

Distance Learning Programs for Pathology Education

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Abstract

In this article we describe the development of distance learning programs for pathology education at Thomas Jefferson University. Our first step was to create a one-credit computer lab for an existing graduate course (Pathologic Aspects of Disease, PA570). Students use this computer lab to review case studies, submit essays, and take weekly quizzes. A Discussion Board is used to publish student essays and provide a forum for class discussion. Examination scores and academic progress are reported online. Our second step was to add lectures to create a complete, three-credit distance learning course for pathology education (Pathophysiology of Human Disease, NU570). These web-based pathology programs are not simply electronic books. They are visually stimulating and interactive. A comparison of scores on standardized tests indicated that students taking the distance learning course (NU570) performed as well as students taking the traditional course (PA570). Our findings indicate that distance learning programs can work efficiently and provide students with a quality education.

Introduction

Distance learning can be defined as a planned learning activity where instructor and student are separated in time and space. Computer-based distance learning includes video-conferencing, email-based learning, and web-based learning. Of these, web-based delivery of information is rapidly becoming the most popular and widely accepted method for distance learning (1).

Distance learning began at Thomas Jefferson University in 1995 with the Learn-

ing Infrastructure Project (LIP). The LIP mission was to explore new learning environments aimed at integrating the power of technology with Jefferson's tradition of teaching excellence. The LIP was charged with focusing on the use of technology to teach basic science and clinical skills, reach distant learners, open new educational markets, improve communication with the alumni, and expand Jefferson's presence and reputation.

One of the outcomes of the LIP at Jefferson has been the development and implementation of distance learning programs for pathology education. Our goals were to provide a more enriching educational experience for our graduate students and offer learning resources to students off-campus. Key features of our distance learning programs include: 1) a ListServ to disseminate information, 2) a Discussion Board to publish student essays, 3) online case studies and weekly quizzes, and 4) a tracking system to monitor students' academic progress. Here, we describe the development of these pathology programs, and evaluate student feedback and performance.

Materials and Methods

PA570 draws students from several M.S. programs at Jefferson, including Biomedical Chemistry, Pharmacology, Microbiology, and Nursing. Ph.D. candidates in Pathology and Cell Biology are also required to take this course. PA570 has grown in student enrollment from 10 in 1994 to 80 in 1999. This course covers selected topics in general and systemic pathology, providing an overview of human pathophysiology.

Jefferson's academic web-site (JEF-FLINE) is maintained by Academic Information Services and Research (AISER) and is served from IBM RS/6000 and

Sun Microsystems Ultrasparc2 computers. Some of the resources on JEFFLINE are password protected, but can be accessed at [http://jeffline.tju.edu] with prior permission. Distance learning courses were developed using hypertext markup language (HTML), Pearl, and Real Audio/Video technology. Animation sequences were created using Macromedia Flash. Academic progress is monitored using a web-version of ORACLE software.

Student feedback was requested during the last two weeks of each summer course. Specific information regarding computer-based learning was solicited online, whereas general information was solicited in class. Response rates for these surveys varied from 50 - 100%

Results and Discussion

One-Credit Computer Lab (PA570)

PA570 is a popular course, with high means on written examinations and excellent student reviews. However, in the past, many students felt that two credits did not adequately reflect the time and effort required to accomplish course objectives, nor did it provide adequate time for reviewing gross and microscopic pathology. In response to these concerns, we developed a one-credit computer lab to accompany our traditional, lecture-based course. We believed that these online resources would serve to strengthen the students' understanding of basic mechanisms of disease and provide them with a more enriching, three-dimensional educational experience.

The PA570 homepage was designed to emphasize weekly homework assignments (Figure 1). It is user-friendly and colorful. A color-coded menu bar also appears on internal pages. Key features of the PA570 computer program include:

- Case Studies (morphology of disease)
- Clinical Vignettes (problem solving)
- Weekly Quizzes (self-assessment

- and review)
- Learning Resources (syllabus, objectives, glossary)
- Discussion Board (essays submitted by students)
- ListServ (class announcements)
- Academic Progress Report (quizzes, essays, examinations)

Each week students are expected to attend a two hour lecture on campus and complete a two hour computer module. Written examinations count for 80% of the students' final course grade; 20% is based on the completion of online course activities (quizzes and essays). Essential elements and major objectives of the PA570 computer lab are outlined below:

Case Studies: Each week students review 20-30 images of gross and microscopic pathology illustrating important diseases. Major topics are introduced with a clinical vignette. A short-answer essay question is appended to each case to stimulate critical thinking. Students are expected to answer one essay each week. These essays are posted on the Discussion Board the following Monday.

Weekly Quiz: Each week students complete an extended matching quiz (10-20 items) that emphasizes basic concepts and tests understanding of medical terminology (2). Quizzes are scored online, providing instant feedback. The primary purpose of these weekly quizzes is self-assessment.

Clinical Vignettes: Each week students read a clinical vignette and select a diagnosis from the options listed. This exercise emphasizes problem-solving skills. It is intended to be an enjoyable learning experience (application of knowledge). A histogram showing the distribution of student responses and an explanation of the correct diagnosis are posted on the Discussion Board the following Monday.

The Log-On page requires students to enter their name and personal password.

Students are encouraged to contact the Course Director if they have questions of a scientific nature and the Technical Support Staff for all other concerns. The List-Serv is used to post announcements to the entire class. Together, Email, List-Serv, and the Discussion Board serve to maintain excellent lines of communication between the students and the faculty.

Student response to the PA570 computer lab has been overwhelmingly positive (Tables I and II). All students responding to the online survey in 1999 thought that navigation within the course was easy. Students enjoyed the clinical vignettes, case studies, and weekly quizzes. The most popular exercise was selecting a diagnosis for the clinical vignette (97%). Only 67% of the students used the Discussion Board, but 100% of the students used the Academic Progress Report. Most students (71%) accessed the course from home, while 15% accessed the course from work. Most students (65%) logged on two or three times per week, but 7% of the class logged on every day! Half of the students indicated that they devoted more than four hours per week to the computer lab - 15% devoted more than six hours per week. All students responding to the online survey in 1999 thought that the computer lab was a welcome addition to the course.

A separate survey prepared by Jefferson's College of Graduate Studies asked the students important questions regarding course administration, teaching, clarity of course objectives, and examinations. Comparison of results obtained in 1998 and 1999 showed that the addition of a computer lab in 1999 significantly improved the students' perception of the course (Table II). Addition of the computer lab even improved student satisfaction with aspects of the course that were unrelated to computer-based learning, e.g., students' perception of the faculty. This finding illustrates how specific course activities can greatly influence overall student satisfaction. Introduction of the computer lab in 1999 did not lead to a significant improvement in student perfor-

mance on written examinations (data not shown).

Written comments further documented the success of our web-based, distance learning program. Interesting examples submitted by students in 1999 are provided below:

- I think that Jefferson has really moved ahead of other Master's Programs with the computer based learning portion of PA570. Since I drive over an hour to get to campus, it is nice to be linked to the class without leaving my home.*
- This class has been THE most fascinating and rewarding course that I have ever taken. The other professors need to borrow Dr. Fenderson's notes on how to run a stimulating and thoroughly organized class.*
- I would not consider myself a "computer person", however I have found the computer based learning for this course to be excellent. I especially liked the case studies and clinical vignettes. It helped me to solve problems and think about the clinical presentation of diseases that I was reading about.*

Three-Credit Distance Learning Course (NU570)

Following our success with the PA570 computer lab, we realized that it would be straightforward to create a three-credit, distance learning course by moving the campus lectures to an online format. We were encouraged to proceed with this project by faculty in the Department of Nursing. Most nursing students have full time jobs, which make it difficult for them to attend lectures on campus. Thus, we developed an online course, Pathophysiology of Human Disease (NU570), for graduate students in the College of Health Professions.

The homepage for NU570 is shown in Figure 2. Like the one developed for PA570, this homepage highlights specific course objectives and weekly homework

assignments. Lectures were added to provide a short overview of each topic in the curriculum. The online lectures include a list of Key Points and images that illustrate Key Morphological Concepts. Animation sequences were added to illustrate basic mechanisms of disease (e.g., metaplasia and neoplasia). We planned to tape the lectures in a recording studio and have the students listen online using RealPlayer. However, to our surprise, most students preferred to read the lectures and print them for future reference. Hence, lectures for NU570 are provided also as HTML files.

NU570 was offered for the first time during the summer of 2000. Twelve students pursuing a M.S. degree in Nursing enrolled. To our delight, none of the students dropped the course. An orientation session, two review sessions, and two examinations were held on campus. Student response was positive (Table III). All students responding to the online survey said they accessed NU570 primarily from home. Most students logged on two or three times per week and most devoted more than four hours per week to online activities. All 12 nursing students finished with an A letter grade in the course.

Written comments were also informative. One student wrote: "At first I was skeptical about taking an online course. However, it really worked out well for me. I was able to work at my own pace. Yet, if I had a question, it was easy to get an answer from the technical support and the professor of the course. I feel that in order for an online course to be effective, there has to be good communication with the professor of the course. The professor was encouraging and very helpful. I loved this course and learned a great deal." Another student offered a contrasting view. She wrote: "I am not that self-motivated and would have benefited more from class discussion.... I missed out on good lectures and the chance to view gross anatomy." Thus, it appears that self-motivation and ability to work independently are critical factors in determining

student satisfaction with distance learning.

Distance Learning and Academic Achievement

NU570 and PA570 ran concurrently during the summer of 2000. Both courses covered the same material (lectures, case studies, assigned reading) and the students were given identical examinations. Thus, we were able to test our hypothesis that students taking a distance learning course perform as well on objective, written examinations as students taking a traditional course.

Comparison of scores on standardized tests indicated that students taking our distance learning course (NU570) performed as well as students taking our traditional course (Table IV). In fact, students who took pathology online scored significantly higher on the final examination. Unfortunately, different groups of students were enrolled in the two courses (nurses in NU570 and a mixture of students in PA570). Higher scores on the final examination among nursing students enrolled in NU570 may be related primarily to their previous training and experience. None the less, these findings demonstrate that web-based, distance learning programs can provide motivated students with an excellent education.

Conclusions and Perspective

Our experience with distance learning at Jefferson has made us appreciate the value of computer-based learning programs for organizing course information and providing students with specific learning objectives. The expanding volume of information in biology and medicine represents an enormous hurdle for most students. To be effective, courses need to provide students with structure and guidance: a road map for learning.

The online pathology courses described here were specifically designed to guide students each week with lectures, case studies, and problem solving exercises.

Students completed homework assignments and received continuous feedback online. We believe this approach to education worked remarkably well. The case studies, clinical vignettes, and weekly quizzes served to motivate students and create an excellent climate for learning (Tables I-IV).

The development of computer programs for graduate education represents an extension of our on-going effort to provide high-quality learning resources for medical students (3). Resources developed for medical students can be adapted to meet the needs of allied health professionals. In return, we believe the distillation of "essential pathology" required by this effort can lead to improved methods for teaching medical students. In this connection, we are in the process of improving the programs described in this article to create an Online Pathology Course for medical students. We hope this new program will serve the needs of medical students who are required to complete a remedial course in pathology.

GRIFE members are invited to visit the pathology programs described in this article. The one-credit computer lab (PA570) and the three-credit pathophysiology course (NU570) can both be accessed for a limited time using the information provided below. Your comments and suggestions are welcome.

<http://jeffline.tju.edu/Education/dl/PA570>

<http://jeffline.tju.edu/Education/dl/NU570>

first name type guest
last name type pathology
password type gripe

Table I
Student Evaluation of PA570 Computer Laboratory

Variable	% Students Agree*
<u>Technical Questions</u>	
Connecting to the course was easy	91
Communication with classmates	61
Communicating with instructor	93
Navigation within the course was easy	100
Primarily accessed course from home	71 (15% from work)
Satisfied with images and load time	89
<u>Content Questions</u>	
Enjoyed the Clinical Vignettes	97
Enjoyed the Case Studies	89
Weekly Quizzes helped me focus	95
Used the Discussion Board	67
Used the Glossary of Keywords	67
Used the Academic Progress Report	100
Computer Lab was welcome addition	100

*Results of this online survey were obtained in 1999 (N = 46). Similar results were obtained in 2000.

Table II
Effect of Computer Laboratory on Student Satisfaction

Question	Student Evaluation Scale 1-5 (Agree-Disagree)*	
	1998 (2 credits)	1999 (3 credits with lab)
Faculty were well prepared	1.76	1.41
Course was well balanced	2.46	1.86
Objectives clearly defined	2.03	1.52
Course met objectives	1.85	1.41
Course added to knowledge	1.92	1.36
Exams covered content	1.68	1.36
Satisfied with the course	2.12	1.51

*Data represent the mean of student responses, N = 63 (1998) and N = 56 (1999). The only significant difference between PA570 offered these two years was the addition of a one-credit computer lab in 1999. The differences are statistically significant (P < 0.05).

Table III
Student Evaluation of NU570 Distance Learning Course

Variable	% Students Agree*
<u>Technical Questions</u>	
Connecting to the course was easy	100
Communication with classmates	50
Communicating with instructor	100
Navigation within the course was easy	100
Primarily accessed course from home	100
Satisfied with images and load time	83
<u>Content Questions</u>	
Enjoyed the Clinical Vignettes	100
Enjoyed the Case Studies	100
Weekly Quizzes helped me focus	100
Used the Discussion Board	50
Used the Glossary of Keywords	100
Used the Academic Progress Report	83

*Results of this online survey were obtained in 2000 (N = 7). On a five-point scale (agree-disagree), the students overall satisfaction with this online pathology course was 1.2 (N = 12).

Table IV
Effect of Distance Learning on Academic Achievement

Course*	Mean Student Scores \pm SD	
	Mid-Term Examination	Final Examination
PA570 (Traditional)	86 \pm 8	89 \pm 6
NU570 (Distance Learning)	88 \pm 5	94 \pm 4

*PA570 and NU570 ran concurrently during the summer of 2000. Both courses covered the same material and students were given identical examinations. Mean scores on the mid-term examination were not significantly different; however, nursing students taking NU570 scored significantly higher on the final examination ($P < 0.001$).

Welcome to PA570!

Case Studies
(Key Morphologic Concepts)

Weekly Quizzes
(Self-Assessment)

Communication

Learning Resources

search help refine glossary

Figure 1. Pathologic Aspects of Disease (PA570) homepage.

Pathophysiology of Human Disease

communication

digital library

evaluation

syllabus

Course Syllabus
(Instructions and Curriculum)

Case Studies
(Key Morphological Concepts)

Lectures Online
(Overview and Examples)

Clinical Vignette
(You Make a Diagnosis)

Discussion Board
(Conversation and Feedback)

Weekly Quizzes
(Self-Assessment)

search help refine glossary

Figure 2. Pathophysiology of Human Disease (NU570) homepage.

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Acknowledgments

The authors wish to acknowledge the expert technical assistance of Chris Braster, Todd Ohl, Paul Solor, and Gennady Nevsky. We also appreciate the encouragement of our colleagues, most notably Mary Schaal, Edward Tawyea, Fred Gorstein, and Emanuel Rubin.