INSTRUCTIONAL DESIGN AND ASSESSMENT

Promoting Learning in a Health Care Systems Course by Multiple Teaching Methods Including Internet-Based Quizzes

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Objectives. The objective of this study was to evaluate the effectiveness of *WebCT* internet-based quizzes and other teaching methods on learning in a health systems course for first-professional year pharmacy students.

Design. The course used formal lectures with class note handouts, guest speakers, videotape presentations from the American Medical Association, unannounced quizzes, a patient visit, and practice quizzes using *WebCT*. Content analysis was used to assess student comments to questions about the course.

Assessment. The number of *WebCT* quizzes completed positively correlated with examination scores. Students' comments indicated the guest speakers and the *WebCT* quizzes were the most positive aspects of the course.

Conclusion. Interactive-learning techniques, such as *WebCT* quizzes, can improve student performance in a health care systems course.

Keywords: health care systems, Internet, *WebCT*, active learning

INTRODUCTION

Teaching administrative or basic science courses to first-professional year doctor of pharmacy students can be a challenging task. At this early stage of their education, students typically have difficulty grasping the relevance of courses in administration, including pharmacy management and United States health care systems. At the University of Georgia (UGA), a 3-credit hour administration course focusing on the United States health care system, *Health Care Systems Social and Behavioral Sciences in Pharmacy*, offered during the spring semester of the first-professional year, is the only formal exposure these students receive on the subjects of managed care, Medicare, Medicaid, and pharmacy benefit managers. At UGA, the United States health care system administrative course is introduced early into the curriculum, which may also contribute to the difficulty students have in understanding their relevance.

Approaches reported to facilitate student learning include intermeshing different teaching modes/strategies, changing the pace of lectures (eg, pauses spaced at logical intervals during lectures), and active learning, all of which are intended to stimulate student thinking and reflection on the subject matter.[1,2] Active learning can be

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approached in numerous ways and, classically, is thought to involve student discussions in small groups.[3] With the current shortage of practicing pharmacists, many schools and colleges of pharmacy are increasing class enrollments, thus creating the challenge of being able to conduct class discussions in a meaningful manner as a method of reinforcing the volume of information presented to students. To stimulate interactive learning, pharmacy educators are using alternative approaches, including the Internet.

Matthews merged more traditional passive-learning strategies with active-learning strategies to help students understand the relevance of a biochemistry course.[1] An interactive software program, *Persuasion*, was used to create animated slides showing biochemical pathways, class handouts, and quizzes. This paper is one of a few in the pharmacy education literature that documents the successful use of the Internet as an interactive-learning tool in teaching nonclinical courses. Others have focused on using multimedia in case-based learning.[4-10] Although the Internet is readily available to educators, its effectiveness as an educational tool has not been well documented. Access to the Internet does not necessarily lead to learning in the depth and breadth required of professional students.[11] The objective of this paper was to evaluate the effectiveness of *WebCT* Internet quizzes and other teaching methods on learning in a first-professional year healthcare systems course.

Figure 1. *WebCT* quiz 1: *WebCT* screen view after automatically grading quiz.

DESIGN

Health Care Systems Social and Behavioral Sciences in Pharmacy (PHRM 3750) is a required course for first-professional year pharmacy students. The course is designed to provide a description and analysis of the organization and financing of medical care services in the United States with an emphasis on the role of medications and pharmacy services. The major objective of the course is to provide a framework of understanding of the medical care system in order to prepare pharmacists for an active role in planning and implementing the provision of medications and pharmaceutical care.

Course Structure

The course structure included the following components: (1) formal lectures (75 minutes each) with class lecture notes included in the course packet in the order they were presented to enable students to spend less time writing in class and more time listening; (2) 3 guest speakers with "real world" experience in the domains of Medicaid, the Georgia Drugs and Narcotics Agency, and community pharmacy, respectively; (3) a videotape presentation on health literacy by the American Medical Association (AMA); (4) four, unannounced quizzes given to encourage classroom attendance, especially for guest speaker presentations; (5) a patient visit assignment requiring students to visit a designated patient; and (6) online *WebCT* quizzes – practice examination questions (described in detail in the following section).

Course Evaluation Methods

Course grades were earned from student performance on 4 examinations, noncumulative in content. Each examination had equal weight and together totaled 80% of the final grade (ie, 20% each); the 4 in-class, unannounced quizzes constituted a total of 10% of the final grade (ie, 2.5% each); and 1 patient-visit assignment contributed the balance of the grade (ie, 10%). The patient-visit assignment, which was a component of the College's early experiential program for first-professional year students, involved the student obtaining a medication history from an assigned patient and discussing the patient's health insurance issues.

WebCT Quizzes

In preparation for examinations, students were invited to complete online practice quizzes using *WebCT* software. These online quizzes were designed to reflect the same caliber of difficulty of questions as those on the examination. Students were advised that if they could complete the online quizzes without difficulty, they should also be able to complete the respective examination with the same level of competence. For example, a *WebCT* quiz on the Food and Drug Administration (FDA) is presented in Figure 1, and a quiz question for this same topic is presented in Appendix 1. Figure 1 and Appendix 1 demonstrate that the questions were not identical, but completion of the online quizzes was expected to be helpful in preparing students for the actual examinations.

Table 1. Summary of Completed *WebCT* Quizzes (n = 121)

Quiz	Number of Students Completing Quiz (%)
1	93 (76.7)
2	102 (84.3)
3	98 (81.0)
4	97 (80.2)
5	52 (43.0)
6	100 (82.6)
7	98 (81.0)
8	98 (81.0)
9	102 (84.3)
10	99 (81.8)
11	93 (76.9)

WebCT quizzes were in multiple-choice or matching formats, with an average of 5 questions per class topic. Once students completed the quiz, they were able to submit their responses electronically for immediate scoring. Along with their total score, the student received a copy of the quiz with the questions they answered correctly in green and questions answered incorrectly in red accompanied by the correct response (Figure 1). *WebCT* questions were not part of the formal grade structure; therefore, students could repeat the online quizzes as often as they desired. However, *WebCT* questions were not available to the students online for an indefinite period. *WebCT* questions were posted for no more than 2 weeks after the respective class topic was presented. This strategy was used to encourage students to keep up-to-date with class materials. Furthermore, students had the option of not completing any of the online *WebCT* quizzes without penalty.

WebCT quizzes 1 through 4 were made available prior to the administration of the first examination; *WebCT* quizzes 5 through 8 were made available prior to administration of the second examination; *WebCT* quiz 9 was made available prior to administration of the third examination; and *WebCT* quizzes 10 and 11 were made available prior to administration of the fourth examination. Only enrolled students had access to course materials on the Web site.

Evaluation of *WebCT* Quizzes

To evaluate the effectiveness of completing *WebCT* quizzes, the number of completed online questions was correlated with the overall student grade, accounting for gender. The number of *WebCT* quizzes completed was expected to correlate positively with the overall student examination score. Next, individual student examination scores were correlated with the number of completed *WebCT* quizzes assigned to that section. The number of

WebCT quizzes completed for each examination was expected to correlate positively with each respective examination. Lastly, students were asked as part of the course evaluation to respond to the following items, "What do you perceive to be the positive aspects of this class?" and "What changes do you think would make this class a better experience?" Qualitative student statements were analyzed using content analysis.[12] Based on convention, all statistical tests conducted assumed a level of 0.05 significance (2-tailed). *SPSS 11.5* for Windows statistical package was used for all statistical analyses.

RESULTS
WebCT Quiz Completion

During spring 2003, 121 students were enrolled in the United States health care systems course. Ninety-eight students were women (ie, 81%). Of these 98, at least 75% attempted 10 of 11 online quizzes, 82% completed 7 of 11 quizzes, and 33 students (ie, 27.3%) attempted all *WebCT* questions. Only 5 students completed 2 quizzes, while 3 students did not attempt any quizzes. On average, each student completed 8.5 online quizzes (SD = 2.82). Table 1 shows that quizzes 2, 6, and 9 were completed the most number of times, and quiz 5 (Medicare) was completed the least. Less than half the class attempted quiz 5.

Based on examination grouping of *WebCT* questions, over 80% of students completed all or missed only one quiz assigned to examinations 1, 2, and 4, and 80% of students completed quiz 9 assigned to examination 3. The Pearson r correlation between the number of completed *WebCT* quizzes and a student's overall examination score for all 4 examinations demonstrated a positive trend and was statistically significant, r = 0.288 (p = 0.001). Students completing online quizzes were more likely to have higher overall examination scores. The number of completed *WebCT* quizzes for examinations 1 and 3 was also in the predicted direction and significant: r = 0.235 (p = 0.01) and r = 0.238 (p = 0.009), respectively. Students completing the online quizzes for examinations 1 and 3 were more likely to have higher scores on those examinations.

Student Perceptions about the *WebCT* Quiz

In response to the following item, "What do you perceive to be the positive aspects of this class?" the 126 recorded qualitative student statements (n = 119) were coded into 1 of the following 8 topics: (1) class examinations, (2) patient visit assignment, (3) in-class quizzes, (4) *WebCT* quizzes, (5) class notes, (6) guest speakers, (7) course coordinator lectures, and (8) general class com-

ments. The first 3 topics were included because they formed the basis of student grading, and the second 5 were added based on course structure and student comments.

No comments regarding the patient visit assignment or in-class unannounced quizzes were made and only one student mentioned the examinations. Guest speakers and *WebCT* quizzes made up 39 and 18 of the comments, respectively. Typical student comments regarding *WebCT* quizzes included "*WebCT* quizzes –excellent for test preparation" and "*WebCT* quizzes are very helpful." Typical student comments referring to outside speakers included: "I truly enjoy the speakers and appreciate their expert opinion," and "The speakers were really interesting and emphasized some of the main points of the course."

The remaining 68 statements (ie, 54%) referred to general class comments (ie, 56 statements), with the balance related to instructor teaching (4 statements) and class lecture notes (8 statements). The 56 general class comments focused on 4 broad areas: relevance of material; opportunity to discuss issues not addressed in other classes; alternative career paths; and class structure. The majority of these statements focused on the relevance or usefulness of the course to pharmacy practice. For example, the terms, "informative," "useful," "interesting," "relevant," "applicable," "real world," and "practical" were mentioned 37 times. Additionally, "This information seemed very applicable to the pharmacy profession," was a comment that was consistently offered. Students stated that the course provided an opportunity to discuss administrative issues (eg, insurance, Medicare, and Medicaid) not included in other courses. Students also noted they had an opportunity to learn more about alternative career paths in pharmacy. The last group of comments applied to course structure.

The 87 qualitative student statements (n = 119) recorded in response to the following item, "What changes do you think would make this class a better experience?" were coded into 9 categories, which included the 8 topics listed above, and a ninth category, ie, "no changes," Seventeen of the 87 comments included in this category either stated "no changes" or otherwise indicated that the students liked or enjoyed the class "as is." The remaining 70 comments made no mention of in-class quizzes, patient-visit assignment, or coordinating lecturer. Eight comments each were received on class notes, guest speakers, and examinations. Overall, students desired more guest speakers and easier examinations. Comments appropriate to presentation delivery, ie, lecture notes, made the recommendation to have all class handouts included in the course packet in chronological

order of their appearance in the course. Fourteen students requested more *WebCT* quizzes. One student suggested the provision of extra credit for *WebCT* quiz completion, and another requested more material on health literacy, which was the subject of a class presentation based on a video by the American Medical Association (AMA). The balance of student comments made reference to time: length of lectures, length of course, and the time of day the course was offered. The course was offered twice a week (Tuesdays and Thursdays) in the mid-afternoon, while students' comments demonstrated a preference for a morning schedule.

DISCUSSION

In an attempt to make a course on healthcare systems a more enjoyable learning experience, an interactive learning strategy was intermeshed with the traditional, passive lecture format. These study results confirm or bring to mind the old adage, "practice makes perfect." That is, the correlation between *WebCT* quiz completion and examination scores was positive and significant, but not in all cases tested (ie, between *WebCT* quiz completion and examinations 2 and 4). Upon initial reflection, the high correlations could be attributed to a small population of conscientious students driving up the examination grades. Thus, a secondary analysis was conducted, excluding students who completed all *WebCT* quizzes (n = 88). The results showed similar correlations to those of the group as a whole, ie, the Pearson r correlation between the number of completed *WebCT* quizzes and students' overall score for all 4 examinations, r = 0.312 (p = 0.003). Similarly, the number of completed *WebCT* quizzes for examinations 1 and 3 was also in the predicted direction and significant: r = 0.232 (p = 0.03) and r = 0.266 (p = 0.012), respectively. The secondary analysis demonstrated that those less conscientious students benefited from the online quizzes no less than the meticulous students.

The lack of correlation between quiz 5 on Medicare and examination 2 can be attributed to the low completion rate for this quiz (Table 1). Curiously, in the past, students often complained about not understanding why they needed to learn so much detail regarding government health care programs, Medicare, and Medicaid. This was because of the notion that legislation would probably change by the time they earned their doctor of pharmacy degree. However, in this class, students completed Medicaid but not Medicare quizzes, even though the Medicare prescription drug benefit was receiving much attention in the media at the time. A possible explanation for the discrepancy between the rate of completion for the

WebCT quizzes on Medicare and Medicaid is the inclusion of a guest speaker for the latter but not the former. Also, the Medicare material was the last topic addressed prior to the second examination, but not included on this examination. Therefore, students may not have felt any sense of urgency to complete the online quiz materials on Medicare. However, had this been the case, one would have expected to observe the same lack of response to the other online quiz topics. Furthermore, lack of response to quiz 5 cannot be attributed to other examinations because there were no other examinations scheduled at the time of the Medicare *WebCT* quiz. Lastly, as for the lack of correlation between students completing the *WebCT* quizzes in preparation for examination 4 (*WebCT* quizzes 10 and 11) and their scores on examination 4, this course examination was the last examination of the semester and scheduled late on a Friday afternoon. Possible explanations for the lack of correlation between the 2 parameters tested could simply be student fatigue or that their attention was devoted to other course work. This is supported by verbal comments that students made to the author after the final examination.

The original intention of this study was to show the value of using an interactive Internet tool, *WebCT*, in learning and teaching. The introduction of the multimedia tool, *WebCT*, one of many interactive Internet teaching tools available, was well received by students in an administrative course, similar to the positive experiences with problem-based learning courses reported by others.[4-10] However, in terms of word frequency lists, almost twice as many comments were made regarding guest speakers as were made about the *WebCT* quizzes. This finding was made possible by the incorporation of a content analysis of comments made by students where no solicitation of topic(s) was made. Furthermore, in terms of suggestions for course improvement, students desired more *WebCT* quizzes, but also requested more speakers. Students believed that *WebCT* quizzes helped them improve their grades. Student requests for speakers were not grade focused, but application orientated, ie, speakers helped them understand how the topics related to the "real world" and what vocational opportunities were available for pharmacists. Given that it was not grade orientated, this finding was unexpected. Based on these study results, course changes will include continuation of *WebCT* quizzes, as well as in-class quizzes and examinations that are noncumulative in content.

The addition of technology to a course program is relatively easy, assuming Internet and software availability. However, technology does not, nor cannot, take the place of human interaction as cautioned by the Electronic-Based Instructional Resources Special Interest Group (EBIR SIG) of the American Association of Colleges of Pharmacy at its 2000 Annual Meeting.[11] In addition to the use of multimedia tools, students desire human interaction. The results of the content analysis revealed that students perceived the class to be relevant and useful, an important finding for a nonclinical course in a professional program.

Limitations

The length of time for which each online quiz was available was limited to encourage students to keep up with class materials. Furthermore, students were specifically requested not to print any of the quizzes; however, this could not be controlled. While the software prevented students from readily printing the quizzes, because of a flaw in the software, more industrious students were able to get around this, ie, by copying the page into another document. Therefore, the primary limitation of this study was the potential for students to print out the quiz for later conferral, and even sharing, with fellow classmates. In retrospect, this possibility was considered small given the number of student requests to extend the availability of online quizzes because they had not completed the *WebCT* questions by the due date. Furthermore, if a large number of students had printed out the quizzes and shared them with other students, the investigator would have expected to see lower student completion rates for online quizzes. Lastly, this possible limitation was not supported by the high correlations between quiz completion and examinations scores.

CONCLUSIONS

Intermeshing the traditional lecture format with interactive-learning techniques was well received by first-year doctor of pharmacy students in an administrative course. Based on these study results, the *WebCT* quizzes will be continued, as will the noncumulative examinations, in-class quizzes, and guest speakers. The materials in the course packet, and the videotape on health literacy will be expanded, and a class project will be added on managed care and insurance . Based on the findings of Matthews,[1] as well as student comments noted in this study, the goal of effective teaching is to find just the right balance of interactive and passive learning approaches.

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Appendix 1. An examination question pertaining to the Food and Drug Administration

_____ had provisions that prohibited false and misleading claims for drug products but was difficult to enforce
(a) FFDC Act
(b) Durham-Humphrey Amendment
(c) Sherley Amendment
(d) Harris-Kefauver Amendment
(e) Pure Food and Drug Act