

Lessons Gained from Distance Delivery of an Applied Pharmacokinetics Course

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Applied Pharmacokinetics was delivered to 54 University of North Carolina external doctor of pharmacy students during the Spring semester of 1996 using a combination of printed material, videotapes, and interactive videoconferences. Live interaction was available via videoconference, during faculty visits to regional sites, and by toll-free telephone conversations. This paper describes the course design, course materials, methods of communication, and lessons learned during the Spring of 1996. Feedback regarding the course was obtained via a questionnaire administered to students at the completion of the course. Eighty-one percent of the students reported that videotapes were an effective method for delivery of pharmacokinetic course material. One-hundred percent of responders thought the course-pack was a helpful supplement. Seventy-five percent of the responders wanted more interactive videoconferences. Development and delivery of an effective course for distance learners is an educational challenge that requires careful planning and a team effort.

INTRODUCTION

The University of North Carolina School of Pharmacy initiated a statewide external doctor of pharmacy program during the Spring of 1996. In general, students who enrolled in the program were full-time practitioners located throughout the state. The students (25 male and 29 female) ranged in age from 26 to 52 years of age and practiced in various pharmacy settings (Table I). The first course offered was "Applied Pharmacokinetics". The course was taught using a combination of printed material and videotapes. Live interaction was available via a videoconference network, the North Carolina Research and Education Network (NC-REN), during faculty visits to regional Area Health Education Center [AHEC](1) sites, and by toll-free telephone conversations. In addition, students were encouraged to form local study groups within their AHEC region.

Designing an effective distance learning course for adult students requires careful planning. Appropriate learning experiences and methods of delivery need to be selected. This paper describes the University of North Carolina's first experiences with distance delivery in the external doctor of pharmacy program.

COURSE DESIGN

The goal of the course was to apply knowledge of pharmacokinetic principles, disease processes, and therapeutic response (outcome) to the rational design of dosage regimens of commonly monitored therapeutic agents based on individual parameters. Applied Pharmacokinetics was a three-credit-hour, required professional course for external doctor of pharmacy students. A basic understanding of pharmacokinetic theory/principles was required and was not reviewed in the course. Thus, to prepare for this course it was strongly recommended that each participant read and complete Concepts in Clinical Pharmacokinetics—A Self-Instructional Course published by ASHP(2). To assure that each student enrolling in this course had a similar pharma-

Table I. Practice settings of external PharmD students enrolled in applied pharmacokinetics course

Type of practice	No. of students	Percent
Hospital	40	74.0
Long-term care	3	5.5
Independent	3	5.5
Home infusion	2	3.7
Industry	2	3.7
Clinic	1	1.9
Health department	1	1.9
HMO	1	1.9
Unknown	1	1.9
Totals	54	100.0

cokinetic knowledge base, a self-assessment worksheet was completed before entering the course. This worksheet consisted of 36 questions in a variety of formats (e.g., calculations, short answer, true/false, graphs) focusing on basic pharmacokinetic principles. The worksheet allowed each student to assess his or her abilities and allowed the instructor to advise each student regarding his or her readiness for the course.

The course was divided into three sections and the material was presented in a variety of formats including videotaped, on-campus lectures, extensive course-pack, casebook, textbook, and interactive videoconferences. The students were expected to read the required material, review videotaped lectures, and complete designated cases from the casebook for each session. Five to seven videotapes (two lecture hours/tape) comprised one block of material. The first two sections consisted of two blocks each; the third section contained only one block of material. A two-hour, proctored examination followed each section of material at regional facilities around the state. In addition, each student was required to submit one completed case from the casebook and develop a new pharmacokinetic case from their practice setting. Students were expected to attend each interactive videoconference and participate actively in discussions.

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COURSE MATERIALS

Originally, 64 students enrolled in Applied Pharmacokinetics. Most students utilized the self-instructional course, Concepts in Clinical Pharmacokinetics. Seventy-two percent of the students agreed that the self-assessment worksheet was worthwhile. Although no students were excluded from the course based on the results of the self-assessment worksheet, 10 students dropped the course after self-assessment.

Syllabus. A syllabus² was provided at the beginning of the course that included the instructors' names, phone numbers, electronic mail (e-mail) and office addresses, as well as office hours (morning and evening office hours accommodated students with varying work schedules). In addition, the purpose and objectives of the course, the required text, course format, exam policy and conduct, grading procedures, course schedule, and course fees also were included in the syllabus. Details regarding each block of materials (the videotaped series, approximate time needed to view the videotapes, reading and casebook assignments) and the approximate arrival date of the next shipment of the videotaped series and course-pack materials facilitated student planning. The examination dates were listed prominently at the end of each block along with the material that would be included on each examination (tapes, readings, and/or case assignments). Exam dates were set at the beginning of the course so that students could arrange work schedules, child care, and/or vacations. Changes in the syllabus were communicated immediately so that the students could plan their schedules accordingly. The syllabus was the definitive guide for the course.

Videotapes. On-campus, videotaped lectures comprised the bulk of the course content. A series of videotaped lectures (five to seven depending on the number of lectures in each block of material, as detailed in the syllabus) were collected and distributed approximately one month after the original recording during the regular semester schedule. In general, students (81 percent) favored videotapes because they could view them at their convenience, the visual format kept them alert and connected, and they could rewind and, thus, review certain aspects of the lecture. Fifty-three percent of the students watched portions of videotapes, or the entire videotaped lecture, more than once. Some students (20 percent) believed that audio cassettes would have been a better method of delivery.

Casebook. The casebook consisted of 35 cases on selected topics (aminoglycosides, vancomycin, cyclosporine, theophylline, anticonvulsants, antiarrhythmics, digoxin, heparin, warfarin, methotrexate, lithium, antidepressants, and special populations) and appendices (how to write a pharmacokinetic consult, bayesian orbit graph for phenytoin, body surface area nomograms, and selected equations). The purpose of the casebook was to provide relevant clinical examples that allowed the user to perform pharmacokinetic evaluations of specific therapeutic agents. All students (100 percent) agreed the casebook was a useful tool for the distance learner, and 38 percent desired more cases. The casebook allowed students to apply the knowledge obtained from the videotapes and

reading, kept the student actively involved, and was truly an important feature for students participating in this course. Rapid communication of corrections or differing views that students or faculty identified in the cases was critical. Study groups were able to discuss the nuances of the cases which enhanced individual learning. Specific cases from the casebook also were discussed during interactive videoconferences. A copy of the equation sheet included in the casebook was provided with each examination.

Course-pack. The course-pack included an outline of each lecture and/or a complete handout of the slide/overhead material. Using the outline, the students were able to focus on and fill in important information while watching the videotape. When the lecturer needed to illustrate a point, the overhead projector was used instead of the blackboard. A photocopy of these supplemental overheads also was provided as part of the course-pack. A separate sheet was included in the lecture packet listing additional references. If the lecturer provided an assignment, a separate section in that particular lecture packet was created with a clear explanation of expectations for the external students. For a specific block of material, each lecture topic was separated by a divider announcing the lecture topic, the lecture topic number (so they could match the number to the videotape number), and the lecturer. The course-pack enhanced the material presented via videotape. All but one (98 percent) of the students thought that the course-pack was a helpful supplement that should be continued.

Assignments. Two assignments were required for Applied Pharmacokinetics. For the first assignment, students were expected to turn in a completed case from the casebook before distribution of the answer key. The second assignment required each student to develop his/her own case (either experienced or created) using the format of the casebook, and provide answers to the case. Ninety-eight percent of the students agreed that creating a case was a worthwhile assignment. Due dates (postmarked dates) were established and no exceptions were permitted. These assignments were evaluated on a Pass/Fail basis. The main benefit of the assigned cases was to assure student participation and allow students to share their practice experiences.

Examinations. Applied Pharmacokinetics included three, two-hour proctored evening examinations. The examinations were distributed via Federal Express® to the Director of Pharmacy Education (University of North Carolina School of Pharmacy faculty member) at each regional AHEC center. The examination package contained the examinations in a sealed envelope to assure students that no one had seen the¹ examination before them, a return post-paid pre-addressed Federal Express® envelope, and an instruction sheet for administering, proctoring, and returning the examination. The Director of Pharmacy Education at each AHEC center selected a non-student proctor who was available during the examination period. Once the examinations were graded, they were returned to the student with an answer key and assigned points (including partial credit) so they could evaluate their performance. A statistics sheet also was included with their graded examination which provided the mean, median, range, and frequency distribution of the class scores. This allowed students to assess their performance relative to classmates.

² A copy of the syllabus and questionnaire may be obtained by contacting the corresponding author.

COURSE COMMUNICATIONS

General. An information sheet, usually one page, served as the communication link for the entire class and was provided with each shipment of materials. All students (100 percent) agreed that the information sheet was useful in keeping abreast of course-related issues. The information sheet replaced the one or two minutes an instructor takes at the beginning of class to clarify issues or remind students of what is ahead. The information sheet was divided into sections: (i) The package contents were detailed; (ii) Assignment due dates (postmark, FAX, or hand delivery date), the dates of upcoming examinations, and interactive videoconference dates were listed; (iii) Issues that arose during the course requiring clarification were addressed [e.g., new view on a casebook answer, errors or clarifications in the taped lectures, technical errors (no sound for the first few minutes of one tape), description of the material that was to be covered on the next exam, questions about the format of the assignment]; (iv) The course coordinator's address, fax number, and phone numbers were included.

The telephone was the major mode of communication between faculty and students. The majority of students (82 percent) phoned the course coordinator at least once during the course to discuss either administrative issues or course content; most students (54 percent) phoned two to four times. A toll-free number for the external professional program was established; 97 percent of the students agreed that a toll-free number was useful. Many students turned in their assignments and even posed questions via facsimile transmissions. Only a few students corresponded with the course coordinator via e-mail.

Site Visits. One site visit to each regional AHEC center was conducted prior to the first examination. Site visits throughout the state allowed the instructors to meet the students and the off-campus faculty and witness firsthand the enthusiasm and commitment of the students. Most of the students (72 percent) agreed that the site visits were an important feature of the course. Student-faculty interactions were enhanced after meeting each other in person.

Interactive Videoconferences. The interactive videoconferences were a success. In fact, 78 percent of the students thought that more interactive videoconference sessions were needed. The session began by selecting individual students at each site, by name, and talking with them directly. After the students were instructed in videoconference participation, old issues, new issues, upcoming events, clarifications, and questions regarding the course material were discussed. Cases from the casebook were reviewed and specific questions regarding these cases were addressed. Problem areas from specific lectures also were discussed to assure that everyone had a clear understanding of a particular topic. The students introduced themselves before asking their questions so that the class could appreciate the diversity in the program. Seventy percent of the students thought that it was important to interact with fellow classmates during interactive videoconferences. In general, the students (68 percent) were able to communicate between videoconference sites very well.

COURSE REFLECTIONS AND RECOMMENDATIONS

The following observations and suggestions are based on

our first experience with distance delivery of this course.

Pre-enrollment Recommendations. Most students are eager to complete any pre-enrollment work. Students should be informed of required text or other reading materials prior to course commencement. If possible, students should be provided with fundamental resources, references, and/or local seminar series so that they may prepare for an upcoming course that requires a baseline knowledge of particular concepts. The self-assessment worksheet permitted students to assess their abilities. Initial self-assessment of the learner's preparedness for new materials is an essential step.

Course Design. Diverse instructional methods (casebook, videotape, course-pack, study groups, and interactive videoconferences) accommodate many learning styles. The quality of lectures via videotape can be improved significantly for distance learners by reminding on-campus lecturers that they also are delivering the material to the distance learner. Instructors may want to participate in workshops to improve their teaching effectiveness via videotape and/or interactive videoconferences. Technical issues such as utilizing a Lavalier microphone, as opposed to a free-standing microphone, and restating questions and answers from the audience, can make a tremendous difference in the quality of the videotape. Information written on the blackboard may be difficult to read on videotape. Lecturers may want to utilize the overhead projector with an acetate page when illustrating points. Subsequently, the acetate page can be photocopied and provided as part of the specific lecture packet. When using an overhead or slide projector, large font should be used and minimal text should be presented on each overhead or slide. A camera operator may help improve the quality of videotapes. Delivery of tapes to the reproduction site, the time required to reproduce the tapes, the policy for handling damaged tapes, and the shipping time to the students are all issues that need to be considered in advance. For some courses, it may be possible to distribute all the tapes at once. Approximately one-half (54 percent) of the students agreed that all of the tapes should be distributed at the beginning of the course.

The biggest issue with off-site examinations is assuring that all students are treated fairly. The students must have the same amount of time to complete the exam at all sites. The exam site must be conducive to taking an exam. A proctor should be present to monitor for digressions from the rules. Other issues that should be considered include the availability of a proctor who can help students interpret questions, the type of testing format (take home exam, open book exam, oral exam), and assuring that students have adequate time to complete the examination (*i.e.*, design a 1.5 hour examination to be completed in two hours). Only 30, 10, and 43 percent, respectively, of the students thought that they would prefer open book, oral, and take-home examinations. Most students agreed that they would prefer more frequent examinations (63 percent) and more time for each examination (53 percent). Few students (eight percent) said that they would prefer early morning examinations. A clear exam policy should be included in the syllabus stating the consequences of missed examinations.

There is a balance between too few and too many interactive videoconferences (distance learners probably will not be able to attend a videoconference every week for a full semester due to their schedules—think about flexibil-

ity); some students (23 percent) felt that a two-hour evening interactive videoconference was too long. The videoconference may be taped for those who cannot attend. Videoconference sessions have a time limit (the transmission ends promptly); one person should watch the time and coordinate the session (especially if there is more than one speaker). Faculty should listen to the videoconferencing tips from the staff (don't wear white or stripes; it gets hot under the lights), be familiar with the set-up, arrive early for the presentation to get organized (you don't want to waste air time arranging your papers or logging onto the computer), and use a computer slide presentation or paper as a "blackboard" so that copies can be made for students who missed the videoconference. Lastly, participation in interactive videoconferences can be encouraged by calling on students, by name, at the individual sites.

Course Materials. An organized and clear syllabus was crucial in allaying frequent phone calls. Answer keys were provided for the casebook and examinations in order to help the student understand an approach to solving the problem, case, or exam question. Answer keys may have reduced the number of phone calls and questions.

Updating course materials in future years is an important issue. One advantage of taping on-campus courses is that the course material can be updated readily. Additionally, new cases can be inserted into an updated edition of the casebook to help the casebook remain current.

Course Communications. Communication with everyone involved in the course reduces the workload and benefits everyone. Good communication is an essential aspect of successful distance learning. Course materials should be provided to off-campus faculty that are involved in the course so that they have a "backup" copy and are aware of what is required of the students. Site visits throughout the state helped facilitate communication; it is always easier to

talk with someone that you have met in person. Site visits should be scheduled around an important date (*e.g.*, before an examination so the students may ask questions directly) or combined with a question and answer session on a particular topic. If possible, travel time for both students and faculty should be limited to 1-1.5 hours in order to maximize participation.

Formation of local study groups should be encouraged. Almost half of the students (48 percent) participated in study groups; 95 percent agreed studying as a group was beneficial. Study groups benefit the distance learner by enabling them to monitor their progress relative to classmates, clarifying salient points or problem areas, allowing them to share practice experiences, and serving as a personal support group. The use of a WebPage with a discussion group, or other technologies, could also enhance communications and facilitate learning.

CONCLUSIONS

In summary, development and delivery of a course for distance learners is an educational challenge. As discussed, many issues regarding the course design and course materials need to be considered. A team effort is essential for successful delivery of the course and effective distance learning. Obtaining feedback from the students throughout the course, and evaluation of the course upon completion via a questionnaire², aids in modification of the course to significantly improve the effectiveness of distance education.

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