

The Evolution of Computer-based Tutorials Towards Web Delivery

Charlotte Brack, Kristine Elliott, Graham Parslow and Bruce Livett

Department of Biochemistry and Molecular Biology

The University of Melbourne

c.brack@biochemistry.unimelb.edu.au

Introduction

The Biochemistry Department at Melbourne University has been committed to the use of computer aided learning (CAL) since the early 1980s. Limitations of early modules written in the department were increasingly apparent, as computer technology became more versatile and sophisticated. However, these modules represented considerable investment of time in academic content, multiple choice question formulation and graphic production, and in an environment of reducing resources and increasing demands, preservation of this investment was important. We explored the possibilities of salvaging the value of our early CAL modules and presenting the content to students in a more accessible format. This paper outlines our approach to preserving the academic content and increasing the versatility of early DOS based CAL modules by converting them to Windows based and web deliverable formats.

Methods

Q tutorials were authored using the *Q Instruction Package* (Elsevier Biosoft, Cambridge, UK, 1987,1991) from 1985 until 1995. Graphics were produced in drawing programs (generally *CorelDraw*) or scanned from textbook or journals, and were in self-executable format (*.exe). The program used to convert *Q* tutorials to *ToolBook* format was developed 'in-house'. *ToolBookII* (Version 5) was used for its capacity to convert tutorials to HTML. The HTML editor *HotDog* Version 4 (Sausage Software) was used to write HTML files, and produce image maps.

Results

Between 1985 and 1995 a total of sixty DOS based *Q* tutorials were produced (Elliott *et al*, 1995). These tutorials were written to support lecture and practical material for second and third year Agricultural Science, Dental Science, Medical and Science courses. They contained original text and multiple choice questions, supported by graphics. Students were given feedback when answering questions and a score at the end of the tutorial. Navigation was linear and users could access a screen offering a 'Page selection', although page content was not identified on this screen.

The *Q* tutorials presented users with either a text, graphic or question screen, moving linearly from one to the next. The direct conversion to *ToolBook* produced tutorials that were accessible in Windows. These could be easily and quickly enhanced. Graphics could be placed beside relevant text (Figure 1) facilitating description of the graphic material. Manipulation of image size was also easier, and there was greater flexibility with respect to file format. Additional information was presented as "pop-ups" in layers accessible to the user on 'mouse click'. These features were used in the tutorial "An Introduction to Biochemistry".

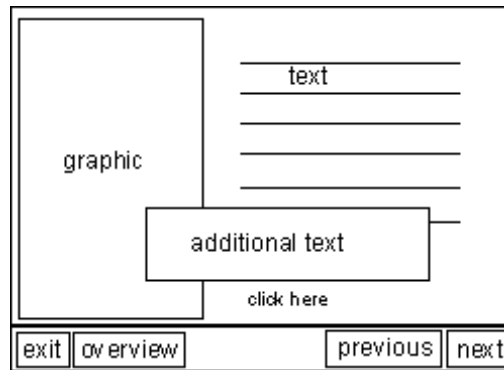


Figure 1. Layout of "An Introduction to Biochemistry"

Conversion of the *ToolBook* tutorials to HTML resulted in the loss of features and a need for considerable modification. It was therefore more efficient to convert the *Q* tutorials directly to HTML. This direct conversion added the flexibility of platform independence, and web delivery. The converted tutorial was then enhanced with frames, hyperlinks, *JavaScript*, image maps and animated graphics. A tutorial written in *Q* for second year medical students, on "The Molecular Basis of Insulin Action" was converted to HTML (Brack, 1997). This module is currently under revision and evaluation is planned for the second semester of 1998. The tutorial on "Calcium Homeostasis" was written directly in HTML (Brack, 1998). Production of this module is in progress.

The use of seamless frames allowed for easier navigation with a hyperlinked menu of sections always on screen. This navigation frame was either placed down the side or along the bottom, each with different advantages. A side menu is consistent with many current web site designs and would therefore be familiar to users. In addition, the side menu broke up the screen into dimensions that were easier to view particularly when text was presented. The navigation at the bottom of the screen was most efficient in space taking only 17% of the screen. Graphics and text could be presented together in HTML (Figure 2). Frames were used to combine visual and text information in a variety of combinations with some user control. Hyperlinks from text were used to access relevant graphics or to move between sections.

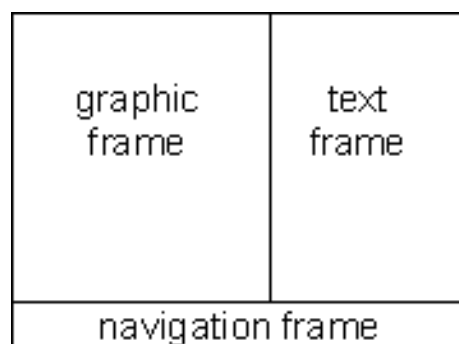


Figure 2. Frame structure of HTML tutorials

The multiple choice questions were presented using *JavaScript* forms. This allowed for feedback to students.

Image maps were used for navigation, providing access to material from a visual perspective. Animated graphics were easily produced, and careful timing, cycling and linking of animations allowed users to step through with some control. This is illustrated in the animation in the tutorial "The Molecular Basis of Insulin Action".

Discussion

Early investment in CAL has provided essential support to the teaching of fundamental areas of biochemistry. The key feature of early tutorials was the feedback to students and scoring of answers. In addition, information from disparate sources could be brought together further distinguishing the tutorials from the textbook format. In the 1990s the need to redress the educational focus of teaching and learning was recognized, and CAL modules designed from an experiential perspective are currently in production. However, the academic content held within existing tutorials was of continuing relevance. Conversion of these tutorials to Windows and web formats made the material more accessible to students. In the evolution of our CAL material from DOS based to Windows and eventually web deliverable tutorials the functional advance has been in the flexibility of navigation and user control. The learning material has become more accessible to students and has kept pace with the advances in technology expected by students.

Summary

Conversion of DOS based *Q* tutorials to *ToolBook* format resulted in Windows delivery, enhanced graphic presentation and more flexible access to information. The further conversion of *Q* tutorials to HTML formats also allowed cross platform (Mac and PC) and web delivery.

The use of simple HTML tags and *JavaScript* in web deliverable tutorials allowed for easy and rapid enhancement of the material from the *Q* tutorials. The enhancement was to greater flexibility in navigation both between and within sections of the tutorials, and more extensive and flexible linking of media elements (text, graphics and questions).

These conversions preserved the academic content of the early modules, and resulted in rapid delivery of enhanced CAL material to students.

References

- Elliott, K. A., Parslow, G. R. And Livett, B. G. (1995). *The use of computer-based tutorials to teach biochemistry*, Proceedings of the 12th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education, p588.
- Brack, C. M. (1997) *The Molecular Basis of Insulin Action*.
<http://grimwade.biochem.unimelb.edu.au/tutorial/h2730.htm>
- Brack, C. M. (1998) *Calcium Homeostasis*.
<http://grimwade.biochem.unimelb.edu.au/tutorial/caltute/cal-hom1.htm>



An Author Usability Trial for the Networked Assessment Toolkit (NEST)

Craig Burton, Engineering Multimedia Unit, The University of Melbourne
aburt@ecr.mu.oz.au

Lorraine Johnston, Computer Science, The University of Melbourne
ljj@cs.mu.oz.au

Introduction

The on-going development of NEST, the Networked Assessment Toolkit, was studied as an example of how a WWW-mounted computer program must be designed to have a pared-down interface that does not attempt to mimic the kind of user control we are used to in stand-alone software.

Originally a UNIX command-line translator for marking up HTML exams, NEST was recently improved so that its authoring capabilities could be used via the WWW. Developed at the University of Melbourne in 1996, NEST was chosen for assessment of its WWW interface to determine how a complex piece of software can support a WWW interface.

A non-trivially complex application, NEST was considered to be representative of the types of applications desirable for access via the WWW.

The philosophies behind NEST, its interface and its function are described below, followed by the rationale for, and outcomes of, a usability study. This paper is most concerned with the areas where technical design considerations have a significant impact on usability issues.

NEST: Structure and Design Philosophy

What is NEST?

NEST was written to allow educators who were not programmers or HTML authors to write complex Common Gateway Interface (CGI) programs via a simple scripting language. It permits the production, delivery and assessment of web-based examinations and surveys. *TopClass*² uses similar technology. In both cases, a program runs on the WWW server to provide a basic interactive WWW interface out of standard HTML forms. Neither employ scripting languages at the client such as Java or Javascript. Interaction with the server (and NEST in this case) consists of submitting HTML forms and being served further forms.

It should be noted here that an HTML page may originate from either a text document sent to the client browser via a server, or alternatively may be created by a computer program, and can contain information assembled specifically for that client. The latter HTML pages are called Common Gateway Interface pages, but this difference can be transparent to the client. An HTML form is a page that has the ability to collect data from the client. It may contain HTML commands to offer the client buttons to click or text boxes to fill in. Forms can be created for the client in either an HTML page or a CGI page. When the client *submits* the form, some other basic CGI program must be ready to accept the submission content.

There are already many web tools to make HTML pages (such as *HTMLAssist* and *HotDog*), but there is currently little support for writing CGI pages, or for creating the CGI programs that process data sent from client forms. To address this need, NEST generates CGI pages with forms that also act as the receiving CGI program for handling the submission from the same form. The same program

then processes the data collected and supplies the author with summary information. The users who supplied the data can be given appropriate feedback such as hints or the results of their individual assessments.

To make the package more accessible, an interface was developed allowing the basic authoring abilities of NEST to be available via the WWW. As a special case of a *NEST Exam*, the NEST WWW interface was written with NEST itself. This allows the substitution of different languages and the re-organising of the interface layout and graphic appearance, again without knowledge of HTML or CGI.

NEST Exams are modular in their design. Each consists of a “cover page”, which holds general information pertaining to the entire exam, such as its graphical appearance, encryption mode across the WWW, access period and access authority list.

To use the WWW interface, authors must provide details of the exam to build up the cover page for the exam. NEST then requires the author to supply text and images for posing the question stimuli (e.g. pictures to click on in a multi-choice scenario), the correct answer for the question and the question number to position this question in the exam lineup. We refer to this as an *exam content item*.

The process of authoring an exam is to submit the cover page information once, then to submit the content as many times as there are to be questions in the exam. To collect this information from the author, a CGI page called the “header” gathers the cover page information, while a second “content” page gets submitted several times for all the exam content items. Both pages have a similar appearance, and the server takes almost exactly the same time to respond to the submission of each.

NEST was originally built to serve exams to students, to collect their answers and to build assessment reports. To date, about 1500 students have sat engineering exams with NEST, and many more have used NEST quizzes built from past exams, or filled in questionnaires and course appreciation surveys authored with this package. Exams and quizzes are automatically marked and statistically analysed. Questionnaires are collated in a variety of ways and can be weighted for hypothesis testing.

NEST has also been used to web-mount an administrative database as well as an election for the Melbourne University Postgraduate Association, where voters were not all in Australia during the election period.

Design Rationale

NEST seeks to exploit a user’s WWW experience and provide a web-page look and feel to what is in fact an interactive computer program. At the same time the design philosophy of NEST attempts to overcome some of the problems arising out of the conflict between “surfing” and user interface navigation. This is, in effect, another *orthogonal extension*¹ to the familiar WWW interface. This section deals with the major differences between this extended WWW interface and the user model of an interface based on their experience with stand-alone software.

It is important to note that users in this NEST trial were assumed to be computer literate, with experience using stand-alone packages. We also assumed that users had basic web navigation skills, i.e. they were familiar with both HTML widgets (such as scrollbars, clickable buttons and text boxes) as well as the more traditional windowing interface widgets (such as windows and dialogue boxes).

The “page” interface presents interactions with NEST as a series of HTML pages. We made use of the fact that many complex activities can be reduced to a series of linear steps; which is most helpful to less experienced users. A recent development that allows for the creation of WWW



“Wizards”⁶ likewise extols the benefits of streamlining tasks into simple steps, much like the installation “Wizards” that accompany software distributions.

A simple HTML page also has a smaller *footprint* than other design alternatives. The footprint of a page that arrives at the client is the sum of its content volume (in bytes) as well as the time taken to execute any scripting languages that might be embedded in it (such as Java). A small footprint, form-based page is desirable and is also a robust method of talking to the client, since the user can resubmit the page if a fault is detected, such as a timeout. Further, the page model is in keeping with the user’s expectation of a browseable system and their experience of common HTML forms.

Our approach reflects the philosophy of Shubin and Meehan⁵

“The World Wide Web is a new application development platform. For better or worse, people come to it with expectations based on their experience with other platforms such as Windows, Macintosh and UNIX. This experience makes up a user’s model. Unfortunately, that model conflicts with the model of navigation of the Web.”

They conclude it is important to hide “the split between the browser and the application”.

Other models of interaction over the WWW could be used, which would present a different appearance to the user. For example, Kindlund’s³ WWW-mounted administration program presents a new window on top of the browser window, which then behaves like a local program. In fact, the application must then juggle the user’s requests with the distant server. We chose not to follow Kindlund’s path, as we sought to exploit the user’s familiarity with the browser, and did not want to introduce other control elements. Also, such special control of the browser requires a large footprint with a greater amount of information being sent to the client and the penalty of execution time of a complex script.

The Study

A usability study was carried out for both the authoring interface for NEST as well as for its presentation interface (exam, quiz or questionnaire). This identified a number of design issues which are relevant in the production of usable WWW interfaces.

Twenty-two students participated in the evaluation of each of these interfaces during two two-hour workshops held a week apart. Their objective was to give feedback regarding usability issues in the interfaces.

The students were in their fourth semester of the Information Systems degree at the University of Melbourne, and this was part of their experimental work in the subject “Human Computer Interfaces”.

Initial instruction was given to the class as a whole about the purpose of the package and how they could access it on the WWW. They were also given written directions on what they were expected to do. Students worked in groups of two or three on the project.

In the first workshop, they were to develop a set of questions for a questionnaire. They were allowed to choose from question styles which have: a single answer from a multiple-choice set; multiple answers from a set of possible answers; or a text answer.

While one attempted to generate the questionnaire, the other person recorded the usability deficiencies which they noticed. In lectures they had been introduced to Nielsen’s heuristic

guidelines⁴. Hence, for this evaluation they were directed to use these heuristics to assist them with identifying problems.

For the second workshop they were tasked with answering questionnaires constructed by other groups. While doing so, they were required to note any potential problems with the interface, again using the heuristics to help them find potential problems.

For each session students were given evaluation sheets to record problems, severity rating and comments.

Observed Usability Issues

Both oral and written feedback from the usability assessment sessions helped identify several important issues. These are discussed below. The usability studies indicated that the approach used in the development of the NEST WWW interface can, indeed, produce other usable interfaces.

Disorientation Effects

Even when the user had found the required information early on the page, they were often uncertain what to do, unless the end of the page was immediately visible.

A typical page for a question displays the question information first then any possible answers relevant for that type of question. After this, and at the bottom of the page, there was a “Make” button to indicate completion of the task of dealing with that question.

Long pages of information (e.g. those containing wordy options for answers to questions) were observed to cause a loss of orientation for the users. Where they needed to scroll to find further information, we observed extra scrolling, apparently in an attempt to collate all the information.

If pages were limited to a shorter length, these orientation problems would not arise. On the other hand, permitting only shorter pages requires the overall material to be split into smaller pieces. A potential outcome of this is lack of control over how to divide items, or a limitation on the content of the items.

Page Length

Page length is related to the volume of information being displayed. This in turn has an effect on the time it takes to transmit the information.

A designer has thus to trade off manageable page lengths versus the optimum size for a bundle of information. This, in turn, affects the upper limit for the number of items permissible per page.

In NEST one may offer up to seven possible answers to a question, and some subjects found this was too limiting.

Deficiencies in HTML

Subjects noted the problem of radiobuttons in HTML. They also found similar problems with check boxes. Once a radiobutton was selected, it was not possible to retreat to the “none-selected” state. It would be possible to use check-boxes with a checking script at the server to overcome this, but this is not in keeping with the design philosophy for NEST of minimising processing.

One of the problems with the widgets in an HTML form is that non-selection or non-entry of information can not be used as a “no” answer. In the client-server arrangement, anything missing in the transmission is simply not processed. Thus, NEST does not allow the generation of exam



questions where, for example, a single checkbox is offered for a YES/NO type question. Presumably, the user would click for YES and leave un-clicked for NO. In a windowing interface where the application is tightly coupled to its application, this kind of interaction is more reliable. However, with the WWW, not all clients allow the estimation of whether a transmission is incomplete.

Confusion over naming

Names used on buttons may be quite brief, but they have a non-trivial effect, as was found in this study.

“Make” was the name chosen for the button to indicate completion of a question. This word caused confusion, as it was not seen to be intuitive. It was suggested that wording such as “complete/finalise question” would have been more explanatory.

A similar complaint was levelled at “Upload”. Perplexity is common over whether one is “uploading” or “downloading”, mostly depending on the local jargon. In the present situation, the intention was to provide a local file to be sent to the server for use in the questionnaire. Such confusion can be avoided by using a more explicit description such as “Choose file”.

Cooperative work

The WWW accessibility of NEST allows remote authenticated authors access to a common questionnaire. This made the co-authoring of questions very easy, since both authors could access the file.

However, there were deficiencies noted here, in that under the current setup, there are no locks on shared files nor some other method of resolving conflict over shared writing.

This is serious for WWW applications, as all program actions should be allowed to occur in parallel with the activities of other system users.

Browser incompatibilities

There were complaints from our authoring subjects that they could not use *Internet Explorer3.0* for this trial. Although the design of NEST tried to take browser incompatibilities into account, this was not entirely successful.

At the time of the study, only *Netscape* provided a facility to send a private file to the server. While this was not implemented in any other browser at the time, it was used because of its utility and the fact that other *Netscape*-only additions to HTML, such as frames, had been readily adopted by the W3 Organisation in the past.

NEST now uses a workaround by offering a standard text box to the author for them to give the URL of an image or other file for NEST to upload. The image must be world readable and be served from a URL that NEST can reach. This means that the author must manually transfer their possibly-private image files to a public site. While this is less than ideal, the workaround also means that very large files (such as MPEG video) can be uploaded into the server. The *Netscape* upload facility is not stable for files of many megabytes.

Another problem arose with the difference between the UNIX and PC specifications of file names, ie. “/” versus “\”, and the use of spaces in file names. As author-provided application names must eventually become URLs, if they contain characters that UNIX shells interpret, or if they contain spaces, they must be modified. Arbitrary file names can be served as URLs, but spaces (at least) are coded up with special escape characters. The handling of these characters is not uniform over all platforms. It was thus necessary to advise our Authors not to use spaces, shell metacharacters (/,

& , | , -) , etc. Permitted file names were thus reduced to combinations of alphanumerics and the underscore character.

Help facilities

Although subjects were somewhat critical of the precise content of the help available while using NEST, they were enthusiastic about the ease of accessing the online help. Of special mention is the natural support for context-sensitive help that can be linked directly to pages of a WWW interface.

The simplicity of HTML for providing basic image and hyper-linked information means that this is the medium of choice for delivery of resources that support the WWW interface such as on-line help, mail, demonstrations, purchasing and upgrades.

Further, generation of tutorial and help information is also greatly simplified, as states of the WWW interface can be “saved” as HTML and used as examples. To do this, pages of the interface (the HTML form statements) are copied off the interface, and pasted into the help pages. With a proforma of a different coloured background, and with the “quoted” section of the interface in some sort of thick-bordered table, this activity prevents the need to capture screens and crop out the parts of the interface.

At the moment, because the interface “quotes” look (and feel) like the actual interface (as opposed to being images of it), some of the subjects were confused, commenting that they could not work out whether they were on an interface page or in a help page.

However, the advantage of this method of graphical representation of the interface is the small footprint for help. This is contrast to the current trend where the help facilities for software frequently outweigh the software itself in size. It is also easy to maintain, as only re-pasting sections of the interface is required. We suggest that there are other ways to present the interface extracts, say by using reduced fonts, or by employing unusual colours or with an unusual border. This would remind the users that they are in a help page, and not the interface.

User Model Confusion

Incompatibility of the user model with the model presented here caused difficulties for some users. PC-savvy subjects were confused by one element of the NEST design which resulted from an attempt to be economical with the layout.

On PC machines, widgets such as checkboxes and radio buttons can be selected by clicking on the text next to them (we call this their “textual element”). This is also true of browsers on that platform.

Our users expected the words beside a checkbox to be part of the clickable area. Instead, they were confused by two things: only the button area itself was selectable, not the text beside it, and the interface was set up so that a context-sensitive help link was part of the checkbox text. Attempting to “check the box” instead called up the help mechanism. This was a deliberate design decision in an attempt to save space.

Conclusions

The aim of this study was to validate a page-based HTML approach to serving a complete user interface over the web. Our main design rationale was to exploit the user’s familiarity with the web familiarity. The activity of WWW navigation is necessarily subject to transmission delays, and users are mostly content to accept this. However, similar delays for a single-user windows-based application would not be acceptable. Therefore we expected that users would accept a web-based interface to an application if it had the “look and feel” of navigation.



For a simple page-based WWW model, embedded script was not needed, nor were HTML4.0 frames exploited. This technology was avoided in as much as it is still evolving, and as it blurs the WWW-navigation/window-using experience for the user. Such technology was also avoided because it results in a larger footprint (download volume and/or greater page rendering/execution time) in what may already be a fairly slow operation, depending on the complexity of the WWW-mounted application.

One of the compromises of this page model is that all interaction with the server must be reduced to a series of steps. However, this simpler model of interaction may be more desirable as it increases the equity of usability for the application. Cited examples are the recent developments of “Wizards” for streaming complex activities.

Nielsen⁴ documented that a simple approach to identifying usability problems can have decided benefits. In the present situation, subjects were asked to do a heuristic evaluation of the interfaces involved with the WWW-based NEST examination tool. Nielsen indicates that such an evaluation is not particularly useful with only one evaluator, but that as few as five evaluators can find a significant number of problems. We used 10 pairs of evaluators for our usability assessment, and uncovered a number of issues.

Overall, all the subjects in the study were able to use the new interface and complete a complex interactive authoring task in a reasonable time. Difficulties we document fall into two categories; those which we could predict based on the spartan nature of the HTML widget set and those arising out of the interface design itself and its conflict with users' navigation or user interface skills.

References

- ¹ Fox, A, Gribble, S D, Chawathe Y, Polito, A S, Huang, A, Ling, B and Brewer, E A. (1997) “Orthogonal extensions to the WWW user interface using client side technologies”, *UIST*, Banff, Canada.
- ² Graziadei, B. (1997) “TopClass announcements and news”, <http://cpdt.itec.suny.edu/cpdt/tc/tcnews.html>.
- ³ Kindland, (1990) “Navigating the applet-browser divide”, *IEEE Software*, 107-108, May.
- ⁴ Nielson, J. (1993) *Usability Engineering*, AP Professional, New York.
- ⁵ Shubin, H and Meehan M. (1997) “Navigation in web applications”, *Interactions*, 13-17, Nov-Dec.
- ⁶ Tidwell, D and Fucella, J. (1997) “Taskguides: Instant wizards on the web”, in *Crossroads in Communications, Proceedings of the 15th Annual International Conference on Computer Documentation*. SIGDOC, Oct 1997 263-272 IBM Almaden Laboratory.

Acknowledgments

The authors would like to thank the following people for contributing to NEST and its derivative projects: Dr. Robert Barnett, Jennifer Port, Matthew Higgins, Bernie Kirby, Samantha Sharp, Karsten Haley, Sandy Munro, Yi-ren Ng and the student participants from “Human Computer Interfaces”.

This document is an excerpt from “Will World Wide Web interfaces be usable”, same authors, unpublished.

WebMC: A Web-based Multiple Choice Assessment System

James R. Dalziel and Scott Gazzard

Department of Psychology, The University of Sydney
jamesd@psych.usyd.edu.au

Development of WebMC

This paper describes the development and evaluation of WebMC, a web-based multiple choice assessment. By using the web as the basis of this system, no paper resources are required, and students may use WebMC from any location with access to the Internet, such as classrooms, libraries, home and work. By using the advantages of web-based computer programming, the system is interactive (using cgi scripts) and platform-independent (i.e. it will run on any computer with web access regardless of operating system, such as PC, Macs and Unix-based systems). These advantages of the web have already been utilised for “Web-based tutorials” (Gazzard & Dalziel, 1997), but can also be used in assessment. The system was designed in such a way that students received immediate feedback on whether they answered each question correctly or incorrectly, and information regarding why each question option was correct or incorrect. Further, at the end of each initial feedback screen, a “more information” link was provided, which allowed students to go to a further feedback screen which presented a general discussion of the question and the topic area to which the question was related. Students would then proceed to the next question from either of these feedback screens. Figure 1 illustrates the structure of the formative assessment system. The version of WebMC evaluated in this paper can be viewed at <http://www.psych.usyd.edu.au/mcweb/>.

WebMC - Formative Assessment

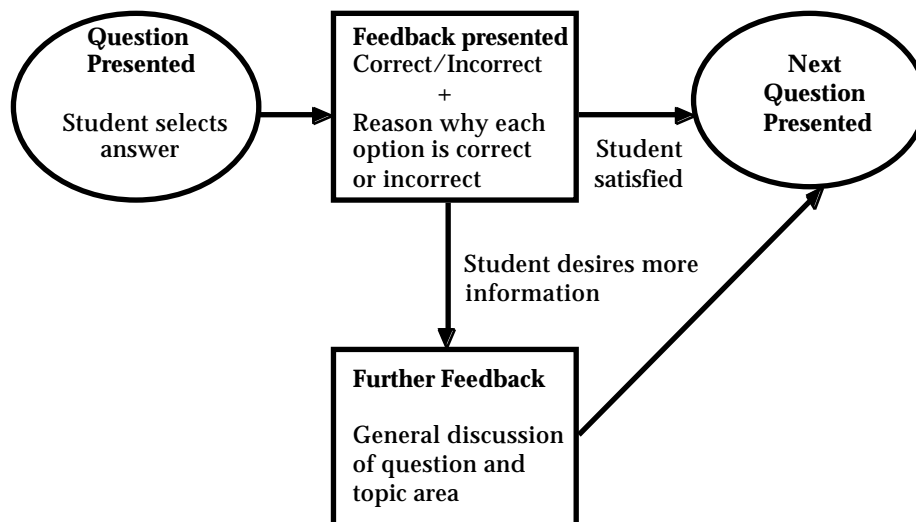


Figure 1. Structure of question and feedback system used in WebMC

The first practical application of WebMC was with a large (1200+ students) First Year Psychology course at the University of Sydney. Tutorial material for this course was previously assessed by an end of semester summative multiple choice quiz. In 1997, WebMC was provided as an additional learning tool in the weeks prior to the quiz, and sets of questions and feedback for each topic area were developed and made available to students via WebMC so as to allow an opportunity for formative assessment prior to the summative quiz. Tutorial rooms (which contained web-connected computers) were left open all week prior to the quiz (there were no classes in this week), with a tutor available to assist with any problems. All students were invited to use WebMC, and were informed that a few of the practice questions could be used in the quiz.



Evaluation of WebMC

The response to WebMC was exceptional. Over 10,000 hits were recorded on the main WebMC page during the month that it was available, and over 1000 First Year Psychology students accessed WebMC at least once (students logged in with their student IDs, so multiple uses were only counted as one student). The tutorial rooms were full for much of the week, and external access to WebMC occurred at all hours of the day (including the early hours of the morning). The general response of students appeared very positive.

On a general evaluation question asking students to rate WebMC as a learning resource (on a seven point scale), 61% of students rated WebMC as “(1) Excellent”, 28% rated it as “(2) Very Good”, 9% rated it as “(3) Good” and 2% rated it as “(4) Average”. No negative responses (5, 6 or 7) were received. In open questions designed to allow students to state what they found best and worst about WebMC, and what they would change, students provided a wealth of comments about the project, the majority of which were very positive. In terms of the best aspect of WebMC, the most popular responses were related to “explanation of wrong answers” and “immediate feedback on answers”. Other positive comments included:

- “Very informative and thorough”
- “Great having it on the Internet”
- “It emphasises your strengths and weaknesses”
- “Easy to use, a fantastic learning tool”

Many students also indicated that using WebMC had encouraged them to go back to their class notes and do further study, such as:

- “It motivated me to study, since I knew less than I thought I did”

The following three longer quotes provide further general information about how students viewed WebMC:

- “It gave me a chance to get a perspective on what to study, as well as being an opportunity to test my knowledge”
- “It was comprehensive, and very helpful having the ‘more information’ option and the summaries”
- “The ‘more information’ section [was best], as it helps students to remember the tutorial, and to put questions in context, giving students the opportunity to take notes”

Many students left the “worst” and “change” questions blank, or indicated that they thought that WebMC was performing well. Several suggestions for change were received. These included: a suggestion that a timer would be helpful; comments that feedback in different sections was not always in the same format; and a request that the text be made smaller so that the entire question would fit on one screen (rather than requiring scrolling down on web browsers with large text formats). All of these suggested changes have since been incorporated.

Finally, many students offered spontaneous praise for the layout, design, structure and even just the provision of WebMC, indicating that they appreciated the system. Quotes such as “THANKYOU! Overall it was great!” were common last comments on the survey. Several students noted that they wished that other courses offered the kind of question and feedback system provided by WebMC.

Conclusion

The design and construction of WebMC was based on sound principles of assessment practice and utilised the inherent potential advantages of the web. Student evaluation of WebMC indicated that it

made a valuable contribution to their learning, and that many students made use of this resource in the context described. Current work on WebMC is developing the system for general use in any course, and additional software is being designed to allow academics with no background in web-design or programming, but just simple word processing skills, to build their own question and feedback sets for courses they teach, and for these to be directly incorporated into a permanent WebMC server. A summative assessment system based on WebMC is currently being finalised.

Reference

Gazzard, S. & Dalziel, J. R. (1997). *How it looks from their side of the screen: Evaluation of a Web-based tutorial at the Department of Psychology at the University of Sydney*. Paper presented to the 97 ASCILITE Conference in Perth, Australia, December, 1997.

Acknowledgments

The authors gratefully acknowledge the assistance of Simon Barrie, Christine Asmar, Agatha Brizuela, Matthew Carroll, Michael Cavanagh, Julie Hatfield, Tony Huxley, Peter MacCallum, Sadhana Raju, and Gina Sartore. This project was supported by a “Student Progression Assistance Scheme” grant from the Teaching Development Fund of the Faculty of Science, The University of Sydney.

Note: WebMC and all related material are copyright, 27/1/98, all rights reserved. No part of this material may be reproduced or used without the authors’ permission.



Exploring the Value of the Web in an Undergraduate Immunology Program

Elizabeth M. Deane, School of Science, University of Western Sydney, Nepean
e.deane@nepean.uws.edu.au

The Program

Tertiary science education aims to provide students not only with a sound knowledge base and associated technical competencies, but also with investigative skills and a thirst for knowledge which long outlives their time as university students. Paradoxically, graduates of science programs have been praised for possessing the first two but condemned for their lack of the latter.

This paper details the development of a third-year subject which has, over a period of four years, evolved to meet the need for cultivating such competencies. The web browser is but one tool in a holistic approach to student learning and is directed primarily at (a) providing students with a framework to conceptualize their learning, (b) facilitating access to information outside traditional “textbook” boundaries, but at the same time maintaining the focus of their efforts. Other tools used to achieve the learning objectives are accessing and critiquing research papers; group discussions and presentations of issues raised in research papers; solutions of laboratory based problems, including development of protocol, organizing laboratory equipment and consumables, conduct of experimental work, subsequent analysis and presentation. All strategies are directed at developing (a) investigative and analytical skills, (b) capacity for critical thinking and communication and defence of such critique, and (c) teamwork.

In four years close to 90 students have undertaken the course. All students have been given exit questionnaires to provide information on their perceptions of effectiveness and ideas for modifications for all components of the subject. In the light of such comments, changes have been made to both the subject structure and the web material. In the former, small group discussions were introduced and the number of papers reduced to provide time for more in-depth analysis. The web browser has had a number of sites added and a spoken glossary added. It is not complete; and it is desired, time and finances permitting, to add video clips and more stimulating visuals.

Students using the web site are often tempted to download and print out reams of material — of dubious value, given the unique way such material is organised. To alleviate this, students are provided with a coherent text-equivalent. The web now becomes more a framework for visualizing the field of immunology and a jump-off site for exploration. It is providing the Big Picture.

From the perspective of both staff and students, the web browser is a small but valuable part of a busy interactive subject. Cost, once the site has been established, is restricted to modifications and embellishments. On the whole, the subject has benefitted from such a resource, but it has not replaced the strong interpersonal approach generated through staff:student and student:student interactions.

Web address: <http://edtech.nepean.uws.edu.au/science/lci/index.html>

Thermal Physics Resources on the Web

Pal Fekete and Brian McInnes

Sydney University Physics Education Research Group (SUPER)

School of Physics, The University of Sydney

and **Paul Walker**, University College London

fekete@physics.usyd.edu.au

Introduction

In 1995 Dr Fekete was employed by McInnes and Walker as part of a CAUT project, “Diagnostic Tools for Concept Development”, to develop a practical and accessible database of resources that would encourage deep learning through interactive teaching in large class environments to be used in a first year lecture course on Thermal Physics. The web was chosen (<http://www.physics.usyd.edu.au/teach/thermal.html>) as the preferred choice of delivery as it was the most suitable medium to disseminate information to a large international body of academics. The material was specifically designed for large lecture theatre environments and included:

- information on how to use demonstrations interactively;
- a bank of questions designed to promote deeper conceptual understanding;
- references to research literature; and
- information on CD, video and film resources.

A previous discussion of this work and the database can be found in an earlier UniServe Science article “Interactive Teaching Resources for Thermal Physics Available on the Web”, UniServe Science News, Vol. 8, November 1997.

Background

Both the lecture resources developed and the medium chosen to disseminate them were intended to be interactive in nature. Academics are able to choose demonstrations and other resources which complement their teaching styles and through these resources are also exposed to alternative approaches in teaching, in particular interactive teaching. If used by lecturers these resources encourage students to develop deep approaches to learning, rather than the common “surface” approaches of trying to remember facts, formulae and mathematical techniques. Students are able to identify relationships between physics and the real world and become more confident in the use of words as well as equations and algebra to describe the phenomena they observe.

Interactivity in demonstrations is encouraged through the Predict, Observe, Explain (POE) (Liew and Teagust, 1995) process where students are first presented with a demonstration and asked to make a prediction. They are then shown the experiment which if well constructed will show a contradiction to their prediction. They are then asked to explain any discrepancies between their initial prediction and observation. The questions are also worded to encourage students to contemplate and explain their predictions.

Evaluation of Teacher Resources

Evaluation of the resources was carried out through a number of means. Approximately 10 students from each of the three normal classes were interviewed both before and after the course was taught; entry and exit quizzes were administered to all students of all classes at the start and finish of the



course; student appraisal and attendance was recorded; exam performance was evaluated. From this analysis we were able to show:

- students were better able to identify relationships between physics and the real world and showed greater conceptual understanding (interview and quizzes);
- student questionnaire responses indicated that the lectures were enjoyable, stimulating, satisfying, challenging, productive and thought-provoking; sustained student attendance throughout the course supported this judgement;
- the interactive style of teaching was popular with the students compared to the traditional teaching styles (course rating 4.0 out of 5.0 (best) compared to 3.5 and 3.3 for two parallel streams);
- preliminary student performance on traditional examination questions was equivalent to previous years;
- analysis of some of the quiz questions showed that conceptual understanding of students exposed to interactive teaching improved by as much as 30%;
- anecdotal evidence indicated that some students adopted deeper learning approaches; and
- despite my overzealous attempt to get the students to participate in lectures and take control of their learning participation was still less than about 30% of the time spend in the lecture theatre.

The database has already been shown to be useful to teachers both at our own university and other universities in Australia and abroad. Several people and places outside The University of Sydney have used the resources, however in general they are not well patronised. It is believed that the main reason for this is that lecturers are too busy to spend time exploring new resources. As a result of the poor patronage by academics it has been decided to develop these resources to become student centered.

Student Centered Resources

It is intended that these resources will be developed so that the ownership of learning is on the student. The web will be used to deliver content and to develop some conceptual understanding in students. This will free up lectures for reinforcement of concepts, development of more difficult concepts and problem solving, i.e. deeper learning.

Our current lecture course in Thermal Physics (TP1) is taught in second semester of each year to first year students and consists of 12 one hour lectures and 4 one hour tutorials spread over four weeks. In this course students get lecture notes in terms of *PowerPoint* handouts printed six per page. Two assignments are given with a formal exam at the end of the semester covering material from TP1 and two other courses.

The facility for students to access the material themselves, the newsgroup for communication, will aid this process. The use of the web will also assist by improving feedback about student preparedness, the effectiveness of teaching and ongoing course development. This should result in better performance by students in qualitative physics and an improvement in their understanding of fundamental concepts.

Conclusion

During 1995 and 1996 a database of teaching resources was developed on the web, which includes information on how to use demonstrations interactively and probing questions which are suitable for use in a lecture course on Thermal Physics. The original database was intended for use by academics

when preparing lecture courses and tutorials, and was documented in a way to encourage academics to develop deep learning strategies in their courses. This resource has been demonstrated to be useful to academics when teaching Thermal Physics and popular with students, however it has not been well patronised by academics.

In order to combat this Fekete is now extending this resource for use by undergraduate students. Students will be able to access the resource for themselves and also communicate to each other and the lecturer via the web. Various approaches to enhancing the web site for student use have been described.

Ultimately we may use the resource for distance based learning. We are also exploring using *NetMeeting*, a computer meeting environment with voice, whiteboard and other forms of communication. In the future it may be possible to reduce face to face contact allowing more time for problems and discussion in tutorials.

Reference

Liew, M.C.W. and Treagust, D.F. (1995). A predict-Observe-Explain teaching sequence for learning about students' understanding of heat and expansion of liquids, *Aust. Sci. Teachers J.*, **41** (1).



Web-based Protocols for Bioinformatics Education

Bruno A. Gaëta, Kirsten Balding, and Timothy Littlejohn

Australian Genomic Information Centre, The University of Sydney

kirsten@angis.org.au

The many genome projects initiated in the last few years have brought about an explosion in the amount of DNA and protein sequence and structure data available to biologists. Computers have become essential tools for the analysis of this information, and as a result, there is a growing demand among molecular biologists for education in bioinformatics, a new field of study at the forefront of computer science and molecular genetics.

Bioinformatics has a wide range of uses in molecular biology, for example the identification of the function of biomolecular sequences, the analysis and prediction of the three-dimensional structure encoded by a given sequence, and the inference of phylogenetic relationships between a group of sequences or their organism of origin. Furthermore, bioinformatics tools are useful for the management of experimental results as well as the planning and design of experiments.

The Australian National Genomic Information Service (ANGIS) is an Internet-based service providing Australian molecular biologists with access to a large collection of databases and software for genome analysis. ANGIS is based at The University of Sydney but is accessed over the Internet by over 3000 scientists from academic institutions, research institutes, hospitals and biotechnology companies throughout Australia. ANGIS uses the World Wide Web (WWW) as a front end to over 70 databases of DNA and protein sequences, genome information, molecular structures, sequence motifs and literature citations. The service also provides access to over 400 programs for biomolecular sequence analysis, database information retrieval and computational genetics. The software and databases are integrated under a simple WWW user interface that facilitates its use by biologists with limited computer literacy. This WebANGIS interface provides a useful and user friendly means of accessing bioinformatics programs and databases. It is ideally suited to biologists who have an awareness of the available bioinformatics programs and their uses. However, the user friendly nature of the service and the power of the bioinformatics databases as information resources are encouraging growing numbers of novice users to attempt bioinformatics analyses. Thus, commonly encountered questions relate to (1) the choice of suitable programs/databases and (2) the pertinent usage of programs including appropriate choice of parameters. Furthermore there is currently no guidance for biologists through what are often necessarily complex analyses involving the use of several programs.

Choosing a program or set of programs for a bioinformatics analysis is not a straightforward process, but one that requires a good understanding of the function of the programs and of the nature of the biological data being studied. Hence, it is important that users have the skills required to make informed decisions.

To this end, for the last five years, ANGIS has been providing its users with a range of educational services. These include courses, teaching manuals and online help. Disadvantages of these educational activities are that they are only available to limited audiences (courses), associate additional costs (courses, books), and require a significant investment of time which many scientists are unable to reconcile with the daily demands of practising laboratory-based molecular biology. Furthermore, detailed knowledge gained at courses tends to be most effectively retained by scientists by continual use of the service (which is often not necessary when doing molecular biology). A more effective (and time efficient) means of facilitating the learning of bioinformatics skills may be to teach the use of software and appropriate analytical decision making at the time of doing an actual analysis.

These issues are being addressed by the creation of on-line protocols describing commonly used sequence analysis procedures in step-by-step fashion. A protocol describes which programs to use, together with explanations of the program function and guidelines for the interpretation of the program outputs.

The protocols are accessed through the WWW as clickable image maps. In order to facilitate comprehension by users, these maps represent flowcharts modelled on the biochemical pathways notation familiar to most biologists. These flowcharts clearly identify the type of file required as program input, the program name and the type of output files created (in place of the chemicals and biochemical reactions of a biochemical pathway). The program name itself is a hypertext link launching the program in another WWW browser window. This allows the user to carry out the analysis with the protocol still visible. Information on the input and output files is also available by clicking on the relevant icons in the flowchart.

The flowcharts may also include 'decision boxes' that represent a decision made by the user when examining a program output, for example whether the output is of sufficient quality to warrant further analysis or whether it should be refined first using a different approach. These decision boxes are hyperlinked to guidelines for the interpretation of the output and other information required for making a decision. In some cases protocols may also contain steps representing manual intervention by the user, for example editing a file using a text editor, or using a non-WebANGIS drawing program to refine the final program output into a publication-quality figure.

Most protocols have been broken down into a collection of sub-protocols, or modules, as the complexity of most bioinformatics protocols results in very large flowcharts. These are sub-optimal since they are unsuitable for displaying on the WWW and are confusing for users. Collapsing a protocol into modules facilitates the display of a simple and clear overview of the entire protocol, which all fits on one page. Clicking on one of the icons representing a module displays the flowchart for the corresponding sub-protocol. This approach is suitably economical since it allows modules to be re-used in a range of different protocols.

Protocols are initially designed by ANGIS scientific staff, often in collaboration with expert biologists. The protocols are then drawn using the flowcharting program **visual thought**. One of the outputs from **visual thought** is a text file describing the flowchart in a LISP-like logic computer language, which can be processed by other computer programs. This output file is entered into an ANGIS-developed program, which creates the clickable image map automatically and inserts most of the relevant hyperlinks. This approach allows protocols to be created and modified with minimum intervention, and also maintains consistency of format between different protocols.

At the current stage of development, the initial protocols are being implemented. These include methods for molecular phylogeny, data collection, multiple sequence alignment, the design of PCR primers from a group of related sequences, and three dimensional structure prediction from protein sequences. The next step involves recruiting a number of expert users to test these protocols. Further protocols will then be developed, ideally including all of the programs available in WebANGIS in at least one protocol. These protocols may then be used for research or for *in silico* practicals teaching the basics of bioinformatics analysis to undergraduate students. It is hoped that scientists will eventually be able to create and save their own custom protocols for re-use, and ultimately, that protocols can be refined sufficiently for integration into automatic sequence analysis programs for the processing of large amounts of sequence data such as those produced by genome sequencing projects.

Web address: <http://www.angis.org.au/>

Learning Dialogues Using the World Wide Web

David Green, Department of Applied Physics
University of Technology, Sydney
dcg@phys.uts.edu.au

Background

The use of interactive techniques such as asynchronous discussion groups, and synchronous chatrooms is beginning to fill an important part of online learning strategies in University courses. The potential of online methods in the teaching of advanced science concepts has been realised, and is most effective when the strategies employed to involve students are well designed¹. In this paper I describe an implementation of the “learning dialogues” concept as part of a teaching strategy in a second year physics for engineers subject.

Web Based Teaching System

Although the main emphasis of this paper is the use of a web based system for enhancing flexibility and student learning, the generic aspects of the system used for this work need describing. A hybrid web based teaching system² was purpose built from freely available software running under the Linux (a unix-like operating system for personal computers)³. The main components of each website fall broadly into four categories:

- digital *resources* (notes/multimedia/solutions/hints);
- interaction* facilities (email/virtual tutors/newsgroup/chat);
- administration* functions (scores/student profiles/assessment tasks); and
- other *virtual* spaces (links out/web gallery/diagnostic test centre).

Students and staff need to be registered and each subject/group website is protected by server *htaccess* control. In so doing, it is intended that a web space is created that is equivalent to a face to face class, in so far as opinions and misconceptions expressed by individuals would remain within the group. The UTS student identification number, though somewhat impersonal, provides a unique 8-character username. Passwords must be http compliant.

The newsgroup software (*HyperNews*) supports multiple threading and indentation of responses and a variety of modes for the addition of messages including a simple to use “smart text” as well as hypertext markup language. Newsgroup discussions can be established in one of three categories:

- Staff owned (assessible discussion groups started by the teacher);
- Staff and students Zone (discussions on any topic, started by anyone); and
- Staff free zone (discussions between students in absence of staff).

Proprietary systems such as *WebCT*, *TopClass*, *WCB* can now provide many of these features with increasing flexibility and reliability.

Students’ profile and virtual Physics Learning Centre

As part of the registration for the web site students were asked to complete an online survey. The survey was aimed at gauging their confidence and experience with using web based technologies, as well as the nature of their access to it and any concerns they might have about web based teaching.

The profile of the students has been an ever-changing one. The data collected represents a snapshot in autumn 1998 from a sample of $N > 175$ students:

On campus full time (ie. greater than half load)	84 %
Have remote access (work or home)	57 %
Engineering students studying physics	81 %
Fraction of part-time students <i>with</i> remote access	78 %

Students' perception of their experience with internet technologies was measured using a 3 point Likert scale. As can be seen in Figure 1, nearly all respondents claimed some experience in the core technologies of WWW, email and search engines. The majority of students however were not so experienced with email listservers and computer mediated discussion. (Care was taken to explain the meaning of these terms in the survey form). Students' confidence with these technologies was also probed. The student responses however showed that in excess of 50% of respondents claimed to be very confident in the use of the core internet technologies. Approximately 20% described themselves as not confident, but few described themselves as being worried about using the web.

Open feedback was also sought about any concerns they had at outset:

It's going to make the course &/or assignments more difficult than usual.

I've only used the internet for fun so far, & I'm a bit hesitant about using it for coursework.

I attend uni on ... only & I find using the web etc very time consuming.

Call me old fashioned, however I prefer to learn from a human being.

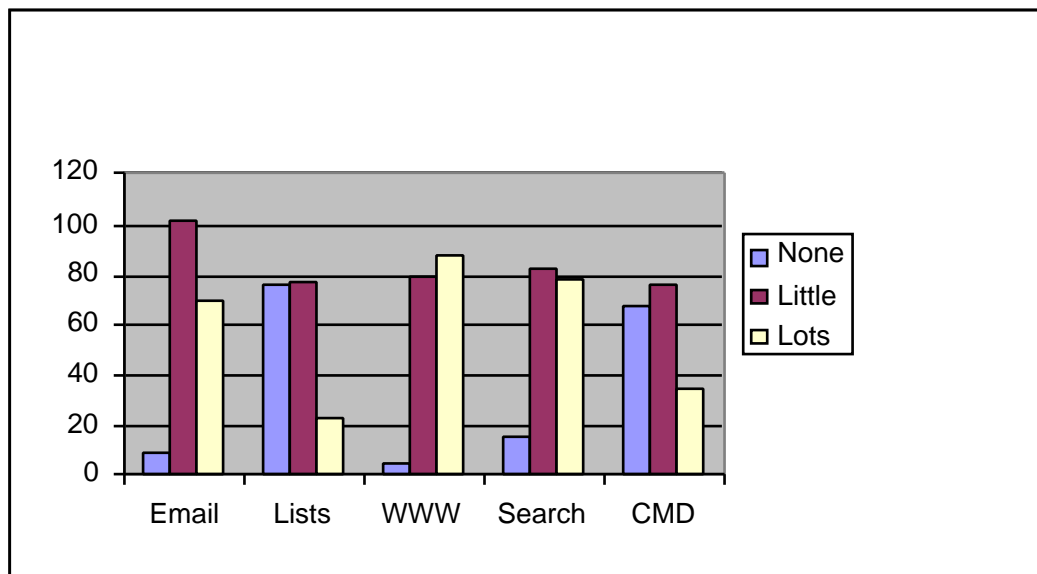


Figure 1. Students' ratings of their experience with Internet technologies.
Lists=Listservers, Search=Search Engines, CMD=Computer mediated discussion

The majority of the students surveyed are registrants for the Virtual Physics Learning Centre (vPLC). Involvement in the vPLC is completely voluntary for students and staff. Greater than half the eligible students and a quarter of staff are registered. The website has the same generic structure as that described above, however the main emphases of it are:

- to provide equity across different strands of the same, new first year subject;
- to provide an avenue for timely updates, help (v-tutoring) and advice; and
- to facilitate some self-help online diagnostics & provide interaction with staff and fellow students.

Learning Dialogues

The use of web based computer mediated discussion has been trialled and developed over several years. This work has its origins in the many emails to and from students that were often on administrative and time management (a polite term for begging for extensions on assignments) issues, and which not surprisingly increased in frequency near to the final examination period. Amongst this correspondence were genuine attempts on the part of students to formulate mature questions, and to provide reasoned “self-answers” inviting comment. The benefit of this *semi-formalised* “thinking aloud” has been recognised as an important attribute of computer mediated discussion.⁴ A strategy has been developed as a way of trying to engage students in dialogues with each other, with the teacher and importantly internally with themselves. A teaching and assessment strategy has been developed that engages students in “thinking aloud”. The asynchronous discussion format provides a flexible and interactive vehicle for this thinking to take place. A small number of key concepts in the subject are dealt with in this way.

The important features of the strategy are:

- open questions as the stimulus (room for interpretation in question & answer);
- exploration of the question can usually take place at several levels;
- each question(module) starts a fresh newsgroup;
- questions are set as as prework for next class (often revision of earlier studies);
- virtual tuition (comments/arguments) from peers or teacher; and
- self review later in semester.

Figure 2 shows schematically the timeline. A module will remain “active” for upto 4 weeks to allow stragglers to complete (commence) the modules. The input from the teacher is shown on the left, feeding in where necessary to ensure discussion proceeds productively. Critical stages have been found to be just after the module stimulus is posted, and at the end, when contributions from students are synthesised into a summary record. To encourage student involvement, the students’ participation in modules is assessed. The weekly activity, amounts to 5% of the subject assessment, and is assessed primarily on participation. To ensure that all students had the opportunity to consider the prework modules prior to class, a computer lab is made available immediately prior to class.

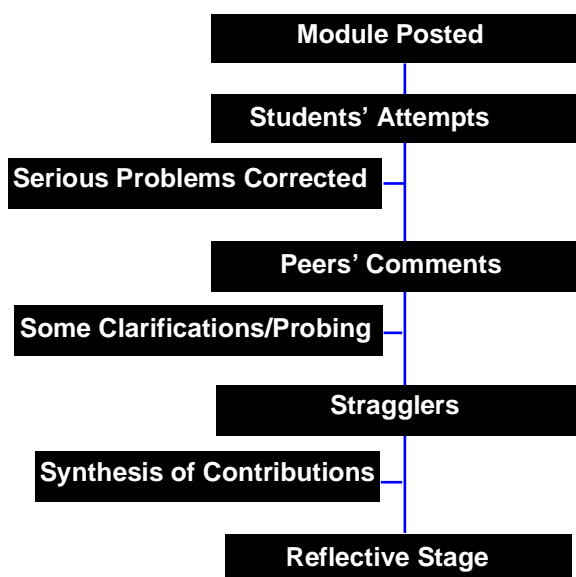


Figure 2. Schematic diagram showing the timeline of a learning dialogues module. The involvement of the teacher at key points in the process is shown as inputs from the left.

A number of implementation issues arose (“Not bugs, ... features”). Although the newsgroup format encourages interaction, a good answer, early in the thread of responses, tends to kill discussion. The role of the online teacher here is to work hard to draw out some broader issues to keep the discussion fuelled. For instance, by seeking clarification from individuals who seem eager to agree with the previous person. In the prototype system, students were not aware of other students responses prior to submitting their own answer. Instead, new responses were incorporated into the newsgroup database using purpose written CGI scripts that returned to the student’s browser, a sample of the previous responses and the invitation to comment. The pros and cons of the two approaches are under review.

The learning dialogues project is still being evaluated and on two levels.

At the technical level, there are questions and issues like:

- Was the newsgroup software easy to use?
- Does the newsgroup and email technology help or hinder?
- Why not just have old-fashioned tutorials?
- Was prework posted early enough to be useful to students?
- Did I underestimate how long students would spend doing the modules?
- Was (remote) access to the internet still an issue for some?
- Is the necessity to express physics in english a barrier to use of technique?
- Analysis of web server statistics is providing a profile of usage.

At another level, there are the intended learning outcomes:

- Do the students feel that the modules helped them understand better?
- Can this understanding be demonstrated using targetted exam questions?
- Were (deliberately vague) comments from the Virtual Tutor helpful?
- Does reflection improve understanding?
- Are learning dialogues really happening?

Endnote

The main emphasis of this paper has been the description of a strategy for incorporation of online discussion for enhancing flexibility and student learning. A snapshot of the everchanging profile of my students involved in web based teaching has been given together with a description of the virtual learning environment that the majority of them are involved in this semester. A specific strategy to engage students in learning dialogues using newsgroup software has been described. Details of evaluation of effectiveness of the latter will take place in a forthcoming publication.

References

- ¹ Taylor, Ed. (1995). *A Different Kind of Mateship*, OzCUPE2 Conference Melbourne.
- ² <http://www.flex.uts.edu.au>
- ³ UTS VCDF Funded Project 1997 *An Integrated Approach to Electronic Mode Flexible Learning*
- ⁴ Laurillard, Diana. (1993) *Rethinking University Teaching: A framework for the effective Use of Educational Technology*, Routledge London (p104)



ActivPhysics and ActivPad

— an Innovative "Webway" of Packaging and Delivering Physics

Suzanne Hogg, Department of Applied Physics, University of Technology, Sydney
Rosemary Penman, Addison-Wesley Longman, Sydney
sue@phys.uts.edu.au

General Introduction

Information technology has expanded at such a rate that the amount of material available to the would-be user is overwhelming. Scientific publishers have joined the enthusiastic providers of information in this form and are producing some excellent material. At the same time there is much which is being trialled which is proving to be not effective and is being abandoned for more successful modes of presentation. Two key factors in the success or lack of success in this endeavour are:

- ease of navigation for the user; and
- value of content.

Suzanne as the active lecturer/presenter has been interested in making use of the wealth of materials provided by various publishers and as such has trialled a large number of packages. She also uses some of her own software development in her regular classes and incorporates many scientific packages not only in lectures but also in hands-on laboratory sessions for the students.

This interest in publisher materials brought her into contact with Rosemary who was introducing the new package of *ActivPhysics* in association with her marketing of the University Physics book by Young & Freedman, though the product accesses material from a range of textbooks. This, then, is the third key feature of *ActivPhysics* to be discussed in this paper encouraging exploration beyond the product.

Using *ActivPhysics* and *ActivPad*

The paper is a real illustration of the use of the product(s) themselves in:

- planning a lecture/presentation;
- searching for material appropriate to the lecture;
- overviewing the balance of the material;
- making the presentation; and
- leaving notes for the students to review the material presented.

ActivPhysics

Philosophy behind the package

ActivPhysics is a physics reference package with all of the standard materials available in a textbook:

- theory;
- formulae;
- applications;
- examples; and
- exercises with answers.

Added to this are the features able to be included because of computer technology:

- real-life video clips;

- friendly “talking heads”; and
- simulations with variable parameters.

Added also are the special features of THIS package:

- references to a variety of textbooks;
- simultaneous access to web materials; and
- notetaking /link collecting features of *ActivPad*.

Examples of this might be the included “Balloonist Drops Lemonade” problem from Young & Freedman which has variations in many other texts. The initial simulation picturing the rising balloon and dropping object is able to be further enhanced if more explanation is needed by a more detailed simulation showing velocity and acceleration vectors at each point in the motion.

Practice and Preparation Time Needed

But not all examples included are so valuable. Some take a long time to fire up — and then spend far too long doing nothing interesting so that both lecturer and students become irritated. For this reason it is essential that the lecturer spends time going through the provided material before referring the students to it. This again highlights the value of *ActivPad* for recording worthwhile material when found.

ActivPad

Philosophy behind the package

ActivPad sits open on the desktop while *ActivPhysics* is in use. It is of value to the student in private notetaking but it is seen as having its greatest benefit for the lecturer in:

- preparing a lecture plan;
- ordering the material;
- searching the *ActivPhysics* for relevant material for inclusion in the lecture — links to *ActivPhysics* are “grabbed” and included in *ActivPad*;
- adding in active links to other material relevant to the lecture;
- live links are “grabbed” for inclusion; and
- running the lecture presentation with a minimum of anxiety of accessing so many links.

Alternative Paths

Because of the ease of links inclusion it is possible to prepare alternative paths depending on the audience reaction to the material.

Student Summary

At the conclusion of the lecture the lecturer may provide the *ActivPad* material as an excellent summary of the material presented, leaving it to the student to access which ever parts of the web material they would like to explore more.

Local Files in case of problems

The brave and daring will be thrilled at the ease of preparing quite exciting and stimulating presentations in this fashion. The more cautious — more experienced — presenters will make sure that, even if the net goes down at the critical time, that a second *ActivPad* file is prepared with alternative, local files downloaded for the entire presentation.




Sample Lecture Material on Waves - in *ActivPad* Format

General Introduction

 UniServe Science - Web Workshop
<http://science.uniserve.edu.au/su/SCH/other/webwshop.html>

..... Sue's reference on the web


 UTS Department of Applied Physics - People
<http://www.phys.uts.edu.au/physics/physpeop.htm>

- publishers producing great material
- how to get the students/lecturers to use them
- Key feature - NAVIGATION familiarity
- encouraging exploration BEYOND the product
- this paper - WHERE ELSE - ON THE WEB

 SWH.html
<http://www.phys.uts.edu.au/~sue/SWH.html>

ActivPhysics

- Philosophy
- Books
- Demo

 Describing Motion: 1.7 Balloonist Drops Lemonade
<file:///ActivPhysics%201/Media/DescribingMotion/BalloonistDropsLemonade/Main.html>

- Not all good experiences - need to prepare first


 Describing Motion: 1.8 Seat Belts Save Lives
<file:///ActivPhysics%201/Media/DescribingMotion/SeatBeltsSaveLives/Main.html>

ActivPad


- Philosophy
- Lecturer use
 - outline format for preparation
 - test order
 - reference click-on list
 - foundation + extras balance
 - alternative paths
- Student use - lecture summaries with references i.e. THIS document

Demo Preparation

- Wave Theory

 Waves: 10.1 Properties of Mechanical Waves
<file:///ActivPhysics%201/Media/Waves/PropertiesMechWaves/Main.html>

- Waves not restricted to Regular Waves

 Waves: 10.10 Complex Waves: Fourier Analysis
<file:///ActivPhysics%201/Media/Waves/CompWavesFourierAnal/Main.html>

Prepared Presentation

Pitch Perception

- Alternative Routes
 - What is pitch anyway?

 Shepard Scales
<http://www.music.mcgill.ca/auditory/shepscal.html>

- If on the other hand the audience might be interested in whale sounds
- Instead of simulation, what about some real sounds - e.g. whales
- whales

 Sounds of Oceania
<http://www.oceania.org/sounds/>

- Local Files in case of problems