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# Evaluation of the Effectiveness of a Web-Based Graduate Epidemiology Course

Molly A. Rose, RN, PhD, Anthony J. Frisby, PhD, Michael D. Hamlin, PhD, and Susan S. Jones, MS

An online epidemiology course was developed, implemented, and evaluated for graduate nursing students through the collaborative efforts of nursing faculty and information, education, and instructional design staff of the library at a health sciences university. This epidemiology course is a core curriculum course for graduate nursing students. The course was piloted with 14 students (one student in Romania); the initial online offering ran concurrently with a traditional classroom section. Extensive evaluation data were collected and analyzed to compare the effectiveness of the classroom and distance-learning formats. Areas of evaluation included objective measures, such as midterm and final examination scores and content analysis comparisons, as well as subjective ratings by the students of time commitments, course objectives, technical aspects of the web-based course, areas of satisfaction or dissatisfaction, and self-confidence regarding epidemiology and computer skills. Recommendations for course development, implementation, and evaluation for similar distance-learning courses will be included.

**Key words:** Distance learning, Epidemiology, Evaluation, Graduate nursing, Internet

Many schools of nursing are identifying distance education as an important and growing option for meeting the educational needs of professional nurses. The use of distance learning in nursing education has been reported for a nursing management course,<sup>1</sup> community health nursing courses,<sup>2,3</sup> a graduate family process course,<sup>4</sup> a graduate psychiatric mental health nursing program,<sup>5</sup> and a doctoral course.<sup>6</sup> This article describes the development of an online graduate-level nursing epidemiology course and compares outcome data for the online epidemiology course and the traditional classroom epidemiology course. The online course was developed, implemented, and evaluated by the nursing faculty in collaboration with the information, education, and instructional design staff of the library at an urban health sciences university.

## COURSE DEVELOPMENT

Course development was initiated after administrative personnel from the nursing school and the Academic Information Services and Research (AISR) division of the library met to discuss the possibility of developing a distance-learning course. The nursing school was interested in reaching potential program candidates who were unable to attend the traditional campus-based course. AISR has traditionally provided programming and instructional design support to the nursing faculty and recently issued an extensive report detailing trends in distance learning and

opening market areas. Some of the content is available on the distance-learning website.<sup>7</sup> The graduate-level nursing epidemiology course was chosen as the first course to be delivered by distance learning.

A team approach was implemented, with a nine-month schedule for developing the course materials. The team consisted of a nursing faculty member who had previously taught the graduate epidemiology classroom course, two library consultants, an instructional designer, a computer-based learning developer and programmer, a computer-based learning designer and graphic artist, and a database administrator. Table 1 depicts the contributions of the team members and time expended. While considerable time and expense went into producing the online course, each subsequent time the course is offered, operating costs are expected to decrease to an estimated 130 hours for faculty, 130 hours for system support, and 40 hours for database administration.

The course content for the web-based graduate epidemiology course and the classroom course were identical (Figs. 1, 2, 3, and 4). The required textbook for the classroom course was an optional resource for the online group. However, alternate teaching strategies were used in the online course. For example, online course materials included graphics, animation, more than 1,200 information pages or frames, a search program, a glossary, self-assessment quizzes, exercises with immediate feedback to the student, and exercises completed by the students and stored in an Oracle database. The Oracle database provided stu-

**TABLE 1**  
Contributions of Interdisciplinary Development Team

Personnel	Contributions	Time (hrs.)
Nurse faculty member	Development of course content, exercises, assignments (similar to classroom course)	300
Library consultants (2)	Developed the initial case study with input from nursing faculty; served as course editor reviewing material for consistency and clarity; attended a local professional meetings on distance, learning development	469
Instructional design specialist	Served as coordinator of technological aspect; identified appropriate learning technology tools; converted course material to storyboards; adapted two epidemiology case studies for use in course	183
Computer programmer	Programmed the storyboards using HTML, Java Script, and PL/SQL into a working course	116
Graphic artist	Worked closely with nursing faculty, instructional designer, and library consultants to produce graphics and animation that made the content come alive	402
Database administrator	Developed database tables, login procedures, and database connections to monitor student progress through the course content	75

dent progress reports to students, held student responses to questions and assignments for faculty review and grading, and allowed faculty to monitor progress of students through the course content.

A two-hour orientation was conducted on a Saturday for students who had registered for the online course. The orientation included an overview of the course requirements, the course components, and directions for using a web browser, email, and webboards (electronic message boards). The online course was primarily self-paced. However, scheduled examinations provided the time frame for completion of material.

## COURSE EVALUATION

The online graduate epidemiology course was piloted with 14 graduate nursing students, including one student in Romania. The online course offering ran concurrently with the traditional classroom epidemiology course of 38 graduate nursing students. Registration materials included both formats for the course. Students then self-selected themselves into the online course after discussing their computer technology and skills with the nursing faculty. Extensive process and outcome evaluation data were collected from both student groups.

The online graduate nursing students were asked in a precourse questionnaire why they chose to take the online course. The primary reasons were to prevent lengthy travel to class, it was the only way they could fit the course into their schedule, to save time, and the personal challenge of trying a new online

course offering. None of the 14 online students had any previous experience with distance learning. Half (19) of the classroom students reported being aware of the online offering. The reasons they chose the classroom over the online course were that they preferred to learn by attending lectures/discussions, they enjoyed face-to-face interactions with other students, they did not have a computer, and they were not comfortable using the Internet.

The online course was divided into five content sections. At the completion of content and exercises for each section, the student completed a process evaluation of the section. Questions included amount of time to complete the section, what they liked and disliked about the section, suggested improvements, and the nature and resolution of technological problems. Students provided extensive comments throughout the term. Since this was the pilot of the first online course at the university, this information proved extremely valuable. Revisions to the course and measures to prevent technical problems were instituted throughout the semester based on this feedback. Examples of such revisions were adaptations of the content frames to clarify information or correct typing errors, balancing campus Internet traffic, and training more library staff to provide technical support to students outside traditional office hours.

The online group completed a midcourse evaluation immediately after the midterm examination. The results showed an overall satisfaction with the course (77%); 92% were satisfied with technical support provided; 92% were satisfied with communication with the instructor; and 69% were satisfied with the

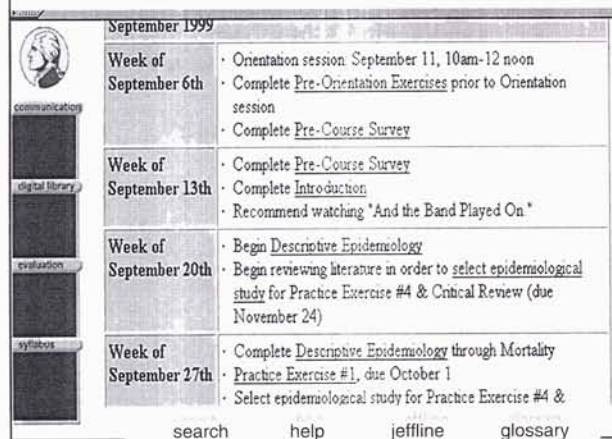


FIGURE 1  
Example of suggested timeline for online course.

assignments. The midcourse evaluation self-report showed that 38% were devoting eight or more hours a week to the course, 23% were devoting five to seven hours a week, and 31% were devoting three to four hours a week to the course.

Prior to each of the two exams, a study review session identical to the classroom group review session was held on campus by the nursing faculty. While optional, nearly all students from the online group attended these sessions. It was obvious at the first study review session (two weeks prior to the midterm exam) that the online students were at varying points in the course content. This caused anxiety among the students who had not progressed as far as others. Student input at the session and through subsequent telephone interviews demonstrated problems with self-motivation, procrastination, and study methods. Many students had to rush through the content just prior to the exam, leaving little time to

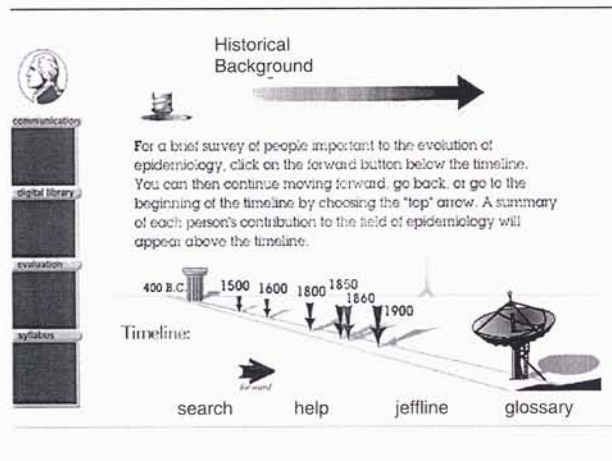


FIGURE 2  
Information frame introducing exercise on interpretation of epidemiological data.

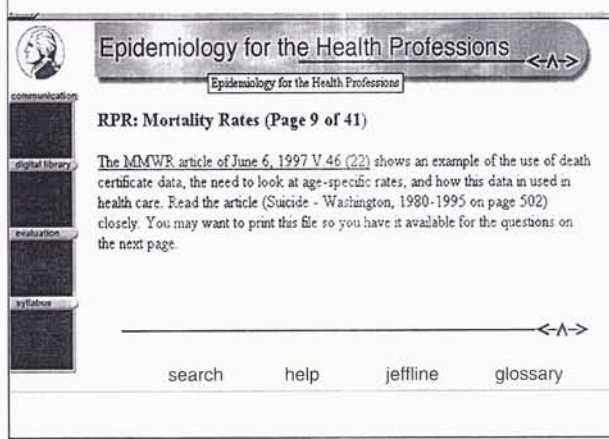


FIGURE 3  
Historical evolution of epidemiology.

study. The evaluation data showed that only 31% of the students used cut-and-paste methods to take notes. One student who excelled in the course stated that she took longhand notes from the online frames, as if in a classroom setting.

The criteria used for student course grades were similar for both the online and the classroom sections. Seventy percent of the grade for both sections was from examinations. For the classroom section, the additional 30% of the grade was derived from the problem-solving assignments. For the online section, these assignments accounted for 20% of their grade with the remaining 10% being from their participation in discussion activities. The midterm and final examinations provided were identical for each group. The midterm grade mean was 84.6 for the classroom group (s.d.  $\pm 6.2$ ) and 87.1 for the online group (s.d.  $\pm 9.8$ ); final grade mean was 83.2 classroom (s.d.  $\pm 8.0$ ) and 87.0 online (s.d.  $\pm 7.9$ ). On a four-point scale with 4.0 =

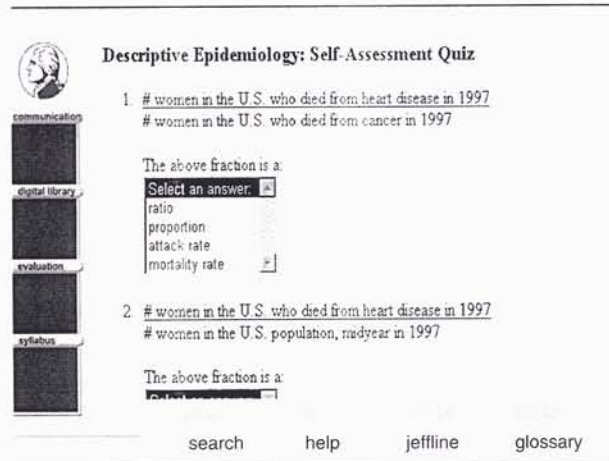


FIGURE 4  
Example of self-assessment quiz at end of units.

A, the classroom mean final course grade was 3.4 and the online mean final course grade was 3.5. There were no significant differences in the midterm scores, final scores, or the course grades between the two sections ( $p = 0.41$ ;  $p = 0.14$ ;  $p = 0.41$ , respectively).

At the end of the course, all students completed an evaluation of the course. On a Likert scale of 1 to 5, with 5 being most satisfied, students in the online and classroom sections expressed satisfaction with communication with classmates (3.83, 3.49), with instructor (4.50, 4.18), assignments (4.17, 4.00), review sessions (4.58, 3.97), relevance of course (4.42, 4.06), and the course overall (4.33, 4.06). There were no significant differences in scores between the online and the classroom groups.

Precourse and postcourse data on student perceived confidence levels regarding epidemiology content were collected from all students (Table 2). For reasons that remain unclear, the online group had significantly higher perceived confidence levels in four areas (descriptive and analytic epidemiology, history, morbidity and mortality rates, and disease surveillance) as compared with the classroom group. However, they had a significantly lower confidence level score for the overall ability to do well in an epidemiology course than the classroom group. Posttest confidence scores for the two groups showed no significant differences. Confidence levels improved significantly for both groups in all areas between the pretest and the posttest.

Students in the online section were asked to rate their perceived comfort levels with computer technology prior to and after the course (Table 3). Of the areas identified, perceived comfort levels prior to the course and after the course significantly improved for downloading from the Internet and installing plug-ins downloaded from the Internet. Perceived comfort levels using Excel or other spreadsheet software pro-

grams significantly decreased after the course. Students used Excel, with difficulty, for the exercises in the unit on investigation of an epidemic. In addition, online students completed midcourse and end-of-course satisfaction scales related to online aspects of the course. Likert scales (1–5), with 5 being most satisfied, were used (Table 4). Students were fairly satisfied with the course at the midcourse evaluation. They were least satisfied with webboards, listservs, and links to noncourse sites. Their experience with these areas increased during the second half of the course. Statistically significant improvements in satisfaction occurred in the areas of self-assessment quizzes, course webboards, and links to noncourse sites. Course listservs satisfaction remained the same.

## IMPLICATIONS

The online epidemiology course was revised recently based on the evaluation data from the initial course implementation. At present, students who think they may like to take the online epidemiology course are referred from the university web pages to a section detailing frequently asked questions about taking online courses. In addition, students are urged to peruse a course overview to see how a distance course looks and what types of materials it includes. Since the orientation session for the initial implementation of the course demonstrated that the students varied considerably in their computer proficiency, students who decide to take the online course are directed to complete a series of online preorientation session exercises that test skills commonly required for online courses. These exercises must be completed one week prior to the start of the course. The online preorientation exercises attempt to develop a more homogeneous group related to basic computer skills to allow for a more fo-

**TABLE 2**

Comparison of Confidence Levels Online vs. Classroom on a Scale of 1–5 (5 = Most Confident)

	Online ( $n = 12$ )		Classroom ( $n = 33$ )	
	Mean		Mean	
	Precourse	Postcourse	Precourse	Postcourse
Current ability to differentiate between descriptive and analytic epidemiology	3.67	4.08	2.46	3.91
Current understanding of history of epidemiology	3.92	4.42	2.73	4.12
Current ability to calculate morbidity and mortality rates	3.83	4.25	2.24	4.09
Current ability to locate sources of epidemiology data	3.50	4.25	2.88	4.12
Current ability to analyze research studies	2.92	3.75	2.70	3.88
Current understanding of disease surveillance	3.58	4.00	2.39	4.09
Current statistical ability	3.08	3.67	2.67	3.33
Overall ability to do well in an epidemiology course	2.33	4.00	3.55	4.12

**TABLE 3**

Comparisons of Online Students' Perceived Comfort Levels with Technology (1–5 Scale with 5 = Most Comfortable)

Comfort level	Precourse	Postcourse
Using desktop computers	4.08	3.92
Using e-mail	4.00	4.08
Using listservs	3.33	3.50
Using the Internet	4.00	3.92
Downloading from the Internet	3.17	3.58*
Installing "plug ins" downloaded from the Internet	2.50	3.50*
Using Excel or other spreadsheet program	3.42	3.08*

\*Statistically significant change ( $p < .05$ ).

cused on-campus orientation session specific to course logistics and taking notes. The exercises also serve as an alert for students who might need to refresh themselves on e-mail or downloading or who might be more successful in a traditional classroom.

A suggested timeline for completion of content and defined due dates for submission of assignments are now included to help students with time management. A manual with hard copies of course objectives and course evaluation methods, problem-solving assignments, and a formula list are given to the students at orientation. Student input through section evaluations showed that having hard copies for particular exercises would facilitate their learning experience. One of the problem-solving assignments was to evaluate a recent epidemiological study. The online student group assignments appeared scanty and hurried when compared with the classroom group. This may have occurred since this was the last assignment and online students were concentrating on completion of content prior to the last exam. This

assignment was moved to an earlier date of completion. Initially, use of discussion boards was lower than anticipated. Students responded to questions presented, but they did not respond to each other's comments. At subsequent offerings, students are specifically asked to respond to the comments of their colleagues.

## SUMMARY

The development, implementation, and evaluation of the graduate epidemiology online course was challenging and very time-consuming. Lawton<sup>8</sup> reported that the individual support needs of each distance learner may require a problem-solving and caring approach to avoid a feeling of disconnection or isolation in the course. While labor intensive, faculty input about their progress, concerns, and questions through personal e-mails was important to the online epidemiology students. Ayoub et al.<sup>1</sup> compared an interactive computer nursing management course with the traditional management course. They emphasized the need for adequate planning time, the importance of technical support, and the overwhelming time required of faculty in telecommunications. Cravener<sup>9</sup> reviewed distance-learning literature and found 185 articles on distance-learning instructional methodology. In the area of faculty workload, most writers noted that having students at a distance increased faculty time demands when compared with the classroom courses.

For this course, the interdisciplinary approach worked extremely well with positive interactions throughout the process. Adequate preparation time and appropriate team members are essential for development, implementation, and evaluation of an online course. Realistic projection of time requirements for all members of the team is crucial. Time-consuming tasks beyond the development of the course material include counseling students, solving technological

**TABLE 4**

Satisfaction of Aspects of Online Course (Midcourse to End of Course)

	Mid	Final
Connecting to course	3.67	3.92
Technical support	4.42	4.25
Navigation within course	3.83	3.92
Self-assessment quizzes	3.92	4.25*
Course web boards	2.67	3.50*
Course listservs	3.17	3.17
Course help screens	4.00	3.83
Glossary	4.58	4.50
Links to noncourse sites	3.42	4.42*

\*Statistically significant change ( $p < .05$ ).

problems, ongoing support through e-mail and telephone communications, and organizing, coordinating, and analyzing data. Both process and outcome evaluation methods were invaluable during course implementation and revision. Similar evaluation methods will be used in subsequent offerings of the course.

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Michael D. Hamlin, PhD, directed the Education Services Division of AISR at Thomas Jefferson University during the design of the online epidemiology course. Prior to that he was Director of Human Resource Development for the School of Dentistry at the University of Washington in Seattle. He is currently directing Educational Technology initiatives for Pepperdine University's Graziadio School of Business and Management in Southern California.

Susan S. Jones, MS, was an Education Services Librarian at Thomas Jefferson University. She helped develop numerous electronic products for education and training, including web-based courses, training websites, and interactive CD-ROMs. Sadly, she is now deceased and we miss her.

The epidemiology web-based course was developed at Thomas Jefferson University in 1998. Evaluation of the course was presented at the American Public Health Association Annual Meeting in Chicago, Illinois, on November 9, 1999.

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