Using the Internet to Facilitate Student Learning in a Large Therapeutics Course: A Three-Year Perspective

Michael A. Crouch
School of Pharmacy, Virginia Commonwealth University, MCV Campus, Box 980581, Richmond VA 23298-0581

This article describes and evaluates a freestanding web site used to facilitate student learning in a large therapeutics course at Virginia Commonwealth University School of Pharmacy. The web site was developed in the fall of 1998 after this instructional strategy was piloted in select therapeutics lectures. The site is categorized into various content areas including a welcome page, course syllabus, announcements, grades, topics, and help/comments section. Most of the content areas are provided to the students in a print format; however, the web site specifically offers two optional, asynchronous learning opportunities consisting of online quizzes and related Internet links. Additionally, students have access to the lecture audio and slides after classroom discussion. During the spring semesters of 1999 and 2000, students accessed the course web site 1,612 and 2,346 times, respectively. Student evaluations support that they feel the web site facilitates both pre- and post-class learning. In addition, grades were higher in students using the site moderately (one to five times per week) as compared to those not using the site at all ($P=0.04$). Moreover, these data suggest that students using the site excessively, defined as greater than 10 times per week, had grades similar to those not using the site. Data from 1998 and 2000 imply that the students’ study time outside of the classroom, which includes Internet usage, was not increased or beyond limits established by the School of Pharmacy (1998; $P>0.2$). In summary, using the Internet to facilitate student learning was well received and this instructional strategy may improve student learning, as measured by examination scores.

INTRODUCTION

Use of the Internet has drastically increased the past few years with this technology being an integral part of daily life for many individuals. Students entering schools of pharmacy need to be increasingly Internet savvy. As such, this medium has become a new method to deliver learning materials and it may be used to facilitate learning beyond the classroom setting. Many schools of pharmacy have developed web sites that support classroom teaching. Various nontraditional Doctor of Pharmacy programs use the Internet for at least part of the curriculum. Although well developed in other countries, this approach has only recently progressed in the United States(1).

There are various advantages of using the Internet to provide educational materials. The primary benefit is high-speed access to vast amounts of information. Traditional resources such as textbooks only have a fraction of the information that is currently available through the World Wide Web. Information for healthcare practitioners can be obtained through online journals, government agencies (e.g., National Institutes of Health), search engines, drug-related databases, and health-related Internet sites like Medscape and WebMD(1,2). The Internet also provides information in a timely fashion. For example, the New England Journal of Medicine posts landmark articles on its web site as full-text before available in print version. Other web sites, such as MedScape and WebMD provide new information daily. Another advantage of the Internet is that the information can be provided asynchronously (e.g., audio/video clips or email) or synchronously (e.g., video conferencing and chat rooms). Irrespective of the material provided, the content must be carefully scrutinized and the abundance of information mitigated so as not to overwhelm students. Certainly, time spent surfing the Internet does not equate to time spent learning the information.

Although pharmacy-oriented, web-based instruction is still in its infancy, some data are available regarding this approach. One study recently compared student performance and satisfaction during a two-hour pharmacotherapeutics session(1). Students participating in this study were enrolled in a post-Bachelor of Science Doctor of Pharmacy curriculum. In a nonrandomized fashion, students received instruction on the same topic by usual classroom teaching (n=9) or web-based instruction (n=12). This investigation found that examination grades did not differ between the two groups ($P=0.25$) and that students who participated in the web-based instruction felt they received adequate guidance. The authors concluded that interactive web-based instruction might be a feasible alternative for therapeutics coursework in a Doctor of Pharmacy curriculum.

Weighing the advantages and disadvantages of web-based instruction, an Internet site was developed for an entire therapeutics course (Disease State Management - four credit hours) at Virginia Commonwealth University School of Pharmacy. The purpose of this article is to describe how a freestanding course web site has been used to facilitate student learning in a large therapeutics course (85 to 95 students per semester) and to evaluate this instructional strategy based on student usage, evaluations, and grades.

Am. J. Pharm. Educ., 65, 7-13(2001); received 08/16/00, accepted 01/02/01.
WEB SITE DESIGN
Platform
Like most universities, Virginia Commonwealth recently provided resources for faculty members to develop school-related web sites. Many individuals in the School of Pharmacy have designed sites that describe their activities while others have developed course-related sites. At the time this site was developed, the University had adopted Web Course in a Box (WCB) as its standard delivery platform. The rationale for adopting a single platform is that it might be beneficial for students trying to navigate through various courses, since they have a similar format. Some faculty members have successfully used this approach to provide portions of their class(3). For this project, however, a freestanding web site was developed using Microsoft’s FrontPage®. Briefly, there were various reasons to use this approach. FrontPage® offers several functions that were not available through WCB, such as the frames format. In this layout, the opening page is divided, where a table of contents is listed on the left side of the screen and remains as one navigates through the site. This facilitates movement through the site, especially as students click through various pages to retrieve information. Additionally, WCB did not provide an easy method to develop online quizzes. Quizzes were a major component of the proposed site and this function was essential when deciding on a platform. Finally, the students did not find WCB particularly user friendly, which was a major concern since this was the first time a web site would be used as part of the therapeutics sequence.

Web Site Goals
The major goal of this web site was to facilitate student learning in a time efficient manner. The specific objectives were to develop a student-centered environment that: (i) facilitated student preparation before attending class; (ii) allowed students to review lecture material after class; and (iii) provided optional, asynchronous learning opportunities beyond the classroom.

Web Site Content
When students access the class web site, they must first enter their user name and password, after which they encounter the welcome page (Figure 1). This web site uses the frames format where two windows open at the same time. The window on the left provides the site table of contents, which includes the welcome page, course syllabus, announcements, grades, topics, and help/comments section. When a student clicks on one of the aforementioned topic areas, the larger window on the right changes and provides the requested information.

The welcome page explains the rationale for the web site and mentions limitations of obtaining health-related information from the Internet. Additionally, this page recommends software programs students must have on their computer to effectively use the site. An example of a recommended program is the Internet browser. Internet Explorer (Microsoft) was recommended since the web site was developed and is updated using FrontPage (Microsoft) and incompatibilities may occur with other browsers (e.g., Netscape). The program Acrobat® is also recommended, since many of the documents on the web site are saved as a Portable Document Format (PDF). Other programs that are used include RealPlayer® for lecture audio and Quicktime™ for certain types of movies. On the web site, links are provided so students can download the suggested software to their home computers. Before launching the site, all of the above software was installed and registered on the school’s computers.

The Internet course syllabus is the same one that students receive as a handout on the first day of class. The rationale to provide an additional electronic copy is that students may not always have a copy of their syllabus handy. Thus, if a student wishes to study, he/she can access the web site to determine an upcoming topic and the expected pre-class preparation.

Although announcements still occur within the classroom, a copy of announcements is provided on the course web site. This section ensures all students are aware of problems or changes that have recently occurred in the course schedule. For instance, the time, date, or location of an exam or class may change. If a student is not present in class, he/she can go to the course web site to retrieve this information. In January of 2000, severe winter weather in Richmond prompted the School of Pharmacy to close on relatively short notice. An announcement was placed on the web site regarding class cancellation as well as plans to make up missed lecture time.

Course grades are also posted to the site. Obviously, students are very interested in their grades and like to have them returned promptly. Usually, the web site provides student grades quicker than merely posting the grades on the class bulletin board. This past year, grades for one exam were not available until late Friday afternoon. Most students had already left school, since no afternoon classes were scheduled. By posting the grades on the web site, students could see their scores before returning to school on Monday. Importantly, all grades are posted using codes that ensure student anonymity. This approach is similar to how many schools post grades on a class bulletin board, where all the grades are posted but students can only identify their grade by an assigned code.

The largest section of the course web site is the Topics page (Figure 2); it is also the area most often visited by students. This page provides information regarding subjects discussed in class. The class is team-taught and divided into modules of disease-related information. Each topic within a module has specified pre- and post-class sections. In the pre-class section, students are provided with information related to the topic including the goals and objectives, required and suggested readings, and a case that should be completed before attending class. For cases, various types of assignments are used.
including directed questions and written SOAP (Subjective, Objective, Assessment, and Plan) notes. All the pre-class materials are provided on the Internet site as well as in a printed version (module packet) that is distributed a week before each module begins. On the Internet, this information is saved as a PDF file that students can read or print.

The course web site specifically offers two optional asynchronous learning opportunities that are not provided to the students in print format: online quizzes and related Internet links. Quizzes are based on the required reading(s) and there are three to ten questions per lecture topic. These quizzes consist of questions that students should be able to answer before attending class with adequate preparation. Students take each quiz by answering several multiple-choice questions and once completed, they are provided the correct answers. The answers are anonymously saved on the web site and if obvious deficiencies in student understanding are identified, the lecturer can address these points during class. Occasionally, unique deficiencies in the students understanding have been found.

The related Internet links connect to various areas including suggested readings, sites that discuss the disease state, or guideline statements. Occasionally, audio or video related to a topic is available on another site. For suggested readings, a link is connected to the National Library of Medicine and students can read the abstract, if desired. Sometimes, full-text articles are also available. The potential for links in this area are endless, but links are carefully scrutinized to ensure quality. Furthermore, faculty members are limited to less than five links per topic to avoid overwhelming the students.

In addition to the pre-class materials, the Topics page provides post-class information. The lecture handout, slides (if different from handout), and audio are available to students after classroom discussion. Importantly, students can only view, listen, print or download documents that are part of the post-class materials. Students cannot save documents in a format that allows them to edit or change the provided materials. If there is a conference for a particular topic, related conference materials are also provided. The purpose of conference sessions is to clarify concepts presented in class and to apply the material to additional patient cases; new material is not presented.

**ASSESSMENT OF THE WEB SITE**

The following sections describe how this web site has been evaluated over a three-year period. Where applicable, objective data are provided including pre-class preparation time and examination scores. All evaluations were anonymous.

**Single Lecture Comparison**

As one may surmise, to develop a detailed web site as described above was time consuming. As such, the site was developed incrementally to evaluate the students’ impressions and to determine if the site should be expanded to an entire therapeutics course. Initially, the web site was used to support a single lecture (endocarditis). Then, the students’ evaluations as well as their examination scores for the Internet-supported lecture were compared to another lecture (meningitis) that was not supported by the Internet. These two topics were chosen for comparison because they have similar pathophysiology, comparable treatment principles, and each was one hour in length. Additionally, they required the same type of homework assignment (directed questions) and they were presented on the same day, to the same group of students, in the same class, by the same faculty member, and at the same time of day (10:00 AM to 12:00 noon)(4).

A week before the endocarditis classroom discussion, the web site was described to the students and they were given the opportunity to use the site, if desired. Following the discussion for endocarditis and meningitis, anonymous surveys were distributed to determine the students’ perception of this instructional strategy.

The surveys were distributed to 92 students, of which 79 (86 percent) responded. Of those who responded, 32 of 79 (41 percent) accessed the web site, primarily using the school’s computers (75 percent). Students tended to use the Internet site if they were familiar with this medium and regularly used the Internet for non-class related activities (P<0.005: chi square). When asked if portions of the web site helped the students’ understanding of the topic before attending class, 28 of 32 (88 percent) students responded “yes.”

Since this was a comparison between the two lectures, students were also asked how well they felt they understood endocarditis (Internet supported) before attending class as compared to meningitis (not Internet supported). Nineteen of 32 (59 percent) students felt they understood endocarditis better than meningitis, nine (28 percent) commented they understood the topics about the same, and four (13 percent) said they felt like they understood meningitis better. Moreover, 30 of 32 (94 percent) students felt that posting lecture materials (handouts, slides, and audio) facilitated after class studying. After using this instructional strategy, a majority of students (97 percent) recommended that faculty members continue to explore the use of Internet supported teaching.

In addition to asking students their opinion regarding this web site for a single lecture, two major objective variables were evaluated: time spent preparing for classroom discussion and examination scores (Table I). There was a concern that the novelty of this new site may result in students spending excessive time preparing for the endocarditis lecture. Yet, studying time was not appreciably different between the Internet-supported and non-supported topics (P>0.2, t-test). For the examination, students were given the same number of multiple-choice questions for each topic addressing the same content areas. When examination scores were compared, there was no difference in the mean scores for the Internet supported and...
Table I. Differences between an Internet supported and nonsupported lecture (Spring 1998)

<table>
<thead>
<tr>
<th>Time to Prepare for Classroom Discussion (n=79)</th>
<th>Spring 1999</th>
<th>Spring 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endocarditis lecture (Internet supported)</td>
<td>2.4±1.1hrs*</td>
<td>2.4±1.0hrs*</td>
</tr>
<tr>
<td>Students using the site (n=32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student not using the site (n=47)</td>
<td>2.4±1.3 hrs**</td>
<td>2.2±1.2hrs*</td>
</tr>
<tr>
<td>Meningitis lecture (Not supported)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mean Examination Scores for Selected Topics (n=79)

<table>
<thead>
<tr>
<th></th>
<th>Spring 1999</th>
<th>Spring 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endocarditis lecture (Internet supported)</td>
<td>75±19% †</td>
<td></td>
</tr>
<tr>
<td>Students using the site (n=32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student not using the site (n=47)</td>
<td>72±20% ‡</td>
<td></td>
</tr>
<tr>
<td>Meningitis lecture (Not supported)</td>
<td>75±16% ‡†</td>
<td></td>
</tr>
</tbody>
</table>

Data presented as mean ± SD.

* No difference between mean preparation time (P>0.2; t-test).
** No difference between mean preparation time (P>0.2; t-test).
† No difference in mean examination scores (P>0.2; t-test).
‡ Mean difference in examination scores was 8% (95% CI 1%, 17%; P=0.0191, t-test).

Table II. Student usage of the entire course web site

<table>
<thead>
<tr>
<th></th>
<th>Spring 1999 (n=85)</th>
<th>Spring 2000 (n=95)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total hits per semester†</td>
<td>1612</td>
<td>2346</td>
</tr>
<tr>
<td>Hits per student</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Hits per day</td>
<td>14</td>
<td>20</td>
</tr>
</tbody>
</table>

†Hits describe the number of times the web site accessed.

Table III. Student evaluations of the entire course web site

<table>
<thead>
<tr>
<th></th>
<th>Spring 1999(n=61)</th>
<th>Spring 2000 (n=75)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary place of access</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>55%</td>
<td>70%</td>
</tr>
<tr>
<td>School</td>
<td>45%</td>
<td>30%</td>
</tr>
<tr>
<td>Area of the Internet site that was most useful</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course syllabus</td>
<td>38%</td>
<td>9%</td>
</tr>
<tr>
<td>Announcements</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Grades</td>
<td>28%</td>
<td>1%</td>
</tr>
<tr>
<td>Topics</td>
<td>29%</td>
<td>86%</td>
</tr>
<tr>
<td>Area of the above topics section that was most helpful</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handout with assignment</td>
<td>8%</td>
<td>4%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>11%</td>
<td>44%</td>
</tr>
<tr>
<td>Related Internet links</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Lecture materials</td>
<td>79%</td>
<td>49%</td>
</tr>
<tr>
<td>Percentage of students that felt the Internet site facilitated pre-class preparation</td>
<td>52%</td>
<td>80%</td>
</tr>
<tr>
<td>25% strongly agree</td>
<td>45% strongly agree</td>
<td></td>
</tr>
<tr>
<td>27% agree</td>
<td>35% agree</td>
<td></td>
</tr>
<tr>
<td>Percentage of students that felt the Internet site facilitated after class studying</td>
<td>88%</td>
<td>89%</td>
</tr>
<tr>
<td>43% strongly agree</td>
<td>73% strongly agree</td>
<td></td>
</tr>
<tr>
<td>45% agree</td>
<td>16% agree</td>
<td></td>
</tr>
<tr>
<td>Percentage of students that felt an Internet site should be developed for all therapeutics classes</td>
<td>83%</td>
<td>95%</td>
</tr>
<tr>
<td>41% strongly agree</td>
<td>81% strongly agree</td>
<td></td>
</tr>
<tr>
<td>42% agree</td>
<td>14% agree</td>
<td></td>
</tr>
</tbody>
</table>
was accessed (hits) has been monitored (Table II). Usage has increased during this two-year period. The number of hits is relatively good, given this was an unfamiliar teaching approach, and it had not been used in any of the other therapeutics courses. The browser used to access the site was evenly distributed with 52 percent of students using Internet Explorer (Microsoft) and 48 percent using Netscape (Netscape Communications). This was an interesting finding, since Internet Explorer was strongly recommended. The web site was most commonly accessed between the hours of 8:00 PM to 1:00 AM (25 percent) and 6:00 AM to 11:00 AM (26 percent). The morning hours correlate to the time immediately before lecture (11:00 AM). Student usage during the days of the week was highest on Monday through Friday. The least amount of activity occurred on the weekends.

Student Evaluations

Of those students accessing the web site, home usage was most common, especially in the Spring of 2000 (Table III). The higher rate in 2000 was likely due to the way lecture materials were delivered through the site. In 1999, if students wanted to listen to a lecture from home, they had to download the entire file before hearing it. The download typically lasted from 20 to 30 minutes, which clearly was too long for most students. In 2000, all lecture audio was loaded in a method that allows for “streaming audio.” In this approach, the audio starts while downloading continues and it only takes a few seconds between requesting the audio and the time that it starts.

Of the four main areas of the web site, the topics section was most popular with a higher rate of use in the spring of 2000 (Table III). The topics section can be subdivided into four areas consisting of the pre-class handout with assignments, online quizzes, related Internet links, and lecture materials. According to the students, the two most beneficial sub-sections were the online quizzes and the post-class lecture materials. Students’ positive ratings of the online quizzes increased in the spring of 2000, which is likely due to the quizzes becoming more sophisticated. Additionally, the number of quizzes doubled from the previous year. During the spring of 2000, the use of the online quizzes was anonymously monitored. From the start to the end of the semester, students took the online quizzes 1,735 times, which correlated to 77 percent of the class taking every available quiz. As mentioned previously, the quizzes had questions that students should be able to answer before attending class with adequate preparation. However, online quizzes were most often taken after class. In fact, of all quizzes taken, only 22 percent were completed before attending the classroom discussion.

The lecture material section was also well received by the students. Of note, before the start of this web site in 1999, students had developed a note taking system where they wrote detailed transcripts for each lecture. Responsibility for these transcripts was equally divided between the class. Having the lecture audio and slides available on the Internet has replaced this system.

One of the major goals of this teaching strategy was to improve student preparation before they attended class. As the web site has developed over the last three years, the percentage of students that felt the web site facilitated pre-class preparation has also increased (Table III), with more “strongly” agreeing in Spring of 2000. In addition to pre-class preparation, students felt the web site facilitated post-class studying. This aspect is not surprising since all the lecture materials are available to the students within hours of lecture completion.

Since this web site is only provided for one of four therapeutics classes, one question posed to students was whether a similar site should be developed for the remaining three classes. Students are clearly in support of this proposal with 95 percent agreeing or strongly agreeing that additional sites should be developed. Finally, students were asked how these web sites should be used to facilitate learning in the future. Various options were provided ranging from the class being taught without Internet support to students taking the entire course on the Internet alone. A majority of students (69 percent) believed that the class should be taught with the Internet as a supplement but not required.

Student Grades

This represents the second year the entire course web site has been provided. The effect on students’ grades, if any, was evaluated. Rather than simply evaluating grades of those using and not using the site, students were subdivided by their extent of use. With the coordinator blinded to the results, students’ use of the site was compared to final examination grades (cumulative) as well as final course grades. The five student-reported levels of usage were defined as zero times per week, one to two times per week, three to five times per week, six to ten times per week, and greater than ten times weekly (Table IV). Grades tended to be higher in those students using the Internet site one to five times per week as compared to those not using the site weekly or those using site greater than ten times per week ($P<0.05$, ANOVA with Tukey’s post-hoc analysis).

This was not a randomized evaluation and students chose how often to use the web site; thus, these results should be interpreted with caution. The size of the comparison groups was not equal and not all students responded to the anonymous survey. Additionally, when one compares the students’ perceived usage of the web site compared to the actual number of hits, they tended to overestimate their use slightly. However, these results are intriguing and should be explored further.

### Table IV. Student grades according to Internet usage (Spring 2000)

<table>
<thead>
<tr>
<th>Internet usage</th>
<th>0 times/week (n=7)</th>
<th>1-2 times/week (n=23)</th>
<th>3-5 times/week (n=21)</th>
<th>6-10 times/week (n=19)</th>
<th>&gt; 10 times/week (n=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean final exam grade</td>
<td>73.9%</td>
<td>82.2%</td>
<td>83.4%</td>
<td>78.5%</td>
<td>74.5%</td>
</tr>
<tr>
<td>(cumulative)$^a$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean final course grade$^b$</td>
<td>74.3%</td>
<td>82.3%</td>
<td>81.7%</td>
<td>78.2%</td>
<td>76.4%</td>
</tr>
</tbody>
</table>

$^a$ Students’ grades were higher in those using the Internet site one to five times per week as compared to those not using the site and those using the site greater than ten times per week ($P=0.04$, ANOVA with Tukey’s post-hoc analysis).

$^b$ Students’ grades were higher in those using the Internet site one to five times per week as compared to those not using the site and those using the site greater than ten times per week ($P=0.019$, ANOVA with Tukey’s post-hoc analysis).
addition to suggesting that moderate use of the web site improves students’ grades as compared to those not using the web site, it also suggests that students relying too heavily on the site may see an adverse effect.

Concerns with this Instructional Strategy

Since students can obtain most of the class information from the course web site (e.g., handouts, slides, and lecture audio), one of the biggest concerns with this approach was that it might adversely affect class attendance. In the Spring of 2000, grades in the class were determined from examination scores and conference attendance. Students were not required to attend classroom discussion. Although the author has not observed a decrease in class attendance since the web site was started, student class representatives have suggested that homework be randomly collected and graded to ensure attendance in the Spring of 2001.

Given that study time has been shifted to encourage students to spend more time studying before class, another fear was that overall study time (before and after class) might be increased beyond School of Pharmacy guidelines. Although this was not the case when the Internet was used to support a single lecture (Table I), it was unknown how it would affect students when the Internet supported the entire class. Fortunately, this has not been the case, as studying time outside the classroom has remained relatively constant at an average of 8.4 and 8.8 hours per week the last two years.

Another concern with the web site relates to copyright issues, which needs to be addressed from both the faculty and students’ perspective. Since faculty members’ handouts and slides are published on the Internet, faculty must be sensitive to copyright laws. With the vast number of slides, pictures, and figures that one can get from the Internet, it is easy for faculty to integrate these materials into their lectures. This was a concern when handouts were the only materials provided to students, but posting information on an Internet site, even though it is password protected, raises the copyright concerns to a higher level. For this class, the course coordinator (author) has requested that all materials posted on the Internet site be in accordance with copyright laws. From another perspective, students also have to be sensitive to copyright issues. Faculty members spend an inordinate amount of time preparing lecture materials. It has been made clear to students that information posted by faculty members is the property of that person and students should not use the information for other purposes unless permission has been granted. In fact, the School of Pharmacy Technology Advisory Committee has drafted guidelines that will be added to course syllabi regarding published web site materials.

A final concern with the Internet site is that the provided links inhibit students from developing the skills necessary to find and interpret quality Internet sites on their own. Indeed, students need the skills necessary to assess the quality of a web site as well as the validity of provided material. Although this is a legitimate concern, making students find Internet sites without guidance may be unreasonable since it might increase student study time beyond practical limits. The goal of a therapeutics class is to increase students’ understanding of common disease states and their treatments as well as help them develop problem-solving skills. As such, the purpose of this class is not to teach students appropriate drug information skills. These skills are essential but they must be adequately addressed in other areas of the curriculum.

POTENTIAL CHANGES AND FUTURE USES OF THIS INSTRUCTIONAL STRATEGY

Web Site Platform

In this current semester, the web site appearance has changed substantially. Virginia Commonwealth University has adopted Blackboard® as the standard platform for providing online instruction. Blackboard® provides all of the desired functions that were previously offered by the freestanding FrontPage® site; however, development of the web site is quite a bit easier, especially for individuals that have never developed a site. In the future, each faculty member may be required to post their information on the web site instead of the course coordinator, which is facilitated by Blackboard®. Additionally, Blackboard® provides unique functions not offered through FrontPage. It has a more sophisticated method for posting grades. Rather than simply posting all the students’ grades with an anonymous codes, this platform allows students only to see their individual grades. Moreover, the password protection for the site is more advanced. Students’ passwords are individually assigned and cannot be used after the semester is over.

Expanding Online Quizzes

The online quizzes are designed to test students’ knowledge before they attend class based on required readings and the case assignment. By monitoring use of this section, it is clear students use this area quite often. However, it was interesting to find that a majority of students took quizzes after class. At the beginning of the next semester, students will be instructed that quizzes are to be taken before class in an attempt to focus studying. In the next phase of development, quizzes will also become more sophisticated. Questions will remain as multiple-choice; however, in addition to providing the correct answer, students will also get the rationale of why it is correct and why certain answers are wrong. For the faculty members that write the quizzes, results may be automatically tabulated and these scores, including the percentage of students that chose each of the provided answers, will be emailed to each lecturer before class discussion.

Self-Study Modules

While the literature-base for therapeutics continues to grow, the time allocated for each topic often remains the same. As such, approaches need to be developed that provide information in a detailed and time-efficient manner but also allows students time to develop problem-solving skills. The use of self-study modules on a course web site is one way to achieve this goal. Within these self-study modules, students can work through interactive cases that address subjective and objective data while developing an assessment and plan. Visual examples of physical findings or cases that prompt the recognition of drug-related problems could be presented. This approach expands students’ basic disease and pharmacotherapeutic knowledge before attending class and allows more class time to discuss topics in more detail as well as develop critical thinking skills. These interactive cases will be piloted using single lectures before implementation.

Methods to Provide Lecture Material

The lecture materials provided on the web site include the faculty members’ handouts, slides, and audio. Since handouts are provided to the students the day of class, slides and audio are most often used. As technology develops, the way the lecture material is provided on the Internet will become more
advanced. In fact, the lecture audio and slides can now be syn-
chronized rather than the student listening to the audio and
changing the slides manually. This approach has been imple-
mented during the current semester. Furthermore, the entire
lecture can now be captured, including the video. This
approach has not been implemented, but may be considered in
the future.

Web Sites for Additional Therapeutics Courses
Based on the students’ overwhelming support for this
instructional strategy, the remaining therapeutics classes have
developed web sites using the Blackboard® platform. In fact,
course web sites are now provided for all the required classes
in the curriculum.

SUMMARY
This article has described and evaluated a freestanding web site
used to facilitate student learning in a large therapeutics course
at Virginia Commonwealth University. The major goal of this
web site, to facilitate student learning in a time efficient man-
ner, appears to have been achieved. Students clearly support
this approach based on the number of times the site has been
accessed each semester, which has increased annually. Course
evaluations support the idea that students feel the web site
facilitates both pre- and post-class learning. When objective
variables are considered, they imply this approach may
improve student learning, as measured by examination grades.
This class continues to use the Internet to supplement student
learning, and the remaining therapeutics classes have adopted
this teaching methodology.

Acknowledgements. The author would like to thank Mary
Ann Kirkpatrick, Lilian Hill, Adrian Goram and Cindy
Kirkwood for their review of this manuscript and their thought-
ful suggestions. Moreover, Veronica Shuford should be
thanked for her assistance in maintaining the web site since
joining the faculty in 1999.

References
instruction within a PharmD therapeutics course,” J. Pharm. Teach., 7,
(2) Trinkle, R., “Pharmacy continuing education available on the internet,”
(3) Goram, A., “The World Wide Web: An effective adjunct in clinical phar-
(4) Crouch, M.A., “The role of the Internet for didactic and experiential