Successful communication with consumers to enable understanding and advise the safe use of nonprescription drugs will need to include the Internet as an information source. Utilizing the Web as a learning tool is a skill that can be acquired in a self-directed problem-based learning setting. This article describes a class project that involved student teams developing an Internet website for consumers which provides a bridge applying content and skills learned in the classroom directly to the patient. Students were successful in using creative and analytical skills to provide and clarify large amounts of information to assist patients in making informed choices and to provide students and pharmacists with a foundation of knowledge from which they can counsel patients concerning the use of nonprescription drugs with confidence and accuracy.

INTRODUCTION

Universal accessibility to Internet resources explaining mild or self-limiting medical conditions and drugs for self-medication has created a dilemma for the consumer in ascertaining the credibility of these references. The mission statement for pharmaceutical education at the University of Toronto directs course structure with activities involving clinical judgement, decision making and problem solving, enabling students to learn knowledge, skills and values necessary to meet drug-related needs of patients in society(1). The two second and third year nonprescription drug courses, titled Pharmaceutical Care, embrace this patient-centred model of practice. In keeping with this philosophy and aspiring to a leadership initiative in providing the public with accurate information concerning drug therapy, an effort to develop a valid and reliable consumer website for nonprescription drugs prepared by students was undertaken. This project would also serve students as an interactive educational tool that enables asynchronous problem-based learning.

COURSE INFORMATION

Two previous manuscripts described two nonprescription medication courses for large classes of 140 students at the Faculty of Pharmacy, University of Toronto. These courses prepare students to practice pharmaceutical care using problem-based, student-directed learning. The first paper examined fostering an interactive, motivating environment during the first three years of evolution and outlines course design, teaching methodology, reinforcing and enabling strategies, case preparation, assessment tools, evaluations and examinations(2). A second paper reviewed the oral clinical skills examination, which uses standardized patients(3). An integral part of the innovative course format (AACP Innovations in Teaching Award, 1998) was the development of course-specific websites as an infrastructure for facilitated asynchronous learning (http://djs.phm.utoronto.ca).

COMPUTER ASSISTED LEARNING IN HEALTH CARE

As communication and knowledge is transformed by technology, computer assisted instruction has begun its own revolution(4). Two models of computing in education worth reviewing are the Telelearning Network of Centers of Excellence (http://www.telelearn.ca) and the Center for Innovative Learning Technologies (http://cilt.org/html). Accessing the home pages of these sites will permit links to a variety of interactive computer learning tools and projects: the Telelearning Network has a variety of postsecondary options available, and the CILT has a number of assessment and visualization projects ongoing. A variety of leading researchers, including Ron Baecker, (whose team is working on CineKit) Maria Klawe, (working on E-GEMS) and Rick Goldman-Segal (working on Web Constellations) believe that students have an affinity for multimedia as a means of self-directed learning. Within health care education and in particular, education of pharmacy students, the literature is increasingly inundated with examples of computer-assisted learning as an important enabling strategy as compared to traditional methods(2,5-12). The development of theories of learning using computers in education has embraced four paradigms: behaviourist (e.g., programmed instruction), information processing theory (e.g., interactive one-on-one tutorials), cognitive constructivist (e.g., discovery-based learning) and socially oriented theories of learning (e.g., collaborative learning). For four years, computer technology has been developed and refined in these two nonprescription drug courses to assist self-directed learning, using either interactive tutorial, discovery-based or collaborative learning models. The consumer website project, is also a composite of discovery-based and collaborative learning which is achieved through online instruction.

Am. J. Pharm. Educ., 64, 339-348(2000); received 6/26/00, accepted 9/27/00.
BACKGROUND INFORMATION: COURSE WEBSITES EVOLUTION

Year One: Fall 1997. Two course-specific websites were launched to provide opportunities for asynchronous learning through computer-assisted interactive tools, and to provide ongoing daily Internet communication from their instructor about course developments(2). This was an innovation to the course design to enable understanding and communication, give students the benefit of new technology, and encourage them to develop skills in this area. The websites were modified with student feedback over the following four years. There is a home page for each course, limiting access to students through the use of individual passwords. (Figure 1) In the first two years, there were three sections to facilitate communication (What’s New?, Exam Review, Marks) and three sections to facilitate independent learning (Supplemental Readings, Clinical Clips, Interactive Cases.) At the bottom of each page, there is a link where students can send an e-mail message to the instructor with comments, questions or suggestions.

The What’s New? hyperlink keeps students abreast of announcements, scheduling changes, tutorials, workshops, test results, and legislative changes in nonprescription drug status. Exam Review lists material required for upcoming examination, sample questions and answers, the approximate number and weighting of questions and copies of old examinations. Marks post the results of midterm examinations, term assignments and cumulative course marks.

Supplemental Readings originally featured extra references useful to students, charts or tables presented in class, follow up questions to guests, as well as interactive computer slide presentations on various topics presented in class by the instructor. This section quickly expanded in response to student demand. The class was appreciative of both the visual aid of computer-assisted class presentations and the ability to access and print them through the website. Students voluntarily changed their class visual presentations to this format, and these were posted on the website in both universally accessible html and PowerPoint versions, after students reported the latter faster and easier to load and print. They next requested that their written case assignments be posted to decrease photocopy charges and to circumvent the difficulty of copies disappearing from the library. These were posted in Word or Word Perfect format. To update at the end of each year, second year student work files were both transferred to the third year website so that advancing students could access cumulative coursework for their oral summative exam, and left on the second year website as archived references.

Year Two: Fall 1998. The course outlines were added to this section. In June of 1999, at the students’ request, the entire syllabus for the coming year was posted as well. This gave them access to all their cases, recommended readings, team members and assignments, and lecture schedules, over the summer, so that they could work ahead in preparing material if they wished. To organize this growing website page, drop down boxes were added in the third year, sorting information into administrative documents, instructor lectures, student presentations and archived presentations. For the fall of 2000, two new drop-down boxes provided students with links to online reference databases, including Medline and Medscape. Clinical Clips contains clinical pictures from the instructor’s personal slide collection, which supplement the case studies. Interactive Cases is a ‘work in progress’ in which additional cases for application of process and content not covered in class presentations or covered by didactic lectures are being developed and programmed. Currently, there are four cases on the third year site, and one case on the second year site.

Year Three: Fall 1999. The homepages were reprogrammed to include some dynamic elements: a linking index to posted material as a side bar, the current date and refined counters. Two additional sections were added that were both a means of communication and an opportunity for asynchronous learning. Conferencing is an on-line threaded discussion forum in which topics are posted by either students or instructor. The decision to use an asynchronous tool was based upon some key advantageous features: students and instructor have sufficient time to read and reply to topics, accessibility is widened to all regardless of time commitments, material posted is more thoughtful and reflective and can be researched and referenced, topics can be revisited and the discussion acquires both breadth and depth. The tool was generated with Microsoft FrontPage. Students can post a new article or search the articles for a word or pattern. In addition, each article has links to reply or navigate the article list. The instructor posted three separate threads for each case, (presenters, assessors and general discussion) so that presenting and assessing teams could use the venue for preparation of work without physically meeting and other students could benefit from discussion. Students were eager to also post clarifying questions and answers before and after class, tests and examinations, and the discussions grew rapidly. The instructor reviewed the discussions daily and responded within a few hours. Student evaluations were strongly supportive of this tool. Quiz of the Day is a tool for self-study or review purposes in which the instructor posts a short one or two question quiz, usually weekly. The subject matter is preparatory or summative: a pre-class brain teaser, a key issue not covered in class due to time restraints, an issue requiring emphasis, a followup application. Students used the tool to self-assess their knowledge base. Students were asked to post their responses under Conferencing. To control the number of responses, students were not allowed to duplicate information but could clarify, question or provide alternatives to the first correct response posted. After a few weeks, the instructor
Table I. Web page topics

<table>
<thead>
<tr>
<th>Second year</th>
<th>Third year</th>
</tr>
</thead>
<tbody>
<tr>
<td>contact dermatitis</td>
<td>lice</td>
</tr>
<tr>
<td>atopic dermatitis</td>
<td>scabies</td>
</tr>
<tr>
<td>seborrhea</td>
<td>eye irritation</td>
</tr>
<tr>
<td>burns</td>
<td>swimmer’s ear</td>
</tr>
<tr>
<td>insect bites and stings</td>
<td>acne</td>
</tr>
<tr>
<td>smoking cessation</td>
<td>hyperacidity</td>
</tr>
<tr>
<td>athlete’s foot</td>
<td>vaginitis</td>
</tr>
<tr>
<td>warts</td>
<td>psoriasis</td>
</tr>
<tr>
<td>colic</td>
<td>cough and cold</td>
</tr>
<tr>
<td>diaper dermatitis</td>
<td>tension headache</td>
</tr>
<tr>
<td>vitamins</td>
<td>constipation</td>
</tr>
<tr>
<td>motion sickness</td>
<td>hemorrhoids</td>
</tr>
<tr>
<td>St. John’s Wort</td>
<td>contraception</td>
</tr>
<tr>
<td>poisoning</td>
<td>pinworms</td>
</tr>
<tr>
<td>photosensitivity</td>
<td>traveler’s diarrhea</td>
</tr>
</tbody>
</table>

would post the correct response on the Quiz page. A side bar contains links to questions and responses. Students were offered the opportunity to have class participation marks assigned for contributing to these sections. The third year class voted for the marks, the second year class chose not to have participation marks. The participation marks made no difference to the use of these tools. The third year participation was extremely high, but the second year participation exceeded this.

Students continue to be overwhelmingly enthusiastic about the introduction of this technology to their learning, and the ability to speedily access and print important material as necessary. The website expansion included the following project in the fall of 1999.

DEVELOPMENT: PLANNING SEQUENCE:

Roberts’ planning sequence was followed to develop the following steps of the project: description, learning goals and objectives, and project strategy. This planning sequence was used successfully by Anderson-Harper and colleagues in their website project(9, 13).

1. Project Description

A Consumer Website for nonprescription drugs would be developed consisting of a homepage, linking a bank of 30 topics. The course instructor randomly assigned each team of seven or eight students the self-medication topics for which they would develop information for the consumer, 15 per class. (Table I) These topics were the same as the class case presentations for which they were assessing a peer group and completing a full case workup. Topics involving more complex therapeutics or care plans were assigned to the third year class, while less complicated subjects were assigned to the second year class.

2. Learning goals and objectives

The learning goals for this new learning tool were:

- To assist students in the acquisition of knowledge and skills in developing competence with all the course objectives (Table II).

Table II. Course objectives with the teaching or learning and the methods of assessment

<table>
<thead>
<tr>
<th>Course objectives</th>
<th>Teaching/learning activity</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Be able to identify, prevent and solve drug-related problems related to self-care and non-prescription drugs.</td>
<td>Team work-up of assigned case and presentation to the class Written case work-up of case to be assessed</td>
<td>Team and self-assessment (form) Peer team assessment (form) Written and oral examinations Oral interactive class case discussions</td>
</tr>
<tr>
<td>2. Be able to utilize and adapt the Pharmaceutical Care process as a systematic approach to self-care counseling</td>
<td>As in #1 plus Interactive class development of pharmacy care plans</td>
<td>As in #1</td>
</tr>
<tr>
<td>3. Use problem-based learning techniques as applied to simulated case studies</td>
<td>As in #1 plus Role-playing of assigned cases Cumulative review interactive session</td>
<td>As in #1</td>
</tr>
<tr>
<td>4. Be able to apply special techniques and appropriate communication skills with patients who may have special needs</td>
<td>As in #3 plus Consumer web page</td>
<td>As in #1 plus Assessment by guest lecturer</td>
</tr>
<tr>
<td>5. Be aware of moral, ethical and legal responsibilities and social issues associated with self-medication</td>
<td>As in #4 plus Interactive oral class cases Guest lectures</td>
<td>As in #1</td>
</tr>
<tr>
<td>6. Be knowledgeable of basic pharmacology and therapeutics</td>
<td>As in #5</td>
<td>As in #1</td>
</tr>
<tr>
<td>7. Be aware of self-medication hazards</td>
<td>As in #5</td>
<td>As in #1</td>
</tr>
<tr>
<td>8. Be aware of and able to assess issues in self-medication related to advertising, consumer perceptions, packaging, in-store promotions, coupons, availability of products, the roles of the pharmacist, organizations, and the manufacturer</td>
<td>As in #5</td>
<td>As in #1</td>
</tr>
</tbody>
</table>
• To serve central needs of the problem-based, self-directed learning principles of the Pharmacy curriculum.

• To enable, enhance and reinforce learning for large classes by providing asynchronous educational opportunities

The tool also has several unique and innovative benefits:

• By contributing to the project, students experience discovery-based learning (compatible with the cognitive constructivist theory of learning). They need to acquire skills in self-directed research, application of knowledge to a problem, and critical thinking by analysing, synthesising and evaluating both content, audio-visual material and available Internet sites. The self-assessment and survey portions provided an opportunity for evaluating their own outcomes and satisfaction. The team approach provided a forum for collaborative learning (compatible with socially oriented theories of learning)

• By accessing the published topics, students have the opportunity to enhance their knowledge by working through 29 additional topics, a supplemental resource with text and images that can be reviewed asynchronously to enable and reinforce independent learning

• Students are introduced to on-line instructions and a database format.

• Uniquely, it provides a direct link to practice by providing an opportunity for students to apply knowledge and skills directly to the consumer:
  • Utilizing written communication skills at the appropriate language level for public education
  • In question and answer style that must engage and interest the consumer as would verbal dialogue
  • It conforms with the both the University’s and Faculty’s Strategic Plan in providing information to the public about drugs

3. **Strategy for project**

The course instructor examined a number of options for storage of the information and access for the consumer:

• **Option 1**: Each team could generate an individual web page using a software editor or coding in html. The drawbacks to students with this option included lack of technical expertise, increased time commitment and introduction of computer skills in a non-computer course. Lack of standardization between topic pages would mean a decrease in the ease of navigation and use for the consumer.

• **Option 2**: Teams could e-mail word-processor files to the course instructor who could then generate standardized html web pages for each topic. This involved a significant and unreasonable time commitment for the instructor and was less congruent with principles of self-directed learning.

• **Option 3**: Teams could send their information to a database. Once all topics were completed, static html pages could be created using software such as Access. Limitations of this approach were the time lag of eight months for data collection and the lack of student ability to edit the material.

• **Option 4**: Teams could send and manipulate information on-line to a database, with web pages generated on demand. Such dynamic web pages constantly change in response to current information stored in the database. The advantages of this method were the students’ ability to edit material, the ability to publish topics as they were completed, and the standardization of the finished web pages to assist consumer navigation and use. In this scheme, the students would have limited creativity in designing their topic page, and be compelled to manage some html codes as opposed to using an editor such as Netscape Composer or Front Page Editor

In view of these considerations, the fourth option was selected and implemented by the course instructor.

**PROJECT DESIGN**

In preparation for implementation, the course instructor undertook the following steps:

• An Access database was created to store the data for the consumer website. This database was accessed on-line
using FrontPage extensions, which were installed on 
Microsoft Internet Information Service Four. Active 
Server Page (asp) files were written as templates to 
dynamically generate html pages.

• An on-line instruction page for students was developed 
(Figure 2). The page included project description, instruc-
tions, due dates, marking scheme, and samples of materi-
'al. To protect copyright privileges, instructions for inclu-
sion of pictures or video clips included the directions for 
the html codes to link the pages directly to the original 
source, or alternatively, to obtain and submit copyright 
permission for material not on-line. Students were direct-
ed to use language easily understood by the consumer, 
directed at a Grade Six comprehension level. This was 
assessed by the instructor by testing comprehension of the 
material by Grade Six volunteer subjects. All quoted or 
extracted information was to be cited in the text and a list 
of references provided. At the end of the citations, the stu-
dents provided a reference to their team as the author of 
the page. They also were required to list links to similar 
web pages on this topic for the consumer to access. Links 
were to patient education sites that students assessed as 
valid and professional, current and accurate.

A submission page for the database was developed where 
the students would enter their material (Figure 3) All the 
entered text would be entered in html code so that students 
could insert images, clips or format text, if they wished. 
This page included a few html coding instructions and 20 
boxes for data entry that were linked to the database. 
These began with boxes for a title and a subtitle. The pur-
pose of the subtitle was to capture the attention of the read-
er so that they would look at the rest of the page.

• The home page for the consumer site “Carenet” was 
designed and programmed. A drop down box gives access to 
 thirty topics. The site was identified as the product of 
the Faculty of Pharmacy, University of Toronto, and sup-
plied with a counter. The site was entered under common 
search engines. To direct the consumer to respond, an e-
mail address was provided in a hypertext link. The active 
site can be reviewed by this reader at: 
http://djs.phm.utoronto.carenet/ (Figure 4).

• The web page format for each topic was designed to stan-
dardize the appearance of the information for each topic 
(Figure 5). This also allowed editing changes in format, as 
well as viewing, to be done with ease. The design attempt-
ed to attract attention and keep the consumer reading. It 
employed a plain white background for easy viewing, 
organizing the information for quick scanning with blue 
headings, which divided the information into small sec-
tions, with a side bar containing links to the topics in the 
text. An operational decision was made to accumulate the 
fifteen topics of data contributed by the third year students 
before posting any information to the Internet. This was 
accomplished by creating another asp file, which would 
read a specific record from the database, and generate a 
web page. A disclaimer at the end of each topic page was 
included to inform the consumer that pharmacy students 
produced the information.

• In the database, a field, either true or false, determined 
whether a case was published. The course instructor main-
tained the resource, reviewed the unpublished data, rec-
ommended changes, checked all revisions and published 
them for active use.

The tasks of the students were as follows:

• For their assigned topic, develop a series of commonly 
asked consumer questions and answers and source the 
photos, video clips and multimedia enhancements 
• Type their data into the database 
• Provide references for all material, and links to other sites 
on the topic 
• Edit the material with suggested changes from the course 
insructor after it was reviewed

CHALLENGES IN IMPLEMENTATION

As the first 15 topics were entered, the course instructor 
reviewed data on the submission pages on-line. It was not pos-
sible to print out the data unless copied into a separate word 
processing file. As a temporary solution, Access was used to 
make a form to view and print information. Once these cases 
were published, the instructor was able to view and print
remotely from a browser in the finished format.

Student feedback identified the following issues: they were unable to edit the submission boxes and had to retype all the information and resubmit when changes were necessary. They were unable to view their submission in the format it would be published. Some students wished to be more creative and asked for a number of other html codes.

MODIFICATIONS

The following changes addressed the aforementioned issues.

- In order to add an edit function, a Front Page database component was used to access the data and input it into the existing form. Sql code was used to edit the record. An edit option was added to the submission page.
- To control access to editing, each team generated confidential passwords.
- Another page was created that allowed the instructor access without a password.
- One further editing issue subsequently arose with some students. If a submission box was left blank, students were unable to save edited changes. Due to technical problems in programming, the sql code could not be circumvented. Therefore, students were cautioned to place at least one single space (spacebar) in each field or box.
- On the submission page, an option was created so that students could directly view their published or unpublished versions of their topic from that page.

Fig. 6. Project status page.

- A web page status page was created which listed all published and unpublished topics, the true or false fields, and the date submitted. (Figure 6) The status option was added to the submission page.
- These changes allowed the instructor to easily administer the site from a remote location, and the students to enter
data from a remote location. Its dynamic nature updated
the web page as soon as the changes were made.

• More html coding instructions were entered on the sub-
mission page. This allowed students increased creativity to
vary font size or colour.

ASSESSMENT
To assess the effectiveness of this assignment as a learning
tool, performance and perception measures were used. Student
performance was both self-assessed and instructor-assessed
using the same instrument. (Figure 7) Marks were assigned on a
scale of one to ten, using the following verbal descriptors as
guides: inadequate [0-3], marginally adequate [4], adequate
[5], competent [6-7], superior [8] and exceptional [10].
Assessment criteria included:
• Quality of the information: how well the material was
understood and applied as a web page for consumer.

Table IV. Student evaluation survey of consumer web site (CARENET) project for 1999- 2000

<table>
<thead>
<tr>
<th>Agree</th>
<th>Strongly</th>
</tr>
</thead>
</table>
I have made use of the web site this year apart from the project or to conference about the project. | 3.52 | 70% |
I will make use of the web site next year | 3.84 | 77% |

Understanding and communicating with the consumer
Creating a consumer web site is important in preparing for the role of educating the public. | 3.43 | 69% |
The consumer web site project helped me to learn one specific non-prescription drug topic in detail. | 3.4 | 68% |
The consumer web site project helped me to understand issues important to the consumer. | 3.4 | 68% |
The consumer web site project helped me to classify questions of importance to patients. | 3.6 | 72% |
The consumer web site project helped me to formulate questions and responses in language easy for the consumer to understand | 3.4 | 68% |
The consumer web site project helped me to understand principles in engaging or capturing the consumer’s attention | 3.4 | 68% |

Project design
The consumer web site project instructions were well written and easy to follow. | 3.4 | 68% |
The consumer web site project was at a level of difficulty I could comprehend. | 4.6 | 92% |
The navigational tools (e.g., indexes and navigational buttons) allowed easy access to specific areas | 4 | 80% |
This consumer web site project should be continued to be used/updated in subsequent years. | 3.8 | 76% |

Understanding content
The consumer web site project was useful in learning/reviewing the pathophysiology, etiology, and differential diagnosis of a particular self-limiting or minor condition. | 3.8 | 76% |
The consumer web site project was useful in learning/reviewing the interrelationships between a self-limiting or minor condition, non-drug alternatives, specific drug therapy, mechanism of action, pharmacological specifics including side effects, contraindications, interactions, convenience, cost considerations | 3.8 | 76% |
The consumer web site project was useful in learning/reviewing the situations in which patients should seek advice of a physician or other health care professional, and when they can safely self-medicate | 3.8 | 76% |
The consumer web site project was useful in understanding parameters for monitoring outcomes for a self-medicating patient with this condition | 4 | 80% |
The consumer web site project was useful in reviewing the published literature about this condition | 3 | 60% |
The consumer web site project was useful in reviewing other internet sources about this condition | 4 | 80% |
The consumer web site project serves as a useful supplement to the information provided in lecture. | 3.8 | 76% |
This consumer web site project is a useful learning tool. | 3.8 | 76% |
This project encouraged students to take responsibility for their own learning | 3.8 | 76% |
This project was helpful in building students’ confidence in their ability to learn | 3.8 | 78% |
This project helped to learn to manage large complex tasks | 4 | 80% |
This project encouraged the exercise of creativity | 3.6 | 72% |
This project enabled acquiring skills useful in my profession | 3.8 | 76% |
Number of hours that consumer website project required (6-10) | 4.2 | 84% |

Completed consumer Web site
I would recommend that other students view the completed consumer web site (Carenet) as a learning tool | 3.8 | 76% |
Utilizing (Carenet) will enable students to work through course materials at their own pace. | 3.4 | 68% |
Carenet is a useful resource for learning about other self-limiting or minor conditions | 3.6 | 72% |
Carenet is a useful resource for preparation for the cumulative oral skills exam | 4.8 | 96% |
Carenet is a useful resource for preparation for the written exams in 220 and 320. | 4.2 | 94% |
How did the project or completed cases affect the way you learn in this course?

- I learned one case in great detail, and looking at the other cases for the exam helped. I think if you stress its importance in class, more people would use it.
- Cases were useful in that they were an excellent starting ground for research since class structure did not always permit a discussion of issues for more than case patient.
- It gave us a better understanding on the topic that was covered and allowed us to gain background information to use when working at the pharmacy.

How would you improve the project or the cases?

- The website submission is a good idea. Maybe a separate sheet in the syllabus outlining specifically when things are due (you don’t have to put due dates but maybe an example for the 1st case) for the website, the practice case, the rough draft for assessing group (if this still applies) the final draft for assessing group etc.
- I would like more flexibility in the design of the website, though it may need more time.

What barriers did you encounter?

- We did pretty well with our website. Besides trying to figure out the due date, we didn’t have any barriers.
- We had problems getting copyright, and using your codes such as ones for <enter> were annoying.

Other comments:

- The thing I like best about this course was the website project - it was something new, innovative and is a very useful learning tool -- helps clarify issues (x7).
- I really enjoyed learning through the website projects and becoming familiar with common diseases.
- The information can be applied in the summer when I return to my job in a community pharmacy – (x4).
- It is applicable and practical use of knowledge to the profession - I learned a lot about non-prescription drugs (x15).
- We were actively involved in learning.
- It was hands on experience, yet the workload was offset somewhat since it was group work.
- It is very interactive.
- Learned a lot about different disease states and drugs.
- Practice in trying to assess conditions and choosing therapies.
- Nothing beats actually trying things for yourself in terms of learning experience is the best way to learn ie website project seemed difficult when introduced but it was not intimidating once we actually tried it.
- I like the idea of this as a communication/relevance source
- Overall the objective are met (without question) and I truly believe we learned our OTC meds better than other schools.
- Emphasis on consumer make this course a valuable learning experience.
- I realize how important it is – learning about products and conditions is great; makes me feel good to be part of the faculty.
- I was placed in a good team that works hard.

The performance of both second and third year student teams on this project is listed in Table III. Average grades for the course are also listed: these are a composite of individual written and oral exams and team case presentations.

Student perceptions of the project were determined by a survey. Survey questions were adapted from the American Association of Higher Education Flashlight Project(14). Students were sent the survey via an e-mail attachment and responded on-line. Additionally, a summary of free response written comments was collected. All quantitative survey questions were graded using a Likert scale with the response “Strongly Agree” = 5 and the response “Strongly Disagree” = 1. Students were asked to complete this survey anonymously.

EVALUATION AND RESULTS

In general, the replies to the survey probed student perception of learning. (Table IV) Survey results recorded students’ views of the value of the project in understanding and communicating with the consumer, project design, as a means of understanding content issues, and of the completed consumer website as a learning tool. In general, 70 percent of the students indicated that they used the course websites apart from the project or to conference about the project and 77 percent indicated an intention to use them the following year. The hit counter for the two course websites showed an average of 13,300 hits over six months, for the 80 students per year who used it routinely, or approximately one hit daily.

The free responses regarding both the computer assignment and the finished website were very supportive and enthusiastic. (Table V) The overall view expressed was that they found the two not only interesting but also educationally beneficial to students. Students commented that it was innovative, practical, applicable to their profession, interactive and self-directed, and that they enjoyed the experience. These comments are a clear indication that this project and the completed website were successful in achieving the course objectives.

DISCUSSION

Computer assisted learning represents a significant instructional tool because it raises teaching standards to new levels of sophistication, is cost effective when time is limited and addresses specific challenges, such as concept visualization. This project’s innovative approach using technology was worthwhile in providing the following benefits to students. It allowed the students to have an interactive experience that could not be duplicated, in a relatively convenient and time-efficient manner. It permitted students to reach significant numbers of consumers directly, which could not be matched by one-on-one simulations in a lab. It was a cost-effective way to provide a practice supplement to a theoretical class. It bridged the gap to active practice by enabling junior students access to

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Table V. Student free response to consumer Website (CARENET) project for 1999-2000

<table>
<thead>
<tr>
<th>How would you improve the project or the cases?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The website submission is a good idea. Maybe a separate sheet in the syllabus outlining specifically when things are due (you don’t have to put due dates but maybe an example for the 1st case) for the website, the practice case, the rough draft for assessing group (if this still applies) the final draft for assessing group etc.</td>
</tr>
<tr>
<td>I would like more flexibility in the design of the website, though it may need more time.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What barriers did you encounter?</th>
</tr>
</thead>
<tbody>
<tr>
<td>We did pretty well with our website. Besides trying to figure out the due date, we didn’t have any barriers.</td>
</tr>
<tr>
<td>We had problems getting copyright, and using your codes such as ones for &lt;enter&gt; were annoying.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other comments:</th>
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</thead>
<tbody>
<tr>
<td>The thing I like best about this course was the website project - it was something new, innovative and is a very useful learning tool -- helps clarify issues (x7).</td>
</tr>
<tr>
<td>I really enjoyed learning through the website projects and becoming familiar with common diseases.</td>
</tr>
<tr>
<td>The information can be applied in the summer when I return to my job in a community pharmacy – (x4).</td>
</tr>
<tr>
<td>It is applicable and practical use of knowledge to the profession - I learned a lot about non-prescription drugs (x15).</td>
</tr>
<tr>
<td>We were actively involved in learning.</td>
</tr>
<tr>
<td>It was hands on experience, yet the workload was offset somewhat since it was group work.</td>
</tr>
<tr>
<td>It is very interactive.</td>
</tr>
<tr>
<td>Learned a lot about different disease states and drugs.</td>
</tr>
<tr>
<td>Practice in trying to assess conditions and choosing therapies.</td>
</tr>
<tr>
<td>Nothing beats actually trying things for yourself in terms of learning experience is the best way to learn ie website project seemed difficult when introduced but it was not intimidating once we actually tried it.</td>
</tr>
<tr>
<td>I like the idea of this as a communication/relevance source.</td>
</tr>
<tr>
<td>Overall the objective are met (without question) and I truly believe we learned our OTC meds better than other schools.</td>
</tr>
<tr>
<td>Emphasis on consumer make this course a valuable learning experience.</td>
</tr>
<tr>
<td>I realize how important it is – learning about products and conditions is great; makes me feel good to be part of the faculty.</td>
</tr>
<tr>
<td>I was placed in a good team that works hard.</td>
</tr>
</tbody>
</table>

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real patients as opposed to standardized patients, in a setting that allowed the information conveyed to be verified before delivery.

The project design delivered course objectives by providing a unique opportunity for autologous problem-based learning that incorporated both creative and analytical skills, communication techniques that were written yet embraced concepts of verbal dialogue, and evaluative skills that required high order critical thinking. It was valuable in creating a student-generated resource other students can utilize as a supplemental active-learning reference.

Students successfully integrated all required elements with the content of the web pages. The completed works contained appropriate information, in dialogue created to engage the reader. They performed well in assessing and including links to other reliable educational or organization sites. Notable examples include the psoriasis page, which was illustrated with exceptional graphics and the sun awareness site, which altered the format with color and font changes. The contact dermatitis page exhibited a clear understanding of the target audience in the language level. All 30 projects were an attempt to help improve patient quality of life through education.

Student reaction to the experience reflected their appreciation of its positive value and the significant role of the Internet. Their perception of their own learning reflected achievement of a greater underlying depth of understanding both in synthesizing content and in evaluation, as they were always conscious of the target audience and their related needs. It created a sense of confidence in both their knowledge and in their communication skills. The sentiment was expressed, moreover, that working in a state of the art medium put them on the cutting edge in a way that was also enjoyable, interesting and applicable to the profession.

Collaborative learning was partially responsible for the project’s success. The efficiency in working in teams is evidenced by the reasonable number of hours spent on the project. Students were able to divide the work, discuss through web conferencing and meet as needed to coordinate. Portions such as computer skills, efficient writing skills, or content research were assigned based on team members’ expertise. The ease of collaboration within teams may be attributed to some significant attention to intentional team assignments and awareness training in interpersonal dynamics and learning styles. Team composition is academically stratified based on academic averages from the previous year. For example, when students begin the second year course, the first team consists of students with the highest standing, the lowest standing, the sixteenth highest standing, the sixteenth lowest standing, etc. Each team has a cross section of academic abilities to facilitate mentoring between stronger and weaker students. For the third year class, a Myers-Briggs inventory had been carried out prior to second the year. This opportunity for self-reflection was not used to create groups but undertaken to explore their learning and problem-solving styles to heighten their awareness in adjusting to team dynamics. During that year, their team dynamics were so positive that all fifteen teams requested to stay together for third year, and thus these students had a history of successful collaboration for two years when they began this project. For the second year students, the David Kolb Learning Style Inventory was carried out prior to the course, and they participated in a day seminar with activities centered on understanding and accommodating learning styles. They also worked effectively in their assigned teams and their response was also enthusiastic and positive, requesting to stay together for the following year, having completed this project.

Student feedback regarding problems and difficulties was addressed whenever possible as the project proceeded. Comments from the third year students regarding technical problems of editing or increasing creativity in formatting resulted in changes for the second year project. In general, accessibility to computers was not a problem but some students with older hardware had long waiting times when downloading from the Internet.

It is difficult to establish if there is a quantifiable beneficial impact on their learning outcomes. Comparing course scores to project scores does not necessarily reflect the impact of the experience since assessment methods for the course are composite and different. The survey and free response results, however, clearly indicated that the project and the completed website promoted active, self-directed learning, and positive practices for acquiring knowledge, skills and values.

IMPLICATION FOR FACULTY WORKLOAD AND FINANCES

The project required a significant effort and time commitment on the part of the course instructor. In addition to the time necessary to design and program the consumer home page, the instructions and submission pages, and the modifications (approximately 200 hours), additional hours were required weekly to review the submissions on-line, suggest changes, check the revisions, answer student questions or problems, solve technological problems and complete assessments (approximately 15 hours). Internet access was necessary to grade the assignments, which was possible remotely on evenings, weekends or when traveling.

The availability of the finished project on-line after students have completed the course presents an additional responsibility to the instructor. Maintenance of the site is an ongoing responsibility and will entail revisions with future classes.

The interactive technology revolution create a challenge to faculty in developing new ways to present content, creating new assignments, implementing appropriate evaluation, and measuring outcome assessment. It is increasingly difficult to have the time and resources to effect these changes.

CONCLUSION

This project was intended to reinforce concepts presented in lectures and to afford individual students with an opportunity to apply knowledge and skills. It successfully allowed students to actively gain practical experience in presenting information to the consumer. In transforming the learner into the teacher, it augments the educational experience: ‘when one teaches, two learn’. Additionally, it presents not only the student but also the consumer with the opportunity to autonomously direct their own learning. Delivery of course objectives in an appealing format and project that cannot be duplicated by texts or lectures resulted in a positive student experience, since enjoyment enhances learning.

The online site will be monitored for the next year, noting the number of hits and messages from the viewers and then the project will be redesigned and reassigned. After assessing feedback from the consumer, and surveys from additional classes of students, suggestions noted will be addressed. Teams will be required to update each topic, improving the submissions to change content, review links, and augment creativity with added graphics and video clips.
Acknowledgements. The author wishes to thank the students of the classes of OT1 and OT2 for their efforts, feedback, and for granting permission to post their web pages in a permanent website on the Internet. A debt of gratitude is owed to Matthew Sibbald for his voluntary assistance in technical design and programming.

References