WEB-BASED DELIVERY OF COURSEWARE, TUTORIALS AND ASSESSMENT WITH WebOL

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Abstract

A role for computer-based assessment in support of learning is well established. There are various software packages that enable the construction of computerbased assessments and many of these enable delivery through the World Wide Web. However, many of these packages have disadvantages such as (i) being restricted to use solely through the World Wide Web, (ii) being restricted to solely producing assessments, (iii) having a restricted range of question styles, (iv) being difficult to install, particularly for inexperienced users and (v) being difficult to use. WebOL attempts to provide a package that addresses these issues. It is easy and quick to use through completion of fill-in forms for a wide range of question styles; can produce lecture style courseware, tutorials and assessments and can be delivered through a variety of media such as the World Wide Web, LANs, CD-ROMs and floppy discs. The information that is displayed to the user is easily customised when designing a project. The system makes it easy to reuse questions and web pages to produce interrelated projects. The basic formatting enhancements are available and additional materials such as video and animations can be included in questions. Indeed any type of web page component can be added either within WebOL or through a web editor.

Introduction

Computer-based assessments (CBA) can be formative or summative. This paper will focus on formative assessments and courseware but some of the comments will also apply to summative assessments. The various reasons for using CBA such as to automate marking and to link teaching and assessment have been discussed elsewhere, for example by George Brown et al (Brown, Bull & Pendlebury, 1997a). It may be anticipated that most modern CBA systems will enable delivery through the World Wide Web. This reflects its great reach, its presence in educational institutions and the availability of free browsers. To construct an assessment you need to create some questions, to package them together to make the assessment and enable its delivery to the users. There are various software packages available that enable the construction of assessments and may also enable their distribution

and management. Some systems were outlined by George Brown et al (Brown, Bull & Pendlebury, 1997a) and The Computer Assisted Assessment Centre (http://caacentre.ac.uk/onlres4.shtml) provides a summary of some of the main software packages available. Some software packages such as WebCT (http://www.webct.com) and Blackboard (http://www.blackboard.com) are enterprise solutions that include elements of assessment management. Some of these systems have significant limitations inherent in their design such as (i) systems designed as enterprise solutions that cannot be installed by individual users, (ii) systems with limitations in terms of distribution media, (iii) systems that use proprietary or system specific software and (iv) others that only allow the construction of assessments not other materials. Some do not appear to be userfriendly in terms of how questions are constructed or how the system is installed. The purpose in designing WebOL (http:// www.luton.ac.uk/biology/webol) was to produce a system that was (i) able to produce a range of courseware materials based on web pages; (ii) a small simple system that was quick and easy to use by an individual though could be run at an enterprise level; (iii) a system that was based on standards and (iv) one that could be run from a variety of media.

Question Styles

Most assessment systems enable the construction of a range of question styles in order to enable appropriate styles to be used for topics and to enable good practice that encourages the use of a variety of question styles. WebOL includes all of the main styles:

- (1) radio buttons associated with text or images
- (2) check boxes associated with text or images
- (3) text input as single words/short phrases or the use of larger text areas
- (4) numeric input
- (5) zone selection of images or part of an image or a location from an X/Y grid
- (6) matching of text to text or text to images
- (7) ranking text options

Although WebOL provides a basic layout for questions it will not ensure good question design, that is in the hands of the designer. In order to achieve good designs for questions it is essential that question designers have some staff development in this area or that they read appropriate literature. Some useful articles are by Norma Pritchett (Pritchett, 1999), by Susan Case & David Swanson (Case & Swanson, 1998) and by George Brown et al (Brown, Bull & Pendlebury, 1997b).

All questions can include additional components such as sound, video, java applets, images and animations to support or provide a basis for a question.

Formative Assessment

Formative assessments are designed to aid learning. This can be done in a variety of ways, for example setting essays that are marked and provide feedback.

However, topics which can be assessed by essays can commonly also be assessed through the styles of questions available with CBA. Formative assessment can be more difficult for some aspects of courses such as practical work, particularly if this relates to practical work that has not been undertaken. Such learning may be supported by data interpretation exercises but paper based exercises cannot address issues that are dependent on running the practical. However, through the use of computer-based simulations practical components can also be assessed through CBA. Formative assessment can be used to enable students to feel involved in the learning process, to check on their progress and to practice for summative assessment. The issues involved with computer-based formative assessment have been discussed previously for example by Dan Charman (Charman, 1999) and by Leith Sly & Léonie Rennie (Sly & Rennie, 1999). There are various reports of effective use of formative assessment for example by Kay Sambell et al (Sambell, Sambell & Sexton, 1999). However, there can be problems with CAL. Some of these have been summarised by Graham Parslow (Parslow, 1997) and mainly reflect poor design and implementation. Basic good design rules for the use of fonts, colour, etc. should be observed when constructing materials. Guideline are available from the web. for example at the collection at http://usableweb.com or by Tom Arah (Arah. 2001) and in the literature for example by Jakob Nielsen (Nielsen, 2000). WebOL attempts to incorporate these into the default formatting for the web pages it generates. Implementation should ensure that the assessments fits into the delivery of the curriculum, that access to the materials is not restricted and that the assessment is undertaken in a suitable environment.

Getting started with formative CBA

Three factors that can limit the introduction of formative CBA are (i) time to construct the assessments & support materials; (ii) the availability of easy to use software tools, and (iii) support by the institution.

Software tools that have a steep "learning curve" or are difficult to use can be seen as contributing to the construction time factor. Similarly software that generates materials that cannot easily be re-used in alternative ways increases the time to produce interrelated materials and revised versions of a project. Commercial software provided by an institution may not be readily available to staff due to cost or licensing arrangements. The institution may provide support for the delivery of assessments but this may be directed at summative rather than formative assessments. Software that is complex to use requires support for its implementation. An institution may not provide support or support may not be readily available.

WebOL attempts to address these issues. The software does not have a steep learning curve. There is very little that is hidden from the user behind arrays of menus. At a workshop at ASE 2001 participants with no previous experience of WebOL were able to construct a project containing a few questions in under one hour. Questions and Web pages within a project can easily be utilised in other projects. It is possible to convert between tutorial style and self-assessment style projects in a few seconds. The software is free and can be easily obtained and installed by an individual user or by an institution. WebOL is designed to be easy to use and has built in help so that it does not require any formal support from an institution. An exception is when projects are to be delivered over the internet or a local area network (LAN) when the project files will need to be put on an internet or LAN server respectively. However, WebOL simplifies this task through maintaining all of the files for a project in one directory ready for distribution.

Flexibility

It is not possible to foresee clearly how assessment materials will be used beyond the initial project. It is therefore necessary where at all possible that the materials should be flexible so that they can respond to future scenarios. Assessment projects need to be flexible in a number of ways (i) able to use the questions and other web pages in a variety of different projects, (ii) run on a variety of target platforms and (iii) be distributed through a variety of media.

Navigation between web pages is commonly undertaken by constructing a hyperlink in a web page that enables the user to move to another page. For navigating between questions in assessments (or other courseware) this is not suitable since although the guestions are arranged serially they may be required to be delivered in random order and it would prevent the reuse of the web pages in other projects. The navigation through WebOL projects does not involve links in the web pages. This means the questions produced by WebOL can be liked into any number of projects and can be rearranged within a project without any alteration. The questions and projects are based on HTML 3.2 (World Wide Web Consortium, 1997) and JavaScript 1.1 (Netscape, 1996) and do not contain any features specific to a browser or to an internet server. All of the questions can be edited in any text editor or web-editor. These features ensure the projects will run on any PC that has a browser that supports these specifications such as Netscape Communicator v4.0 or greater. Internet Explorer v4.0 or greater and Opera v4.0 or greater. Browsers of this specification are freely available for all major PC operating systems making the delivery of the WebOL projects platform independent. For delivery over the Internet the projects are independent of the operating system or server software on the internet server. For formative assessments WebOL does not require any scripts to run on the internet server.

Assessment systems based on web pages are inherently flexible in their delivery options if they are not constrained. Constraints can appear by requiring web-serverbased components such as cgi scripts, active server pages and server-side databases. The presence of such components limits delivery to the web. In many instances this may be adequate. However courses may develop and be delivered by distance learning perhaps internationally where internet access cannot be guaranteed. The ability to transfer materials to other media such as CD-ROM may become essential. WebOL is designed with this flexibility in mind so that WebOL projects will remain compatible with future developments in the delivery of courses.

Although WebOL is primarily designed to create assessments it can also be used to create lecture style courseware based on web pages. Assuming the web pages used for the courseware do not contain any of the constraints discussed above the resulting courseware will have all of the flexibility described for WebOL

assessments. The materials used for such courseware can be reused in tutorial assessments as the support pages to which users are directed when they give incorrect answers. Also courseware, i.e. non-question web pages, can be mixed with questions in tutorials or self-assessments.

WebOL - Development Environment

Although WebOL generates web pages and JavaScript files the user requires no knowledge of HTML or JavaScript. The original version of WebOL that was presented at CUBE 98 (Harper, 1998) included all of the aspects described above but was based on template files which could be edited to create questions and projects. This was not sufficiently user-friendly and versions have been developed that simply involve the completion of forms. This software for constructing questions, web pages and projects only runs on Microsoft Windows based PC systems, though as discussed above the output is platform independent. Questions are created in a Question Development Environment (QDE) containing 2 forms. One form is where the question and answers are set and is unique to the question style, e.g. a text based radio button (fig. 1). The other is common to all questions (fig. 2). This sets support files, the cognitive ability assessed by the question according to Bloom's Taxonomy (Bloom, 1972), the level of the question and enables project values (see (iv) below) for the marking of questions to be over-ridden. A project is then constructed by completing 4 forms: (i) Name/Type/Files; (ii) Navigation; (iii) Display and (iv) Set marks. At any time questions and projects can be previewed to see the effects of changes. All resources for the project or series of related projects are maintained in a single directory that should be copied to the delivery media (removable disc or server) on completion. The project(s) can then be run from a browser by opening the start-up page (or URL) created by the software.

😢 Question: text_radio.htm	_ 🗆 🗵
Question _Answers Information	
The Question:	
A question	
Add Answer Options:	Set Correct
answerl	C Correct
answer2	Correct

Figure 1: Question & Answers Form

🗐 Question: text_radio.woq
Question + Answers Information
Topic: testing
The of the conference
Set Marks: Image, Video, etc
Correct: 1 - Incorrect: 0 - AttemptAdjust: 1 - 1
nosuport htm BeSize Width: 300 Height: 200
Set Hint:
None ReSize Width: 300 Height: 200
Cognition: Level:

Figure 2: Information Form

The types of project that can be constructed are Lecture, Self-Assessment and Tutorial. A "Lecture" is a series of web pages. These may have branching links to other pages as necessary beyond the basic spine of pages. A "Self-Assessment" is a series of questions, possible interleaved with other web pages. The page shows a "Mark This Question" button and responds with "Correct" or "Incorrect" and indicates any spelling errors where appropriate. The page can also update relevant information on progress such as the mark scored for the question, the number of attempts and the total correct scores. In order to provide feedback, on reaching a maximum number of allowed attempts the correct answer may be displayed. On finishing the whole assessment the overall score is shown. A "Tutorial" is as described for "Self Assessment" except the mark scored for the question is not shown for the individual questions and in response to incorrect attempts supporting pages can be shown. These pages should be designed to help the student understand the topic and answer the question. They may form part of a "Lecture" on the topic. The focus in a tutorial is more on support and less on assessment. Most of the information that can be displayed and the types of responses can be customised when designing the project.

WebOL - Limitations

Questions designed in WebOL by default have minimal formatting - the answer options are centre aligned and for text given a suitable font and size. The latter is editable through a cascading style sheet so that all of the questions in a project will look the same. Some formatting enhancements can be added within the WebOL QDE such as line breaks, paragraphs, fonts, colours & alignment. Tables can be inserted to aid formatting. However, a purpose of WebOL is to shield the user from HTML and to have a short learning curve so these facilities have been kept minimal. Users who want additional formatting options must use a web editor. It is a facet of the flexibility of WebOL that all of the web pages generated can be edited in web editors. WebOL includes a simple text based web editor to aid formatting questions and to enable the construction of supporting web pages.

Some advanced features available in browsers are proprietary and are not generated by WebOL. Some features of DHTML can be added in the web editor, however these are based on browser independent routines. Other advanced features such as "Flash" animations can be added to pages. However, pages modified in this way require the browser to have an appropriate "plugin" and cannot be guaranteed to work. It should be noted that enhanced multimedia interactivity does not necessarily result in improved learning and that simple well designed CAL can be effective (Parslow, 1999).

WebOL does not contain any features for the recording of assessment results at the enterprise level.

Conclusions

Formative assessment is a valuable tool to support learning. CBL can provide an avenue to deliver formative assessments and other learning environments. The ubiquitous availability of browsers makes materials based on web pages effective universal delivery vehicles. Various software packages are available to enable the construction of such courseware. WebOL provides a free, flexible, customisable and easy to use entry into the construction of web-based assessments and courseware.

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