

## INSTRUCTIONAL DESIGN AND ASSESSMENT

### Redesign of a Pediatric Pharmacotherapy Elective Course to Accommodate Budget Reductions

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**Objective.** To redesign a pediatric elective pharmacotherapy course and determine whether the redesign resulted in changes in outcome measures.

**Design.** Active learning activities were moved to an online format. Prerecorded lectures continued to be used. Peer evaluation was incorporated to give the students more feedback on their performance.

**Assessment.** Presentation grades, average examination grades, course grades, and evaluation scores from each student who completed University course evaluations were documented for students during the 2 semesters before and the 2 semesters after the course redesign. Although for undetermined reasons a drop in examination grades occurred after the course redesign, no significant differences in presentation grades, final grades, or course evaluation grades occurred.

**Conclusions.** A strategic course redesign successfully reduced the costs and faculty time required to offer an elective course viewed as essential to the curriculum, allowing the course to be continued in the face of state budget cuts.

**Keywords:** pediatric pharmacotherapy, curriculum, distance education

## INTRODUCTION

With approximately 24% of the population in the United States under the age of 18 years, there is concern regarding the need for health care providers to be well educated in pediatric medicine.<sup>1</sup> This need for pediatric education extends not only to medical education but also to pharmacy education. Because of the continual evolution of the health care system, pharmacists are now in an excellent position to provide pediatric pharmacotherapy.

Pediatric training is lacking in most colleges and schools of pharmacy in the classroom curriculum and in experiential training. In 1994, only 9% of pharmacy schools offered a pediatric elective and dedicated an average of 5 hours of the classroom lecture portion of the curriculum to pediatrics.<sup>2</sup> In 1999, approximately 18% of pharmacy schools offered a pediatric elective and the average number of required classroom lecture hours devoted to pediatrics was 16.7.<sup>3</sup> By 2009, 60% of pharmacy schools offered a pediatric course, most often as an elective, and 88.9% taught pediatric pharmacotherapy as part of one of their broader courses.<sup>4</sup> The American College of Clinical Pharmacy and the Pediatric Practice and Research

Network of the American College of Clinical Pharmacy provide recommendations for the inclusion of pediatrics in the curriculum.<sup>5,6</sup>

Only 1 pediatric lecture is included in the required curriculum at the University of Florida College of Pharmacy. Additional exposure to pediatric topics is provided in the pharmacotherapy course series through active-learning exercises such as pediatric cases on self-care topics. The third-year pharmacotherapy courses also devote a 4-hour case study to a pediatric topic. To provide additional pediatric content to interested students, the college has offered a pediatric elective for over 10 years. The pediatric elective course was traditionally offered to third-year students at all 4 campuses as a 16-week, 2-credit course in the fall semester, ending only 2 months before students began their advanced pharmacy practice experiences (APPEs). Because of the course coordinator's other teaching responsibilities, the course was moved to the spring semester in 2008 as an 8-week course offered immediately before third-year students began their APPEs in early March. In spring 2008, the college's department of pharmacy practice cut all funding for elective courses due to state budget restraints. This course, similar to most electives taught in the department, relied heavily on adjunct faculty lecturers. With the reduction in state funding, a decision was made to offer the course in the fall 2008 to the next group of students, using the same digitally recorded lectures as used in the spring 2008 semester. In addition to

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traditional lecture content, 3 discussion sessions were held during the course. Distance campuses were able to continue to pay course facilitators, allowing these discussion sessions to be retained in fall 2008. The course coordinator traveled to the main campus from her base at a distance campus to facilitate the course discussion sessions that fall due to lack of funding on that campus.

This study sought to determine whether there was a difference in student performance in presentation grades, average examination grades, and final course grades after redesign of the elective course. Also, differences in course evaluations from students enrolled in the pediatric elective course after the redesign of the course were compared to those before the redesign.

## DESIGN

In late 2008, the course coordinator initiated a course redesign in an effort to continue offering the Pediatric Pharmacotherapy elective course after the elimination of the course budget. Additionally, the course coordinator wished to increase the number of hours spent on active-learning exercises using existing course management systems and other educational technology, require students to work in groups at a distance, and incorporate peer evaluation of activities into each active-learning component of the course. Given the small number of hours dedicated to pediatric topics in the required curriculum, the college viewed continuation of the elective as important.

The first challenge to overcome was scheduling so the course offering schedule was modified to best use lecture resources and to allow each class to have an opportunity to participate in the course before starting APPEs. Lectures that had been digitally recorded in November and December 2007 had been used in the course for both the spring 2008 and fall 2008 semesters. The course was not offered in 2009, however, as part of the course redesign, lectures were updated and digitally captured in November and December 2009 to be used in the course in spring 2010 and fall 2010. This schedule allowed the lecturers, most of whom were adjunct faculty members, to update and digitally capture their lectures only once every other year thereafter. Additionally, this schedule ensured that the material was less than a year old when presented to the students.

Because of the increase in active-learning experiences in the course, lecture content was decreased from 20 lectures in 2008 to 15 lectures in 2010 (Table 1). Each lecture was 50 minutes in length. The previous lecture topics nonprescription products, renal disease, and leukemia became presentation topics instead. The lectures on attention deficit hyperactivity disorder (ADHD) and gastrointestinal disorders were removed because they were covered in

Table 1. Lectures Included in a Pediatric Pharmacotherapy Elective Course

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Introduction to the Course
Pediatrics 101/Growth and Development
Pediatric Nutrition
OTC Products <sup>a</sup>
Childhood Obesity <sup>b</sup>
Gastrointestinal Disorders <sup>a</sup>
Renal Disease <sup>a</sup>
Respiratory Infections and Otitis Media
Cystic Fibrosis
Drug Use During Pregnancy and Lactation
Serious Infections
Toxicology
Immunizations
ADHD <sup>a</sup>
Congenital Heart Disease
Oncology Part 1 (Blood Malignancies) <sup>a</sup>
Oncology Part 2 (Solid Tumors) <sup>a</sup>
Supportive Care of the Oncology Patient <sup>a</sup>
Neonatal Critical Care
Pediatric Critical Care – General
Pediatric Trauma

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Abbreviations: OTC = over the counter (nonprescription); ADHD = attention deficit hyperactivity disorder.

<sup>a</sup> Removed in course redesign.

<sup>b</sup> Added in course redesign.

other courses. Three oncology lectures were deleted as they were felt to be too advanced for this course. For a 2 credit course, 32 contact hours were needed. Lectures comprised 15 hours or approximately 46% of the course; thus, examinations counted for 46% of the final grade. Presentation activities comprised 7 hours or 22% of the course and thus counted 22% of the final grade. Each case assignment took approximately 5 hours to complete, accounting for 16% of the course and 16% of the final grade (Table 2). Course objectives were unchanged after the redesign except for the removal of the deleted lectures from objective 2 (Table 3). Objectives 1 and 2 were assessed using examinations. Objective 3 was assessed using student presentations and case discussions. All course material including lecture content was housed on the university's course management system.

In 2008, three small student group discussion sessions were held during the course. These discussion sessions involved each student completing a presentation on an assigned topic and the class discussing the assigned cases to reinforce lecture material. In 2010, the on-campus discussion sessions were replaced with online active-learning exercises. Instead of assigning individual presentation topics, each group of 4 to 5 students were required to work together on 1 presentation topic. Each group was comprised

Table 2. Structure of a Pediatric Pharmacotherapy Elective Course Before and After Redesign

Activity	2008		2010	
	Description	% of Final Grade	Description	% of Final Grade
Presentation	Individual activity presented during facilitated small group session on campus. Maximum length was 7 minutes. Grade was purely based on presentation.	10	Group activity recorded on Elluminate. Length was 10 to 15 minutes. Estimated time to complete all activities was 7 hours. Grading broken down as follows: <ul style="list-style-type: none"> <li>● Presentation 12%</li> <li>● Evaluating all other presentations 5%</li> <li>● Question posted for at least 3 presentations 1%</li> <li>● Answered posted presentation questions 3%</li> <li>● Completed group member evaluations 1%</li> </ul>	22
Cases	Individual grade received for participation during case discussion in facilitated small group session on campus	15	Two group activities conducted on course management system discussion board. Estimated time to complete all activities for each case was 5 hours. Grading was broken down for each case as follows: <ul style="list-style-type: none"> <li>● Group posted a quality question for the patient 2.5%</li> <li>● Group posted a quality question for the caregiver 2.5%</li> <li>● SOAP Note 10%</li> <li>● Completed group member evaluations 1%</li> </ul>	32
Examinations	Three examinations each consisting of material from 6-7 lecture hours.	75	Two examinations each consisting of material from 6-7 lecture hours.	46

Abbreviations: SOAP = subjective, objective, assessment, plan.

of students from multiple campus locations. Students met together in a virtual classroom on Elluminate to record their presentations and then posted a link to their presentation on the class discussion board in the course management system. All students were required to watch all of the group presentations and write a peer evaluation on each. Students also were required to ask a minimum number of content questions of the presenting teams, posting those within the same discussion board. Presenting members did not review their own group's presentation but were required to answer their classmates' questions. In addition to receiving a grade for the presentation, students also were graded on their participation in asking and answering content questions and for completing peer evaluations (Table 2).

Before the course redesign, 1 to 2 sections of up to 16 students each were offered at each of the 4 campuses. After redesign, course enrollment was capped at 80 students, regardless of their campus location. Before the

redesign, a list of 16 presentation topics was used to assign topics to students. After the redesign, the presentation topic list remained at 16 topics, but topics were slightly modified (Table 4). After the redesign, the number of presentation topics assigned each semester varied from 12 to 16 depending on course enrollment as group size remained constant. The difference in time required to view and evaluate 12 presentations versus 16 was felt to be minimal (approximately 1 hour). Textbooks were not required before or after the redesign. Course lecturers provided readings from the primary literature as appropriate. Students were required to complete evaluations for all presentations each semester.

Case discussions, which had been held during the on-campus discussion sessions, were replaced with 2 online case scenarios in 2010. In both years, cases were used to reinforce material presented in lectures. In 2010, cases were redesigned to introduce additional content that the students were responsible for researching. Only basic

Table 3. Objectives for a Pediatric Pharmacotherapy Elective Course

After participating in and completing this course in Pediatric Pharmacy Practice, the student should be able to:

1. Identify normal growth and development and understand the impact of acute and chronic illness on that development.  
Understand the impact of proper nutrition and prenatal care on development.
2. Make recommendations on the management of the following disease states. Where appropriate, compare and contrast the management, signs and symptoms, and prognosis as compared to the “same” disease state in adults.
  - Infections (otitis media, sinusitis, bronchiolitis, diarrhea, cellulitis, meningitis, osteomyelitis, pneumonia, sepsis)
  - Preventable infectious diseases (immunization practices)
  - Upper respiratory tract infections
  - The most common congenital heart defects
  - Gastrointestinal Disorders<sup>a</sup>
  - Renal Disorders<sup>a</sup>
  - Ingestion’s and overdoses
  - Cystic Fibrosis
  - Certain childhood cancers<sup>a</sup>
  - Prematurity
  - Pediatric Critical Care
  - Attention-deficit hyperactivity disorder<sup>a</sup>
3. Through participation in case discussions and presentations, the student should exhibit the ability to use references and apply knowledge to make age appropriate decisions about the pharmaceutical needs and management of pediatric patients.

<sup>a</sup> Removed in course redesign

information was included in the case and posted for students on the course management site. Students had 3 days to review the case in their assigned group. During the next 24 hours, groups posted 1 question each for the patient’s caregiver. The case facilitator then answered each question during the next 24 hours. During the following 24 hours, groups posted 1 question each for the health care professional. Depending on the case, the health care professional was a physician, nurse, or pharmacist. The case facilitator then answered each question during the next 24 hours. Each group then wrote and submitted a SOAP (subjective, objective, assessment, plan) note within 3 days. Students received grades for the SOAP notes, as well as for posting questions and completing peer evaluations (Table 2). In both the spring and fall 2010 semesters, second-year pediatric residents served as case facilitators. Their responsibilities were to write the case, answer questions posted on the case discussion board, and grade the SOAP notes.

With the decrease in lecture content from 2008 to 2010, the number of examinations administered was reduced from 3 to 2 (Table 2). The same examination questions were used in the fall and spring semesters in 2010, and graded examinations were not returned to students to maintain the security of examination questions.

## EVALUATION AND ASSESSMENT

The presentation grade, average examination grade, and course grade for every student enrolled in the course during the 2 semesters before the course redesign (2008)

and during the 2 semesters after the course redesign (2010) were entered into a database for comparison. The course evaluation scores from all students who completed an official university course evaluation during the 4 semesters also were entered in the database. The course evaluation tool consists of 13 evaluation questions. Data from spring 2008 and fall 2008 were combined and data from spring 2010 and fall 2010 were combined for 2 reasons. First, students were not required to complete a course evaluation for every course. Instead, they are randomized to evaluate selected courses. By combining 2 semesters with identical course structure, the number of evaluations was greater, thus increasing the power of the comparison. Second, by combining the spring and fall semesters before design change and after design change, any differences that may have existed purely based on whether the course was offered in the spring or fall were eliminated.

Prior to study initiation, the institutional review board granted the study exempt status. Statistical analysis was performed by the University of Florida Biostatistical Consulting Laboratory. T-tests were used to compare the mean presentation and examination scores between the 2 years, and a chi-square test was used to compare the distribution of grades between the 2 years. Course evaluation data were collected by the university course evaluation system using a 5-point Likert scale. Investigators felt the sample size was too small to support 5 categories, so the strongly disagree and disagree categories were collapsed into a single disagree category, and the strongly agree and agree

Table 4. Presentation Topics Assigned to Students in a Pediatric Pharmacotherapy Elective Course

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What special considerations should be given to the use of transdermal therapy in children?  
 What is the appropriate management of head lice?  
 Should the substitution of generic for brand name drugs be allowed in children?  
 How should depression be treated in children and adolescents?  
 What vaccines should be given to a child with leukemia?  
 What precautions should be taken to prevent pneumococcal infections in patients with sickle cell disease?  
 How should patients with febrile seizures be managed?  
 What recommendations do you have for the prevention of medication errors in the pediatric hospitalized patient?  
 What medications do healthy newborns receive at birth and why? What medical conditions are newborns screened for?  
 What special considerations need to be given for children when preparing for chemical or biological terrorism?  
 When should Synagis be given? (2008) How do you treat RSV in children? (2010)  
 How do you instruct parents or care givers to administer liquids, tablets, eye drops and suppositories to young children?  
 (Split into two presentation in 2010)  
 What are the current recommendations for reducing the incidence of childhood obesity?<sup>a</sup>  
 What are the recommendations for iron supplementation in infants?<sup>a</sup>  
 What are the rights and educational needs of children with HIV?<sup>a</sup>  
 What are the current recommendation for the management of school aged children with ADHD?<sup>a</sup>  
 What are the most common renal disorders in children and how do you calculate creatinine clearance for children?<sup>b</sup>  
 What are the common errors made in dosing OTC medications in children, and how do you avoid them?<sup>b</sup>  
 How do you recommend antipyretic/analgesic medications and cough/cold medications for children? Include appropriate counseling.<sup>b</sup>

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Abbreviations: RSV = respiratory syncytial virus; HIV = human immunodeficiency virus; ADHD = attention deficit hyperactivity disorder; OTC = over the counter;

<sup>a</sup> Removed in course redesign

<sup>b</sup> Added in course redesign

categories were collapsed into a single agree category to ensure valid testing and to facilitate interpretation of results. The decision to collapse categories was decided a priori. Chi-square tests were then used to determine whether the distribution of responses was significantly different between 2008 and 2010. Chi-square tests were also used to compare the distribution of grades and evaluation responses between the fall and spring 2008 semesters, and between the fall and spring 2010 semesters. Fisher's exact tests were used where appropriate.

The data set contained presentation grades, examination averages, and final course grades for 249 students enrolled in the pediatric elective course from 4 campuses (Gainesville, Jacksonville, Orlando, and St. Petersburg). Forty-nine students were enrolled in spring 2008 and 72 in fall 2008. Fifty students were enrolled in 2010 and 78 in fall 2010. Course evaluations were completed by 139 students: 28 students in spring 2008, 39 students in fall 2008, 27 students in spring 2010, and 45 students in fall 2010.

Presentation scores before the course redesign were not significantly different from presentation scores after the course redesign (2008 mean = 93.6%, 2010 mean = 93.5%,  $p = 0.8376$ ). Average examination scores were significantly higher in 2008 than in 2010 (2008 mean = 86.0, 2010 mean = 83.2,  $p = 0.0003$ ). Final course grades

before the course redesign were not significantly different than final course grades after the course redesign (Fisher's exact test,  $p = 0.0633$ ) (Table 5).

Ratings for 12 of the 13 course evaluation questions in 2008 and 2010 were not significantly different. Students in 2008 were more likely to agree or strongly agree that the text was useful ( $p = 0.0078$ ) (Table 6). Students in 2008 were more likely than students in 2010 to respond strongly agree than agree ( $p < 0.0001$ ). To facilitate comparison with the analyses of questions 1-13, total scores on the collapsed scale also were compared. With strongly agree and agree combined into 1 category, there was no significant difference in evaluation responses between the years ( $p = 0.1728$ ).

## DISCUSSION

Although students who completed the course in 2008 received significantly higher examination scores

Table 5. Final Course Grades for a Pediatric Pharmacotherapy Elective Course

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Year	Letter Grade			Total
	A, No. (%)	B, No. (%)	C, No. (%)	
2008	57 (47.1)	61 (50.4)	3 (2.5)	121
2010	42 (32.8)	81 (63.3)	5 (3.9)	128
Total	99	142	8	249

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Table 6. Students' Responses to Course Evaluation Questions Before and After Redesign of a Pharmacotherapy Elective Course

Question	Year	Response, No. (%)			P
		Strongly Disagree or Disagree	Neutral	Agree or Strongly Agree	
1. Course objectives clearly presented	2008	4 (7.3)	6 (10.9)	45 (81.8)	0.98
	2010	6 (7.1)	10 (11.9)	68 (81.0)	
2. Course objectives clearly met	2008	5 (9.1)	8 (14.6)	42 (76.4)	0.42 <sup>b</sup>
	2010	3 (3.6)	12 (14.3)	69 (82.1)	
3. Work/study load appropriate	2008	9 (16.4)	15 (27.3)	31 (56.4)	0.16
	2010	18 (21.4)	12 (14.3)	54 (64.3)	
4. Relevancy to pharmacy evident	2008	4 (7.3)	5 (9.1)	46 (83.6)	0.96
	2010	5 (6.0)	8 (9.6)	70 (84.3)	
5. Text was useful	2008	7 (13.2)	17 (32.1)	29 (54.7)	0.01 <sup>a</sup>
	2010	5 (6.2)	48 (59.3)	28 (34.6)	
6. Written assignments facilitated learning	2008	10 (18.2)	8 (14.6)	37 (67.3)	0.08
	2010	7 (8.3)	23 (27.4)	54 (64.3)	
7. Previous courses important for course	2008	4 (7.3)	11 (20.0)	40 (72.7)	0.89
	2010	5 (6.0)	15 (17.9)	64 (76.2)	
8. If team taught, lectures coordinated	2008	7 (12.7)	11 (20.0)	37 (67.3)	0.37
	2010	5 (6.0)	16 (19.3)	62 (74.7)	
9. Exams relevant to lectures or readings	2008	3 (5.5)	7 (12.7)	45 (81.8)	0.88 <sup>b</sup>
	2010	3 (3.6)	12 (14.3)	69 (82.1)	
10. Exams clearly worded	2008	5 (9.1)	8 (14.6)	42 (76.4)	0.97
	2010	8 (9.5)	11 (13.1)	65 (77.4)	
11. Constructive feedback after exams	2008	8 (14.6)	13 (23.6)	34 (61.8)	0.89
	2010	13 (15.5)	17 (20.2)	54 (64.3)	
12. Grades assigned fairly	2008	5 (9.1)	10 (18.2)	40 (72.7)	0.88
	2010	6 (7.1)	14 (16.7)	64 (76.2)	
13. Overall rating as an excellent course	2008	8 (14.6)	7 (12.7)	40 (72.7)	0.68
	2010	10 (11.9)	15 (17.9)	59 (70.2)	

<sup>a</sup> Significant p value.

<sup>b</sup> Fisher's exact test.

than students who completed the course in 2010, there was not a significant difference in final course grades or students' evaluations of the course. The decrease in examination score averages without a significant decrease in final course grade is explained by the fact that the examination scores comprised 75% of the final grade in 2008, but only 46% of the final grade in 2010. The decrease in lecture time alone should not have resulted in a decrease in examination scores, as an identical number of examination questions were used for each lecture topic before and after the redesign. Regarding evaluations in general, students in 2008 were more opinionated (less likely to respond neutral) and more likely to respond with strongly agree than agree. However, on individual evaluation questions, the percentages of students from each year who disagreed, agreed, or had no opinion were not significantly different with one exception: The textbook question elicited much stronger opinions in 2008 than in 2010, with most students in 2008 responding either strongly disagree or strongly agree as to whether the textbook was useful.

Most students in 2010 had no opinion on the text. This difference may have been due to confusion about how to answer the question, as there was no required textbook for the course in either year.

This course redesign was initiated because of a lack of funding for elective courses in the department. Before the redesign, the course coordinator gave 1 lecture in the course and adjunct faculty members gave all of the other lectures and were compensated. After the redesign, 3 faculty members each gave 1 lecture in the course. All other lectures were given by adjunct faculty members but they were not compensated for their time. Before the redesign, facilitators were paid for 6 hours of class time per section as well as necessary time for grading and class preparation. However, stipends for on-campus small group sessions were eliminated with the move of presentations and cases to an online format.

The heavy use of technology for the course, including use of Elluminate, was problem free for most students. The few students who initially experienced difficulty using the

resources had their issues quickly resolved when they used the detailed resource instructions provided on the course site by the instructional media department. Many students noted in the comment section of their evaluations that they did not like being assigned to groups with members from other campuses. Some of those students commented that it was difficult to find a time to work together as a group in a virtual environment. These comments are very similar to comments that the students make regarding group assignment and group work in the college's required pharmacotherapy course series. Students completed the individual peer evaluations and commented that they appreciated the opportunity to provide feedback.

One possible limitation of this study was that all students enrolled in the course were not required to complete a course evaluation per college policy. Although no curriculum revisions took place from 2008 to 2010, there may have been minor changes within required courses. These changes may have affected the students' view of their elective coursework during that semester. Course redesign resulted in significant changes being made to the point allocations in the course. These changes introduced limitations in comparing the data from before and after the redesign.

The course continued to meet the course objectives after the redesign as evidenced by examinations, presentation grades, and case assessments. The course will be offered again in 2012 using the redesigned format. The course coordinator will work closely with students to determine any changes that could be made that would assist students with working together in a virtual environment. Because of the complications of scheduling online meetings, students will be strongly encouraged to schedule time in advance for group work.

## **SUMMARY**

A course redesign that allowed lectures to be digitally recorded only once every 2 years and moved active-learning activities from the classroom into an online environment

allowed an elective pediatric course to continue to be offered at the college following significant budget cuts. No significant differences were found in presentation grades or student course evaluations after the redesign. The average examination grade did drop significantly after the course redesign. The course redesign increased the number of hours that students spent on active-learning exercises, required students to work in groups at a distance, and incorporated peer evaluation of activities into each component of the course. The concepts in this redesign can be useful for others interested in continuing existing or developing new elective courses when faced with significant budget cuts.

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