

WEB-BASED SURVEYS AND ASSESSMENT

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ABSTRACT

This paper describes methods of on-line assessment and students' survey, which utilize the Web interfaces and use them in conjunction with the Internet. To find the most appropriate alternative methods of students' assessment and survey a variety of commercial and public domain tools was used to implement the following two basic tasks:

1. *'Student Suggestion Box' where students evaluate the subject and make comments and suggestions on the subject and its assessment; and*
2. *a partially AutoMark short assessment task, containing two paragraph questions and three multiple choice questions, that offers final marks to the instructor/students and provides prompt feedback for wrong or partially wrong answers to students.*

Two commercial packages, two major Web-based course-building environments, and a locally developed server and client side programs were used to implement the above mentioned pre-defined tasks.

This paper shows sample results obtained from each, and illustrates the result of a comparison that was made in terms of the ease of setting up the assessment/survey task from the instructor point of view, the program installation and maintenance as well as its hardware/software requirements, and the type of learning environment that the program creates from students' view points. New additions and future improvement to these implementations will be dealt with in some detail.

KEY WORDS

Assessment, survey, web, dynamic, interactive.

1. INTRODUCTION

The World Wide Web has provided higher education institutions with a potentially effective medium to distribute course materials over the Internet. The new and emerging Web related educational technologies that were introduced in the last couple of years have made it possible to create and publish dynamic and interactive educational courseware for network delivery. This is a radical departure from the use of the Web for just delivering information as it has been seen in a vast majority of educational Web pages in the last few years.

There are two processes that are central to the successful provision of quality educational courses at the tertiary level. They are student evaluations and students surveys. While the purpose served by each of them is quite different, from an educational technology point-of-

view, their functionality is very similar. A web-based utility that is constructed to act as a survey instrument can readily be adapted to act in a quite different capacity as an evaluation instrument. In this paper we will examine some of the aspects of this functionality.

Server and client side computer programming provide a wide variety of features that can be added to a Web-based educational environment. Students using a freely available Web browser as the only required software tool then can retrieve the resulting educational materials. These features not only offer an enhanced information delivery mechanism but also provide student-instructor and student-student communications, student progress tracking, student self-evaluation, auto-marked tutorial questions, timed on-line quizzes/tests, and students' survey.

To find the most appropriate alternative methods of students' assessment and survey a variety of commercial and public domain tools was used to implement a specified task. This paper shows the result obtained and draws a comparison between tools in terms of the ease of setting up the assessment/survey task from the instructor point of view, the program installation and maintenance as well as its hardware/software requirements from the instructor and computer system administrator view points, and the type of learning environment that the program creates from students' view points.

This paper also provides some background information on tools and methods that make the Web a dynamic environment with some degree of interactive richness. Examples of Java, JavaScript and Common Gateway Interface (CGI) programming are shown and their educational implications are discussed. The main focus, however, is to illustrate the effectiveness of a properly designed Web environment when it is used to assess students and to collect their feedback and suggestions on the subject.

1.1 ASSESSMENT AND SURVEY: COMMON PROGRAMMING REQUIREMENTS

The World Wide Web operates in a client-server system. This is a network architecture in which each computer on the network is either a client or a server. Servers are powerful computers dedicated to managing disk drives (file servers), printers (print servers), or network traffic (network servers). Clients are PCs or workstations on which users run applications. Clients rely on servers for resources, such as files, devices, and even processing power. CGI scripts are server-side applications because they run on the Web server. In contrast, JavaScript scripts are client-side because the Web browser (the client) executes them. Java applets can be either server-side or client-side depending on which computer (the server or the client) executes them. From the computer network viewpoint there is not much difference between running a survey program or running an online assessment program. In both cases either a server side or a client side program is executed to accomplish the task.

The most commonly used programming languages for Web-based assessment and Web-based surveys are Java, JavaScript and Common Gateway Interface (CGI). They can be used to fulfill a variety of educational purposes for development of pedagogically useful course materials. The most common applications being the handling of FORM requests, on-line assessment and survey and submission of assignments and other assessable tasks for HTTP servers.

1.1.1 Java

Java is a general purpose programming language with a number of features that make the language well suited for use on the World Wide Web. Small Java applications are called Java applets and can be downloaded from a Web server and run on your computer by a Java-compatible Web browser, such as Netscape Navigator or Microsoft Internet Explorer.

1.1.2 JavaScript

JavaScript is a scripting language developed by Netscape to enable Web authors to design interactive sites. Although it shares many of the features and structures of the full Java language, it was developed independently. JavaScript can interact with HyperText Markup Language

(HTML) source code, enabling Web authors to spice up their sites with dynamic content. JavaScript is endorsed by a number of software companies and is an open language that anyone can use without purchasing a license. It is supported by recent browsers from Netscape and Microsoft, though Internet Explorer supports only a subset, which Microsoft calls Jscript.

1.1.3 Common Gateway Interface

The Common Gateway Interface permits interactivity between a client and a host operating system through the World Wide Web via the HyperText Transfer Protocol (HTTP). It's a standard for external gateway programs to interface with information systems, such as Web or database servers. A plain HTML document that the Web server delivers is static, which means it does not change. A CGI program, on the other hand, is executed in real-time, so that it can output dynamic information such as online generation of a survey form, display of survey results, quiz statistics, or the latest results from a database query.

2. STUDENT SURVEY

A survey conducted at the University of Wollongong showed a very basic Web-based student survey is currently utilised in only a few Australian tertiary educational systems (Hood, 1998).

The results indicated that:

- The web sites that exist are specifically designed for that University and only outline the procedures and recommendations for that University.
- The web is generally, at present, just a means of communicating administrative information.
- In some cases, the application forms for evaluation questionnaires are available via the web, but the actual evaluations are still sourced on paper forms centrally.
- Very few are using the web to distribute evaluations and collate the data, although some have made tentative moves in this area.

2.1 SURVEY USING TOPCLASS

TopClass is an easy-to-use content, learning and communication management system. TopClass server is a client/server application that runs over TCP/IP networks such as the Internet, a campus local area network (LAN), or an Intranet. Because TopClass uses the Internet or Intranets, courses must be contained in a web deliverable format, such as HTML, Java, or JavaScript. TopClass stores all information on users and courses on a central server. Students, instructors and administrators can access that server from anywhere on the network using a standard Web browser.

The attempt to utilise TopClass as a survey instrument is illustrated in Figure 1. While the appearance is fine, there are some difficulties with using TopClass for this purpose, as it appears that it not designed for the purpose of conducting student's survey.

The first problem is that the evaluation cannot easily be done anonymously, as there is a log-in process that identifies the submitter. Nor is there any apparent way of creating a 'generic student' account that would allow multiple students to log into and submit the form many times over. Another problem with using TopClass in this way is that it is not the easiest program to use to construct questionnaires. Each question and each response has to be entered separately by hand - there doesn't seem to be an obvious way to automate the process. In a complex system where there may be hundreds or thousands of questions in the question bank, this would be an unenviably tedious task. Finally, TopClass does not collate the responses in any meaningful way and this would be a major drawback to the evaluation process.

Netscape: Student Survey #1

Back Forward Home Edit Reload Images Print Find Stop

Number to be done 5
The purpose of this questionnaire is to provide the teacher of this subject with feedback about their teaching effectiveness.

Question 1
The teacher is well prepared for this subject.
 Strongly agree Agree Mildly agree Disagree Strongly disagree

Question 2
The teacher presents the subject matter clearly.
 Strongly agree Agree Mildly agree Mildly disagree Strongly disagree

Question 3
The teacher organises and sequences the subject matter well.
 Strongly agree Agree Mildly agree Mildly disagree Disagree

Question 4
The teacher presents an appropriate amount of material for the time available.
 Strongly agree Agree Mildly agree Mildly disagree Strongly disagree

Question 5
This teacher stimulates me to think about the subject.
 Strongly agree Agree Mildly disagree Disagree Strongly disagree

Figure 1: Sample Survey using TopClass

2.2 SURVEY USING WEBCT

The WebCT course development tool is a full featured product currently shipping and usable under the UNIX operating system with fairly easy to use interface, good technical support, and strong pedagogical components.

The Web Course Tool (WebCT) allows students survey implementation as it provides anonymous survey responses that means students are not identified with their responses, but are instead assigned an ID number. WebCT allows the instructor to view the list of students who have completed the survey. However, a particular survey cannot be linked to an individual student, as survey responses are anonymous.

WebCT was used to compile a new survey, edit an existing survey and view the survey results. It also allows weights to be assigned for each response so that the overall survey results are presented in tabular or graphical formats. For a test survey implemented here the following weights were assigned: 6% for 'strongly agree' and 1% for 'strongly disagree'. Other possible answers: agree, slightly agree, slightly disagree and disagree have 5%, 4%, 3% and 2% respectively. Figure 2 shows a screen capture of questions in the survey form, and Figure 3 illustrates the survey results in a tabular format.

Figure 2: WebCT sample survey form

Title	N	Response Frequencies							Mean	SD
		-	1	2	3	4	5	6		
Contents	6	0	1	3	1	0	1	0	2.50	1.38
Delivery	6	0	0	0	3	0	1	2	4.33	1.51
Subject	6	0	1	1	0	3	1	0	3.33	1.51

Figure 3: WebCT sample survey results

2.3 STUDENT SURVEY USING LOCALLY DEVELOPED CGI SCRIPT

A Web-based students survey was created using a modified version of a public domain CGI program. This survey allows students' input from a Web browser to be stored in two secure files. These files are accessible by the relevant staff member. In a sample included here, students also are given permission to browse the most updated ratings (marks) and comments. The student survey:

- reads student's number from a text file extracted from the subject enrollment form.
- compares student's ID number with the enrollment form, and allows submission for enrolled students,
- creates two files showing ratings and student comments and suggestions,
- calculates average mark associated with each question,
- makes two generated files available on the Web for everyone including student inspection (this can be disabled if the staff member does not like the idea).

2.3.1 Further Improvements

A very realistic scenario for a web-based teaching survey comprises the following components. A database of questions as an integral piece of the web-survey application and a good database management system allowing staff members to access the database, choose their questions and perhaps edit and/or design new questions. The system then will deliver the end result in whatever format the staff member desires (hardcopy, word document, PDF form, html form, etc.).

Alternatively, the survey form can be generated on the fly using dynamic capabilities of modern Web environment and server/client side programs. The system can be made fully password protected where student name and ID number are checked against the subject enrollment form. The survey results are saved in a secure place on the server for final computation and statistical manipulation. There are many programs available that do the computation. A CGI script is written to automate the operation.

The full implementation of a web-gateway for the whole process is technically possible with a high degree of security now. This will involve extensive programming tasks and lengthy testing and debugging periods.

The following features are incorporated into the new release of the Student survey:

- A staff member generates a Web page containing his/her own choices of questions and feedback windows through a web interface. The page contains selected questions from the question bank (whatever number) and selected windows for comments, starting day/time of the survey and its finishing time/day.
- A secure entry stage where student ID number and name are checked against latest enrollment form for a given subject.
- Provision for stopping students from filling out the form more than once.
- Graphical presentation of survey results: average and standard deviation for each question, and overall presentation of rates in graphical and tabular format with appropriate color coding.

3. WEB-BASED STUDENT ASSESSMENT

Testing and assessment remain an integral part of instructional systems design for traditional classroom based courses as well as web based training courses. Assessment is part of the learning process that also helps to determine if learning objectives have been accomplished. A well designed assessment task not only helps students assess their level of knowledge of course material but also gives the instructor a better idea of what students are understanding as well as the concepts that still need clarification.

There is a variety of Web-based courseware authoring tools that have inbuilt assessment modules. Examples include the Web Course Tools (WebCT) and TopClass. Two alternative methods available for online testing that employ either server side or client side computer programs. In WebCT, quizzes serve a number of rules. One is simply a practice mechanism where students can work problems for practice. In this manner they can work on each problem and get feedback as they go.

3.1 JAVASCRIPT AND CGI-BASED PROGRAMS

For the client side method JavaScript is a standard scripting language commonly used today that continues to be very popular since it works with all browsers that use a graphical user interface. As a result it is attractive to most instructors interested in integrating web based testing on their pages especially for formative evaluation. Server side processing on the other end relies on a back end machine to calculate test results and return the output in HTML format to the user. A non-proprietary technology called Common Gateway Interface (CGI) is used to implement server based assessment.

The use of Common Gateway Interface to create an interactive testing, tutorial and survey environment is shown in the WebTest project that was conducted at the University of Waterloo. The WebTest features multiple choice and numeric input, or text input (regular expression matching). It is essentially a test processor written in PERL. It will reside on web server(s) as a program accessible from web documents. WebTest requires a problem file, written by a test/tutorial designer as data, which is interpreted to generate the test/tutorial environment.

An example of a JavaScript application for Web-based assessment is the "Online Exercises System". It automatically generates computer-graded smart exercises for instruction via the Web. HTML documents with graphs, links, and complex formulas are created individually for every student. The system supports answers as numerical or algebraic formulas, true-false, and multiple choice.

3.2 WEBCT AND TOPCLASS BASED STUDENT ASSESSMENT

The effectiveness of assessment for students and lecturers alike can be improved greatly by using an online computerized assessment technique. Flexibility of assessment timing means that students can take tests any time, anywhere, while automation of assessment marking means that lecturers have their marking load reduced.

WebCT is an environment for authoring and delivering educational material. It provides a set of educational tools that can be integrated into any course and a set of administrative tools to assist in course delivery. The WebCT quiz environment incorporates good pedagogical components. There are five different types of question: True/False, Multiple Choice, Matching, Fill in the blank and Short Answer. Each of these question types is automatically marked by the WebCT. For the auto-marked categories, various marking schemes are possible including partially correct, and multiple correct answers.

The TopClass Test environment provides eight question types. These are: Text (an essay or fill-in-the-blank question); Pick One (single answer/multiple choice); Upload (a request for submission from student); MCOjects(media multiple choice); MCA (multiple answer/multiple choice); List Matching (match two lists); ImageMaps (clickable image); and Boolean (true/false). TopClass can draw randomly from large question pools and can be set to Auto Correct. Date and time limits can also be set for all tests.

WebCT was used as the main program for online assessment of a large class of a first year subject at the University of Wollongong in 1998. Around 100 questions were set using the WebCT quiz editor and its uploading feature for multiple choice questions. Figure 4 shows the summary result of a sample quiz in graphical mode.

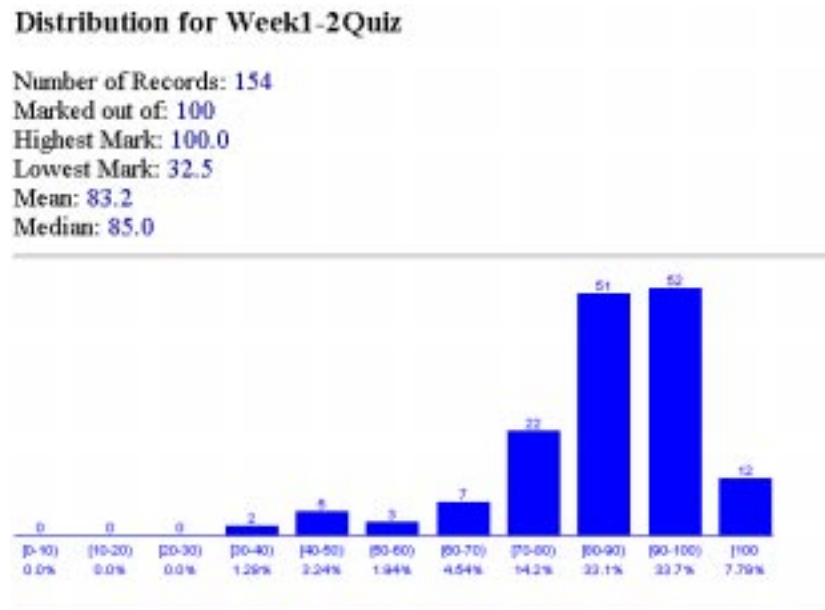


Figure 4: WebCT summary of quiz results

4. CONCLUSION

The commercial programs dedicated for survey and/or testing and assessment purposes are mostly computer platform dependant packages. The installed versions of these programs are typically very large, and they often need large RAM for trouble free operation. Common Gateway Interface (CGI) and JavaScript based programs for students assessment and survey are valid options specially if the instructor has some familiarity with server and client side programming languages and UNIX environment. Modern Web-based teaching and learning resource development tools such as WebCT and TopClass are preferred options because of the built in integration of the assessment and survey with other course components. It was shown that the Web Course Tool (WebCT) is capable of offering students timed online assessment and student survey accompanied by a series of related tools.

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