Online Assessment System

Marius PETRIŞOR*[1], Marius MĂRUŞTERI[1], Dana GHIGA[2], Alexandru ŞCHIOPU[3]

[1] University of Medicine and Pharmacy Târgu Mureş, Medical Informatics and Biostatistics Department, Gh. Marinescu no. 38, Tîrgu-Mures, Romania.
[2] University of Medicine and Pharmacy Târgu Mureş, Medical Research Methodology Department, Gh. Marinescu no. 38, Tîrgu-Mureş, Romania.
[3] University of Medicine and Pharmacy Târgu Mureş, Physiopathology Department, Gh. Marinescu no. 38, Tîrgu-Mureş, Romania.
E-mails: mariuspetrisor@gmail.com;   msm@umftgm.ro;   valentinaghiga@gmail.com;
schiopua2000@yahoo.com

* Author to whom correspondence should be addressed; Tel.: +4-0740-301369.

Abstract
As a continuous effort to improve and increase the use of computers in students' education, we implemented an online assessment server. Its purpose is to ease the students' examination process and to provide a transparent and objective evaluation. The solution we developed is a web application, written using PHP and Javascript. It uses MySQL as a database management system and Apache for the web server, hosted on a Linux system. The site can be accessed through a web browser capable of handling AJAX queries (Asynchronous Javascript and XML). Using the administration module, one can add or remove questions, question categories, can create tests and set its parameters (number of questions, time per question, IP addresses allowed to access the test). The administrator can also monitor the students during the test. The types of questions allowed are multiple choices with a single or multiple correct answers. After a student finishes a test, the grade is automatically displayed and there also is the possibility to review the questions and the correct answers. The system has proven itself to be quite stable; it has been in used for two years. In the nearby future, we intend to develop a second version of the server, one with more capabilities and improved functions.

Keywords: Software; Internet; Students; Medical.

Introduction

The development of Web browsers and tools has enabled the wider use of the Internet for learning and teaching. The process of evaluating student's knowledge is a complex one and often a time and resource consuming. This process can be eased up by taking advantage of the new technologies and using a computer based assessment system [1]. This kind of online assessment system has been successfully implemented in various domains [2], including the medical field [3,4] and the results are encouraging.

Online assessment - advantages:

- Once the assessment has been set up it does not have to be printed before the test takes place.
- The option to randomize questions to discourage cheating [5].

- The exam's results can be made immediately available after the test has been taken.
- The storage of questions, past results and student profiles are all kept in one place.
- The possibility to examine a large number of students simultaneous.
- The possibility to examine a student several times and create adaptive tests, based on the pattern of wrong answers given to previous tests.
  Online assessment - disadvantages:
- A computer is needed for each student in the class
- Cheating has always been a problem with any educational assessments therefore the set up of the computer room is important so that no student can see another student's computer screen. Also the possibility to access other computer resources should be disabled. In a class, one could use a remote teaching solution capable of blocking the execution of unwanted programs.
- Time needs to be taken directly before the assessment takes place, to make sure every computer is in working condition and connected to the internet, which could cause disruptions to assessment timetables.
- If a large number of students are taking the test at the same time, powerful servers will be needed to handle the amount of information being entered into the system and another complication would be created if there was ever a power outage or a server went down during the assessment.
- Teacher training time to use the system.

The aim of this research is the development of a fully customized web based assessment system, suited for internal use of our university.

Material and Method

We implemented a web application designed for online assessment. It uses Apache for the web server and MySQL as a database management system. The coding was made in PHP 5 and Javascript. The hosting is on a Linux system (Debian 5). The application can be accessed through any web browser with Javascript turned on, capable of handling AJAX requests. These kind of asynchronous queries are used for populating lists and validating data input.

Data storage

All the questions, answers, tests details, student details are stored into a database consisting of 10 tables (58 fields). We found MySQL to be suitable for this kind of application, given the need for a relational database and a fast response time [6].

Results

The system comprises two modules: the administrative module and the testing module.

Administrative module

Using this module, an administrator can accomplish the following:

- Adding questions into the database or editing the ones that already exist
- Creating tests or modifying them
- Adding or removing administrator usernames (reserved to master administrator only)
- Adding, editing or removing IP sets allowed to access a certain test
- View results from previous tests
- Monitor the tests in progress

Adding / editing questions

The questions can be grouped into categories. The system uses multiple choice questions – one question and five answers, at least one answer being correct. In order to ease up the process of question editing, we use a rich text editor, capable of basic formatting. The question type must be set to either "single answer" or "multiple answers".

The body of a question or answer can contain images or other resources, stored into the database and displayed in HTML format (Figure 1).

Figure 1. Adding or editing questions

The questions that exist in the database can be viewed as a list, for each category. The statement and the answers would appear as a tooltip on mouse hover (Figure 2).
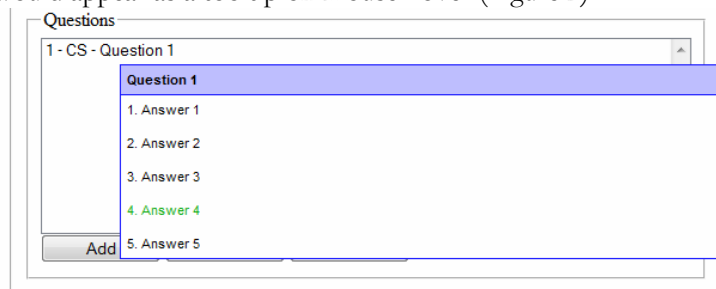
Figure 2. Question preview

Creating a new test

On the creation of a new test, an administrator must fill in or set the following options (Figure 3):

- Test name (e.g. "Biostatistics – Pharmacy January session")
- Test password: every test will have a unique password, used by the student to log in.
- Time per question: number of seconds allowed for each question.
- Correcting type: there are three options available
    - "All or nothing": the student receives the points for that question, if he selects all the correct answers and only those
    - "Partial without wrong answers": a partial score is given if the student selects only a part of the correct answers, only if he doesn't select a wrong answer
    - "Partial with wrong answers": a partial score is given even if the student selects a wrong answer

      For future versions of the assessment system, we intend to develop new algorithms for correcting type.
- Number of questions
- Interface language
- IP sets: for security reasons, only certain IP addresses are allowed to access the test

▪ Questions: the test creator chooses the questions and the score for each one.

Figure 3. Creating a new test

Adding an administrator user

There is only one master administrator account. Only this one can add administrators or add/edit IP sets. For adding an administrator account a username and a password are required (Figure 4).

Figure 4. Adding an administrator

Adding/editing an IP set

For security reasons, a student can access a test only if the IP address of the computer is in the allowed list. This list can be defined by the administrator (Figure 5). The IP addresses are supplied as an IP range (e.g. 1.1.1.1-1.1.1.10) or as an enumeration (e.g. 1.1.1.1, 1.1.1.2, 1.1.1.3). If a student whose computer has an IP address not in the allowed list is trying to take a test, its access would be restricted and a message would appear on the screen informing him about this security measure.

Figure 5. Adding an IP set

Viewing test results and monitoring a test in progress

An administrator can view and monitor a test by accessing a page designed for this purpose (Figure 6). The information available on this page is:
▪ Time and date the test started
▪ Faculty / group

- Student's name
- Percentage of correct answers
- Test progress

The table can be sorted ascendent or descendent by clicking the column name.

Biostatistics - Pharmacy. September

Nr.	View	Date and Time	College	Group	Name	Percentage	Percent Done	Remove
1	View Test	2009-09-16 10:50:04	F - 2	1		36.67	100 %	Remove
2	View Test	2009-09-17 10:06:29	MG - 2	1		65.56	100 %	Remove
3	View Test	2009-09-17 10:06:28	MG - 3	1		51.11	100 %	Remove
4	View Test	2009-09-16 10:17:47	N - 1	1		55.56	100 %	Remove
15	View Test	2009-09-16 10:50:09	F - 1	2		41.11	100 %	Remove

Figure 6. Viewing test results

There is also the possibility to download the results in CSV format for future data use.

The testing module

A student can access the test if he provides his name, the test password and if the IP address of the computer he is on is valid for that test. If the login data is valid, the student would fill in a form with his Faculty, group number and year of study.

The questions and the answers are randomized in order to discourage cheating by looking at another colleague's monitor.

Throughout the test only a single question is visible on a given time. After the student selects the correct answers (using checkboxes or radio buttons) he can choose to proceed to the next question. If the time available for answering the question has passed, the system automatically moves forward. The time left is always visible.

At the end of the test, the score is displayed on the screen and optionally the evaluation of the test. The student can see his answers and the correct ones.

Using this system, we implemented an online assessment environment. At this point it is being used by the Medical Informatics and Biostatistics Department and Medical Scientific Research Methodology Department.

Discussion

Similar solutions were developed at other universities [7,8] and the feedback received from the users encourages the continuous development of improved online assessment systems. There is the possibility of using this system not only for student knowledge assessment, but also for other evaluations, like teaching quality [9].

We chose the use of a web platform for the advantages a web application has over a desktop one:
- No changes are made on the client computer during the use of the application
- Data is centralized, secured and easy to backup
- Easier to update and maintain.
- Every major operating system has at least one web browser capable of accessing the assessment system
- The client computer resources are used minimally.

The disadvantages of a web application could refer to the need of a powerful server capable of handling the amount of data transferred and a stable and fast internet connection. In some cases a system overload caused a considerable delay in the time schedule for some exams [9].

Our application is similar to the assessment part of some commercial solutions [10]. However, we find that using a fully customized system is more efficient and less time consuming.

Considering the late development of the web programming technologies and the increased interest in Rich Internet Applications, we intend to develop a second version of the assessment system, with an adaptive test creator and improved functions.

Conclusions

The presented system is very useful and easy to use by any person with minimal computer knowledge. It provides an objective and transparent way to evaluate students.

All the data inside the database can be easily secured and maintained, everything being stored on a central server.

As a web application, it requires minimal resources from the client computer; the information displayed being processed by the server.

Conflict of Interest

The authors declare that they have no conflict of interest.

Acknowledgements

References

1. Cook DA. Web-based learning: pros, cons and controversies. Clin Med 2007;7:37-42.
2. Thompson D. Integrating Graduate Attributes with Assessment Criteria in Business Education: Using an Online Assessment System. Journal of University Teaching and Learning Practice 2008;5(1):Article4. Available from: URL: http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1060&context=jutlp.
3. Hong CH, McLean D, Shapiro J, Lui H. Using the Internet to Assess and Teach Medical Students in Dermatology. J Cutan Med Surg 2002;6(4):315-9.
4. Buchanan T. Online Assessment: Desirable or Dangerous? Professional Psychology: Research and Practice 2002;33(2):148-154.
5. Olt Melissa. Ethics and Distance Education: Strategies for Minimizing Academic Dishonesty. Online Assessment Online Journal of Distance Learning Administration 2002;V(III):Available from: URL: http://www.westga.edu/~distance/ojdla/fall53/olt53.html
6. Muji M, Ciupa RV, Dobru D, Bica C, Olah P, Bacarea V, Marusteri M. Database Design Patterns for Healthcare Information Systems. International Conference on Advancements of Medicine and Health Care Through Technology 2009;26:63-6.
7. Benjamin S, Robbins LI, Kung S. Online Resources for Assessment and Evaluation. Acad Psychiatry 2006;30(6):498-504.
8. Buchan JF, Swann M. A Bridge too Far or a Bridge to the Future? A case study in online assessment at Charles Sturt University. Australasian Journal of Educational Technology 2007;23(3):408-434.
9. Byrnes R, Ellis A. The prevalence and characteristics of online assessment in Australian universities. Australasian Journal of Educational Technology 2006;22(1):104-125.
10. Yuen AHK, Deng L, Fox R. Use of WebCT in online and blended modes. Interactive Technology and Smart Education 2009;6(4):254-260.