95	76	95	101	85	96	99	85	93	99	97	100	**93.64**
95	98	80	75	97	88	90	55	95	92	78	87	76	100	**86.14**
88	95	100	83	99	90	63	101	92	92	72	94	84	65	**87.00**
90	100	70	96	83	100	72	96	95	89	79	93	84	95	**88.71**
100	100	75	86	102	102	102	101	97	93	82	68	91	90	**92.07**
100	102	96	101	100	101	72	96	84	65	65	75	90	75	**87.29**
98	100	90	86	98	102	86	101	100	100	96	98	101	95	**96.50**
95	102	100	96	105	102	92	101	104	101	101	93	100	90	**98.71**
83	100	95	81	103	100	102	101	94	96	96	98	101	95	**96.07**
100	93	95	96	93	102	92	101	89	93	96	95	100	100	**96.07**
90	102	96	101	98	97	62	86	84	96	92	90	52	90	**88.29**
78	94	100	86	75	100	100	96	100	101	90	93	91	100	**93.14**
60	87	96	75	80	97	17	89	84	56	82	88	96	100	**79.07**
70	72	93	74	63	82	45	100	75	56	78	91	93	80	**76.57**
95	100	90	86	90	80	72	96	85	91	99	88	82	95	**89.21**
98	90	95	91	75	102	65	100	91	102	100	98	88	100	**92.50**
30	97	85	73	100	95	41	90	85	62	86	89	78	45	**75.43**
85	90	75	69	100	71	45	81	63	64	77	80	82	66	**74.86**
90	97	98	70	103	97	80	91	100	94	87	96	80	95	**91.29**
93	95	101	101	105	97	100	96	90	101	81	96	98	70	**94.57**
75	97	97	76	95	86	32	86	70	87	81	100	76	86	**81.71**
95	100	100	86	103	102	97	81	89	89	102	100	98	100	**95.86**
75	99	91	76	98	72	75	86	100	88	89	98	91	75	**86.64**

| 84.72 | 92.37 | 87.42 | 79.35 | 87.56 | 91.53 | 65.12 | 90.91 | 85.44 | 80.65 | 85.33 | 87.51 | 86.26 | 82.14 | 86.57 |

The average quiz scores for students in the Internet course will be compared with the average quiz scores for students in the traditional courses using a Two-Sample T-Test to determine if there is a significant difference between the two groups of students. The results of the analysis are discussed in Chapter 4.

CHAPTER 4

RESULTS

The project included the development of an Internet Pharmacology course using the Jones Knowledge learning platform and comparison of the outcomes of the students who took the course on-line to the outcomes of the students who previously attended class in a traditional classroom setting. This chapter will discuss the implementation of the on-line course and the results of the outcome analysis.

Objective 1: Develop an on-line Pharmacology course using the Jones Knowledge learning platform.

As noted in the literature, the development of an on-line course is a time-consuming process. The degree of computer literacy possessed by the instructor or the amount of technical support available had a direct effect on the amount of time and effort required. For example, it was necessary for the faculty member to learn to create hypertext and compressed files in order to input data into the learning platform. Since Medical Assistant faculty do not necessarily possess a high degree of technical computer expertise, a fair amount of tutoring was necessary beyond what was presented in the instructional manual provided by the learning platform vendor. Technical problems were exacerbated by a change in platform versions between sessions of the on-line course. A program upgrade necessitated re-entry of data and added to the time and effort required to maintain course files.

An attempt was made to supplement the PowerPoint presentations with ".wav" files to allow the students in the on-line course to hear the pronunciation of difficult drug names. ".Wav" files are digital audio files that enable sounds to be transmitted on the Internet. Several methods of linking the ".wav " file to the PowerPoint were attempted, but none proved effective in consistently linking the files to the slides so that the goal of the student being able to hear the drug

names was not met. However, because the students continued to meet with the instructor or another class, it was possible for the instructor to answer pronunciation questions during those meetings.

Students also possessed varying degrees of comfort with computer technology. While all of the students had completed a word processing course as part of the required coursework in the Medical Assistant Program, and had used computers in other applications, some were not comfortable with Internet applications. Detailed printed instructions, specific to the Pharmacology course, were created to assist students in navigating the course platform. Some students required individual instruction in addition to the group orientation meetings. Technical support from the Jones Knowledge Help Desk was also available to students 24-hours a day. During the initial weeks of the course, the focus of discussions between instructor and students was on learning context rather than content, although this focus changed quickly after the second or third week.

Because of the technical difficulties experienced by both the students and instructor, only the basic operations available in the e-education learning platforms were used in the Pharmacology course. Other operations such as the "Chat" features, Grade Book, and On-line Testing were not used; however these options present the potential for enhancement of the course as users become more familiar with Internet technology.

Internet accessibility was also a concern for the students. While all of the students had access to the Internet via computers on campus, not all of the students had computers at home, and those that did had problems downloading some of the larger graphic files associated with PowerPoint presentations. Connection speeds and Internet provider service in student homes varied which created difficulties for some students. All of the students had E-mail accounts via the institutional server, and many, but not all, had E-mail available at home. The students were resourceful, however, and shared tips with and assisted each other.

Leasure (2000) noted a transition in the role of the instructor from "Sage on the sage to a guide on the side." (p. 153). Unable to receive immediate answers to questions from the instructor in the classroom, students in the on-line Pharmacology course seemed to demonstrate more critical thinking skills in the on-line discussion forum than was evident in traditional classroom discussions. After having taught the course several times in a traditional classroom setting, the instructor was able to anticipate the kinds of questions or discussions that were likely to occur each week. These questions were used to stimulate the on-line discussion forum to which the students were required to respond. Faculty members were impressed with the variety of responses, and the creativity and resourcefulness demonstrated by the students in the on-line discussion forum.

Another advantage of the on-line discussion forum was the level of participation by each student. In the traditional classroom, only 35 minutes was allowed for lecture/discussion. During this limited time period, it was not possible for every student to participate, and many students never participated. Because students were required to respond to the discussion forum every week, every student was "heard," creating deeper and richer discussions. Of course, the instructor was required to read each discussion contribution, which further increased the time-investment required.

Many students took advantage of the ability of the platform to create links to other web pages to supplement course material. An advantage to this activity is that the student learned to use the Internet as a resource for health information. However, the instructor needed to closely monitor the Internet links created by students, as not all information available on the Internet is accurate or relevant. Students needed to learn to discern the quality of materials found on the Internet.

Objective 2: Assess the quality of the course by determining if there is a difference in the outcomes between the students who complete the on-line course and the students who attended class in a traditional classroom setting.

      Table 3 summarizes the average of the fourteen weekly quiz scores for each student. There were 42 students who took the course in a traditional classroom setting, and 30 students who took the course on-line.
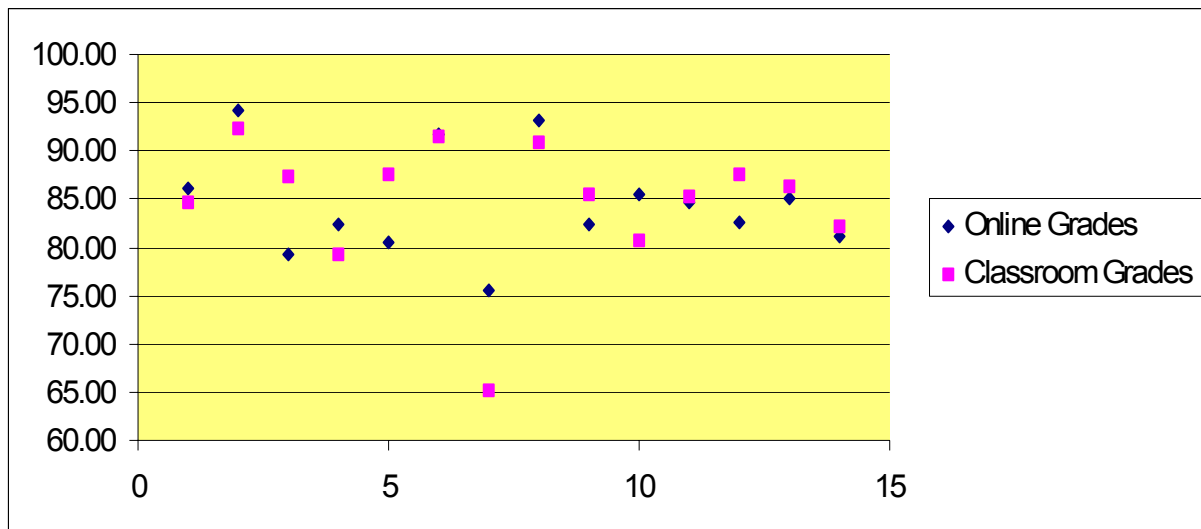
Table 3

Average Quiz Score by Student

	Internet	Classroom
1	75.14	80.43
2	78.57	92.50
3	91.43	69.43
4	79.57	89.86
5	78.57	97.23
6	85.07	88.71
7	92.43	83.14
8	88.93	83.64
9	75.36	88.71
10	88.86	93.07
11	78.79	89.93
12	87.93	70.21
13	84.71	85.36
14	93.07	89.93
15	78.50	88.64
16	88.93	81.43
17	75.36	93.29
18	91.29	81.14
19	82.29	94.57
20	93.64	94.79
21	86.14	80.43
22	87.00	85.79
23	88.71	78.86
24	92.07	87.00
25	87.29	97.77
26	96.50	93.36
27	98.71	89.43
28	96.07	84.00
29	96.07	81.79

30	88.29	92.43
31	93.14	
32	79.07	
33	76.57	
34	89.21	
35	92.50	
36	75.43	
37	74.86	
38	91.29	
39	94.57	
40	81.71	
41	95.86	
42	86.64	

Figure 1 is a graphic representation of the average scores of the weekly quizzes which

demonstrates how closely aligned the student groups were.

Figure 1

Average Weekly Quiz Scores

The average scores of the individual quizzes (Table 3) were analyzed by Minitab

Statistical software using a Two Sample T-Test. Table 4 summarizes the results of the statistical

analysis.

Table 4

<u>Two Sample T-Test and Confidence Interval</u>

	N	Mean	Standard	SE Mean
Classroom	42	86.57	7.09	1.1
Internet	30	87.23	7.20	1.3

      Based on the results of the T-Test, there is no significant difference between the quiz scores

of the students who took the Internet Pharmacology course, and the students who attended the

course in the traditional classroom setting. (T = -0.38, P = 0.70 df62).

CHPATER 5

SUMMARY, CONCLUSIONS AND RECOMMENDTIONS

In an effort to provide more accessible learning opportunities for students, the

Pharmacology for Allied Health course at Lakeshore Technical College was modified for on-line

delivery using the Jones Knowledge learning platform, e-education. To address faculty concerns

about the impact of the change on course quality, outcomes of the students who completed the

course on-line was compared to outcomes of students who had taken the course in a traditional

classroom setting. This chapter will summarize the study procedures, discuss the results of the

statistical analysis, and recommend actions based on the study.

Statement of the Problem and Research Objectives

Pharmacology for Allied Health was delivered using Interactive Television (ITV)

technology to students at a remote location. Due to increased usage of the ITV network to deliver

other courses, scheduling of the Pharmacology course became problematic. It was believed that

circumventing the constraints of time and place would make the Pharmacology for Allied Health

course more accessible and a more viable option for students in other program areas to use as an

elective. Because the potential effect of Internet delivery on course quality and student outcomes

had not been addressed at the college, faculty members were concerned about the impact of the

change in delivery methods.

There were two research objectives:

1. Develop an on-line Pharmacology course using the Jones Knowledge learning platform.

2. Determine the effectiveness of the course by determining if there is a difference in the

outcomes between the students who complete the on-line course and the students who attended

class in a traditional classroom setting.

<u>Summary of Study Procedures</u>

There were 42 students who completed the required Pharmacology course in a traditional classroom setting during the 1999-2000 school year. After modification of the course for delivery on-line beginning in the fall of 2000, 30 students completed the course. All the students were in the second semester of the 1-year Medical Assistant program and had completed course pre-requisites prior to beginning the Pharmacology course. All of the students had access to the same instructor in another course as well as during office hours, and via E-mail and phone messaging technology, and during individual clinical visits.

While the method of content presentation differed between the student groups, all students in both groups took the same written examinations in similar proctored settings at the same intervals throughout the course. Students in both groups were afforded the same opportunities relating to making up missed quizzes. Students in both groups used the same textbook and were required to complete the same learning activities. The same PowerPoint supplements were available to both groups of students.

The major variable was the method of interaction with the instructor during delivery of course content. Students in the classroom setting met with the instructor for one 55-minute session weekly for testing and discussion while students in the Internet-delivered group did not physically meet, but participated in the asynchronous on-line discussions forum.

The data consisted of the average quiz grades for each of the 14 weekly quizzes. The grades were recorded weekly on a Microsoft Excel spreadsheet and were compared using the statistical analysis feature of Minitab statistical software.

Conclusions and Implications

    Educational administrators and faculty members who choose to take advantage of the opportunities created by the Internet to deliver instruction need to consider the time-consuming nature of Internet course construction and maintenance. Internet course construction requires the development of a new set of knowledge and skills. Faculty members who are less-than computer experts will require technical support, regardless of claims of simplicity made by platform vendors. The problem is compounded if the institution or platform vendor requires repeated platform changes or upgrades which require re-entry of data and learning of yet more, new technology. Technicians working with Faculty members can greatly reduce the amount of time, effort, and frustration that is required to learn the nuances of Web page construction and maintenance.

    It is essential to consider the technology needs of students when planning an Internet course. The students in the study possessed basic word processing skills and had demonstrated competency in computer applications in other courses required by their educational program. Yet, not all of the students were comfortable with Internet applications and not all of the students had access to the Internet in their homes. Students needed specific directions related to the course and the instructor needed to provide technical instruction as well as content-specific instruction during the initial weeks of the course.

    Advantages of an Internet-delivered course were afforded in the asynchronous on-line discussion forum that made it possible for every student to participate. Removing the constraints of time and place facilitated more thorough discussions. Students used the course as a jumping-off point for further Internet investigations, but needed assistance evaluating the quality of Internet resources.

Once the technical issues of Internet course development are addressed, analysis of test scores in this study demonstrated that there is no significant difference in outcomes as measured by quiz scores between the traditionally delivered course, and the Internet-delivered course. Since the outcomes were not significantly altered by the change in delivery method, then educators can feel secure that the modification to Internet-delivery can be made without compromising course quality.

Recommendations

The following recommendations are advised based on the results of the study:

1. Lakeshore Technical College should continue to promote the development and evaluation of Internet courses as an alternative-delivery option.

2. Faculty members who are undertaking Internet course development should enlist the assistance of technical support before undertaking the project.

3. Educational administrators should recognize and compensate faculty members for the additional time and effort that is required to develop and maintain on-line courses.

4. Students should be provided with course-specific directions for navigating the learning platform.

5. Technical support should be available to students on a 24-hour per day, 7-day-week basis.

6. Discussion forum questions should promote critical thinking and inquiry. Rewarding discussion contributions on the basis of quality promotes rich, meaningful discussions.

Recommendations for Future Research

In this study, course quality was determined by outcomes as measured by quiz scores. There are other factors that compromise course quality such as student satisfaction. Further research is needed to determine if there is a difference in student preferences and perceptions

between the traditionally delivered course and a course delivered on-line. The research would also be helpful in developing continuous improvement goals.

Another measure of effectiveness is the degree of employer satisfaction. It would be important to determine the perceptions of employers relating to the knowledge and skills possessed by the students after completion of the on-line course.

Students in this study, unlike many other students who participate in Internet courses, had the advantage of having regular face-to-face meetings with the instructor and with peers in other classes. Further research is needed to determine if similar results are obtained when students complete course work in the more impersonal world of pure on-line learning where regular physical contact is essentially eliminated.

This study was limited to Medical Assistant students at Lakeshore Technical College. To generalize the results of this study, it would be necessary to conduct further research with students in different program areas and at different educational levels. This study can be used as a benchmark when evaluating future studies.

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Appendix A

HUMAN RESEARCH SUBJECT CONSENT FORM

Project Title: Pharmacology Course Outcomes: On-Line Delivery versus Traditional Classroom Delivery

Linda Arentsen, Graduate Student, University of WisconsinΒStout, is conducting a research project titled Pharmacology Course Outcomes: On-Line Delivery versus Traditional Classroom Delivery. We would appreciate your participation in this study.

It is not anticipated that this study will present any medical risk or social risk to you. The information gathered will be kept strictly confidential and any reports of the findings of this research will not contain your name or any other identifying information.

Your participation in this project is completely voluntary. If at any time you wish to stop participating in this research, you may do so, with out coercion or prejudice. Just inform the researcher.

Once the study is completed, the analyzed findings would be available for your information. In the meantime if you have any questions please contact Linda Arentsen at 920-693-1893.

Questions or concerns about participation in the research or subsequent complaints should be addressed first to the researcher or research advisor and second to Dr. Ted Knous, Chair of UW--Stout Institutional Review Board for the Protection of Human subjects in Research, 11HH, UW-stout, Menomonie, WI 54751, phone (715-232-1126)

Consent Form

I understand that my participation in this study is strictly voluntary and I may discontinue my participation at any time without prejudice.

I understand that the purpose of this study is to investigate the problem, Pharmacology Course Outcomes: On-Line Delivery versus Traditional Classroom Delivery.

I further understand that any information about me that is collected during this study will be held in the strictest of confidence and will not be part of my permanent record. I understand that in for this research to be effective and valuable certain personal identifiers need to be collected. I also understand that the strictest of confidentiality will be maintained throughout this study and that only the researchers will have access to the confidential information. I understand that at the conclusion of this study all records which identify individual participants will be destroyed. I am aware that I have not and am not waiving any legal or human rights by agreeing to this participation.

By signing below I verify that I am 18 years of age or older, in good mental and physical condition, and that I agree to and understand the conditions listed above.

Signature_____ Date_____

Appendix B

Cover Letter

June 12, 2001

Dear Medical Assistant Program Graduate

How things have changed since you graduated! While we don=t have classes on TV anymore, technology continues to change the way we teach and learn. You may have heard about the Internet Pharmacology course. The students no longer meet at a specific time every week for class, but instead access the course via the Internet. All the Power Point presentations are on-line, and we even have a discussion forum where we can ATalk@ with each other about the topic of the week. So far, the students seem to appreciate the freedom and flexibility this gives them.

When we started this, I was concerned about how Internet delivery of the course would impact student success, so I decided to do a study comparing the quiz grades of the students who took the course on-line to the scores of the students who took the class in a traditional classroom setting. I will be using some statistical tools to determine if there is a difference in outcomes. That is where I need your help.

I will be using my study as the basis for my Master=s Thesis which I hope to complete this summer. Any time that human subjects are used for research, it is necessary to obtain consent so I need you to allow me to use your grades in the study. Please be assured that at no time will any specific individual data about your grades be shared with anyone else, only aggregate data will be used.

If you are willing to be included in the study, all you need to do is read and sign the enclosed consent form and return it to me in the enclosed envelop. I have also enclosed an extra copy of the consent form for you to keep in case you have any questions later on.

Thanks for your time. I hope you are enjoying our career and have found your experiences at LTC valuable both personally and professionally. If you have any questions, feel free to contact me at 920.693.1893, or by E-mail at linar@ltc.tec.wi.us.

Sincerely

Linda Arentsen, RN, BSN, CMA
Medical Assistant Program Director