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A Dynamic Web Site for the Distant Self-Assessment of Students

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Key words: *evaluation, distance learning, self-test, environmental education*

Abstract:

This work deals with the development of a freely accessible website system, useful for self-assessment of distance students of different levels. The system also offers the teachers the possibility to construct tests and to evaluate their students' progress.

The system includes a database that is created in accordance to the theoretical framework that concerns evaluation techniques using new technologies. The database covers the cognitive material of different levels of primary and secondary education.

The contact between the final users of the system and the database is achieved using ASP web pages. The database was designed using a Microsoft SQL Server. A pilot test of the system was applied for the topic of Environmental Education in primary and secondary education students.

1. Introduction

The development of Personal Computers (PCs) and the progressive reduction of their cost gave the possibility almost to everybody to obtain their own PC. Thus, more than ever before, children nowadays use electronic means at home for educational purposes. Educational software, e-encyclopaedias, the Internet are valuable sources that children are using to better prepare their homework. On the other hand, most of the teachers still prepare evaluation tests in handwriting manuscripts. This is so, because electronic evaluation tests adjusted to the school curriculum are not available.

This report presents an e-system for the evaluation of students' performance. It is designed in three directions. The first refers to students' self-assessment. For this purpose the system contains a series of questions that students are asked to answer so as to assess their knowledge on selected subjects. Along the same direction, the system gives the students the possibility to check their progress in a number of subjects and guides them to the background theory that should be studied in order to improve their performance. The second direction is to help teachers develop or assemble the evaluation tests related to the subjects they teach. In this sense the teachers use the system as a tool for the development of students' evaluation tests and as a pool for drawing relevant material prepared for this purpose by other colleagues with access to the same system. Finally, the third direction refers to the use of the system as a diagnostic tool at the beginning of a learning process, or at any time that the teacher needs to obtain information about the cognitive level of the class.

This system was designed so as to meet four basic characteristics, i.e., to be (a) dynamic, (b) friendly and unsophisticated to the user, (c) able to keep records of various kinds and (d) easily accessible to the users with no time and/or location restrictions.

2. System Design

The system is addressed to two categories of users –students and teachers- and to all levels of primary and secondary education. The thematic sections that can be selected are based on the school curriculum for different grades. The use of multimedia data attached to each question adds to the attractiveness of this self-assessment test tool. In this way the questions seem smart and intriguing and the quality of the

safety reasons and for the smooth operation of the system since teachers should alone have direct access to their questions and answers.

The main core of the system consists of an evaluation model that was designed so as to allow for different levels of difficulty and a variable pass level, by introducing a random factor both in the choice and in the numbers of questions. The evaluation model is separated into (a) a self-assessment tool, where the result of the rate of success is presented and (b) a test tool where the grade of the examined student is calculated.

The system includes a database and a web site. These two parts are directly connected and interdependent. At the same time, being two separate parts, they can be easily altered and repaired.

The essential functions of the system include management of the accounts, identification of users, editing and pre-overview of questions, transport of multi-media files, evaluation of students and collection of results. The relevant operations concerning these functions can be performed and altered at a distance using the web pages.

The system provides for the possibility of interconnection with external databases or other sources such as the Web or a file in the local PC. This external source of data can be used in the process of student examined so that the necessary theory is referenced.

Internally, the system's structure consists of the thematic sections, the levels and the classes, the difficulty levels of the questions and the types of the questions.

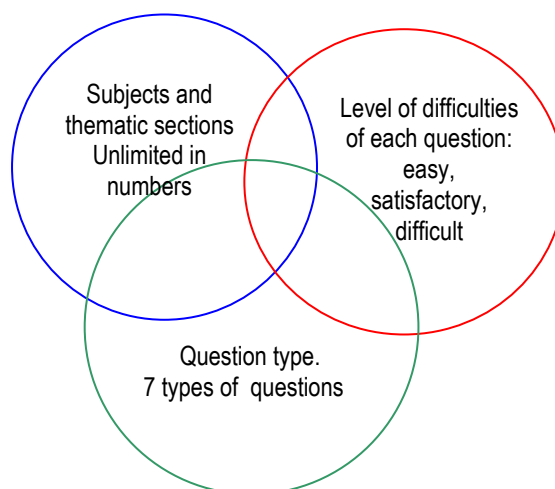


Figure1: The cross-correlation of the system's structures

The model developed for the calculation of the students' grade in the test process is based on the random choice of questions and on the difficulty level of each question.

The model adds up each Question's Difficulty Level (QDL) in order to produce the Total Difficulty Level of the test (TDL). The questions in each Test are picked by the system in a random manner hence the difficulty level of each Test has a variable value.

Using the Maximum Test Level (MTL) a grade B for each question is calculated depending on the difficulty of the question. Thus, in the beginning of each test process, the system knows the level of each question. The model is described as follows:

The grade of each question B_v is calculated by the formula:

$$B_v = \frac{MTG * QDL_v}{TDL}$$

Where, MTG is the Maximum Test Grade.

It follows that

$$\sum_1^v B_v = MTG$$

Using the above formulae for the allocation of marks on each question, the following results are achieved:

1. A top score is attributed to students that answer correctly all the questions of the test
2. Difficult questions have a different weighting in the evaluation procedure.
3. In accordance to (2), a student that answers 50% of the questions does not necessarily get 50% of the top score.

3. Technical Characteristics and Implementation

The system is based on SQL database where data of users, test questions and a comprehensive record of actions are stored.

The database is connected to the interface, a number of dynamic WebPages developed using Visual Basic NET tool. In this way there is the potential to combine the dynamic content of VBScript language with an impressive and friendly Interface, such as HTTP (Diagram 1).

The Web Server is connected to an SQL data base server.

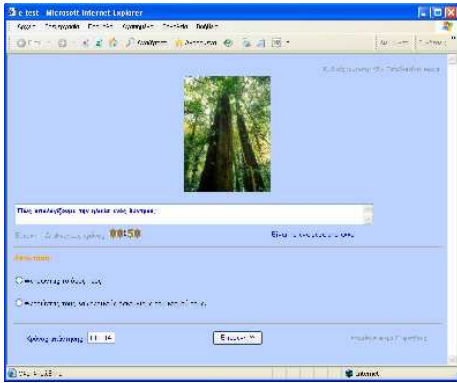
In addition, the SQL server handles the maintenance process of the data such as the condensing of the data for elimination of possible redundant data and the process of creating backup copies Diagram 2.

4. Subject for Implementation

Data was fed to the system to evaluate functionality and goal attainment. **Environmental Education** was selected as suitable subject for a pilot application. Among other reasons, it was preferred to other subjects because (a) it allows a wide use of multimedia, hence it gives grounds for their use; (b) it is a broad and popular subject that forming questions by the teachers is a relatively easy task; (c) it is not an unknown subject to any of the students who were participating in the test run, since all students have some background knowledge and information on Environmental Education from their family, the mass media and their social environment; and (d) it allows for the evaluation not only of knowledge but also of attitudes, stances, opinions, behaviour and values.

Two characteristics of Environmental Education, both referring to interdisciplinarity, are worth mentioning here and played a significant role in selecting this subject for pilot purposes. First, Environmental Education functions as an axis along which many other subjects of education can be studied; hence it can be used in support of teaching other subjects. Second, it is a scientific subject that combines knowledge from many disciplines hence it is appropriate for the application of innovative teaching approaches. It is a subject of great interest for teachers and students alike.

INDICATIVE SCREENS OF INTERFACE ENVIRONMENT



Picture 1: Indicative web page of the evaluation procedure



Picture 2: Indicative web page of the format and the development of questions.

Στοιχεία Δοκιμασίας

Παρατηρητής/ομάδα	Πόλη	Σχολείο	Επίπεδο εξέτασης	Ημερ.	Ώρα
Δημήτρης Κωνσταντίνος	Βόλος	Γενικό Λύκειο Βόλου	Ομάδα Α	21/07/2002	09:00

Αποτελέσματα

Ερώτηση	Απάντηση	Σωστή	1η επιλογή	Βάρος	Απάντηση
1. Η Ελλάδα είναι μια δημοκρατία με πολυκομματικό σύστημα.	Είναι μια δημοκρατία με πολυκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή
2. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή
3. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	0.00	<input type="radio"/>	20.00	Λάθος
4. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή
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11. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή
12. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή
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15. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή
16. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή
17. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή
18. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή
19. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή
20. Η Ελλάδα είναι μια δημοκρατία με μονοκομματικό σύστημα.	Είναι μια δημοκρατία με μονοκομματικό σύστημα.	1.00	<input checked="" type="radio"/>	1.00	Σωστή

Picture 3: Web page of the results of evaluation procedure

5. Test Run

The visitors of the system completed a total of 396 evaluation sessions and answered a total of 5457 questions. The average score of the students in the evaluation sessions, regardless of the thematic modules was 49.6 %. The above shows that the system functions in a satisfactory way and serves a great number of users.

(b) The system was used by many students who did not belong to any of the schools that participated in the experiment. This implies that the experiment was discussed a lot among students and their friends, impressed them and drew their attention. The same result shows that the choice of Environmental Education was right.

(c) The fact that the system was used by students without any guidance from their teachers in relation to the large number of questions that were answered and the long average duration of the connection time indicate that the system is simple, friendly and easily accessible, in other words that it meets the desired characteristics that were set as targets.

(d) The majority of the students that used the system have visited it more than once and from different access points, most likely from their house. This is indicative of how important it is not to have technological restrictions with respect to the operational system, the connection to the Internet and specific software.

(e) From the teacher's point of view, the relatively small average duration of connection to the system (17,01 min) indicated that the design of the relevant tools and the instruction booklet helped them substantially to create their own questions quickly and without any particular problems.

(f) With respect to the types of answers, the greatest percentage of success (60.0%) appeared to questions in which the student had to choose one out of two different answers, probably because of the high probability to choose the correct answer by chance. However in some questions in which the task was the selection of the right picture out of two, the rate of success was relatively low (27.8%). The smallest percentage of success (11,54%) appeared in the question type "one number" or "one phrase" but this is justified by the fact that a. it is an open type question and b. it had a relative great degree of difficulty (30) as it was reported by the teachers that wrote the questions.

The majority of the questions that no answer was given were the open type questions, "Give a number" (28,53%) and "Give a phrase" (21,63%), which was expectable. The large percent of success to question type "Give one phase" (37,88%) was impressive.

(g) From the use of the system some educational conclusions emerge that cannot be generalised but are worth mentioning and constitute issues that should be further searched. Thus, so far as attractiveness of sections is concerned the students showed a preference for the section of Air (75), Sea (48) and Forest (45), while the majority of students selected to be self - evaluated in the questions of all the thematic sections. The success order per section was: Forest (60,74%), Sea (56,85%) and Air (48,48%). Finally, no particular difficulty with respect to the percentage of unanswered questions, regarding the thematic section, since it is ranging from 3,73% to 5,76%.

The interview of the teachers was aiming (a) to discuss the conclusions and to investigate in depth their opinions of the process (b) to collect their observations and (c) to identify any possible weaknesses that they could figure out. These formed the basic sections of the interview.

With respect to these axes, the teachers agree that the system was helpful and friendly. They observed that there was a competition among their students as to who will manage to collect the highest score. This was why many students repeated the processes of self-assessment many times.

With respect to the specifications of the infrastructure of each school that participated, the answers differed among teachers.

All school computer laboratories were connected through the national school network to the Internet using standard ISDN lines (speed of 64 kbps to 128 kbps). Although the speeds were low, the system responded satisfactorily. The proxy server technology implemented by all school laboratories helped in that. We were led to this conclusion, after a teacher observed that the system had a delay in the process to register new students and more specifically in the process to choose the level and the school unit. Discussing the matter, we realised that the laboratory of the specific school didn't use proxy server and after correction, the problem was cured.

The computer laboratories were relatively old with the age of computers ranging from four to eight years and the operational systems used were Windows 98, Window 2000 and Windows XP. All computers were using Microsoft Internet Explorer in various editions.

The students worked in teams of two or three per PC and each one created his own user account in the system. This produced a minor problem since some students did not have enough time to work in the system, during one teaching hour.

A question regarding the weakest point of the system was asked to the teachers. The majority considered that the small number of questions in the thematic section 'Sea' has created problem since the questions were repeated. This was a known characteristic of the system and was confirmed. It is clear that the correct use of this tool requires a very large number of questions in each thematic section in order to have a reliable system of self-assessment after the random choice of questions.

6. Conclusions

In this work a dynamic network environment, connected with an appropriate database, for the distance self-assessment of the students was presented. The network's URL is <http://www.rhodes.aegean.gr/e-test>. The system was based on a database accessed via an interface using ASP web pages.

The system manager of the complete system, according to the rights given, was able to manage the users' accounts, to draw up questions and tests, to fill in sessions of self-assessment and tests and to tabulate repetitive results in time.

The system changes the interface, depending on the level of each user and is calculating the grade of the session (test) based on a model that was designed specifically for this purpose. This model automatically calculates the scores allocated to each question of a test procedure, with respect to the level of difficulty and the maximum score from the test (taking into consideration the random selection of questions by the system).

During trial operation, teachers and students of primary and secondary education from the island of Rhodes participated and some encouraging conclusions were drawn as far as the capabilities and the usefulness of the system is concerned. Nevertheless, the system requires development, tests, extensions, modifications and feeding of data so that it can become a really effective tool for the educational community.

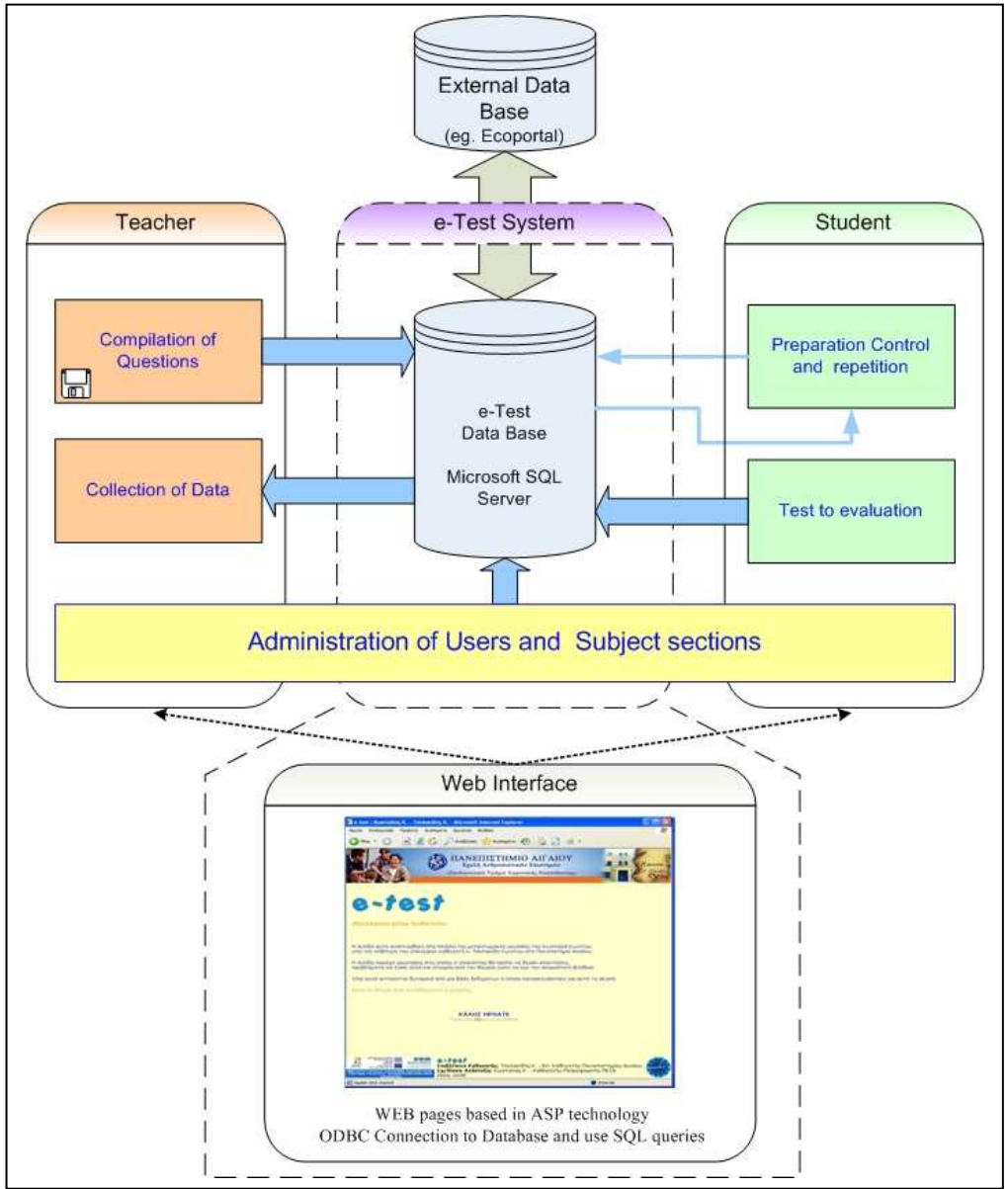


Diagram1.: System and Interface Architecture

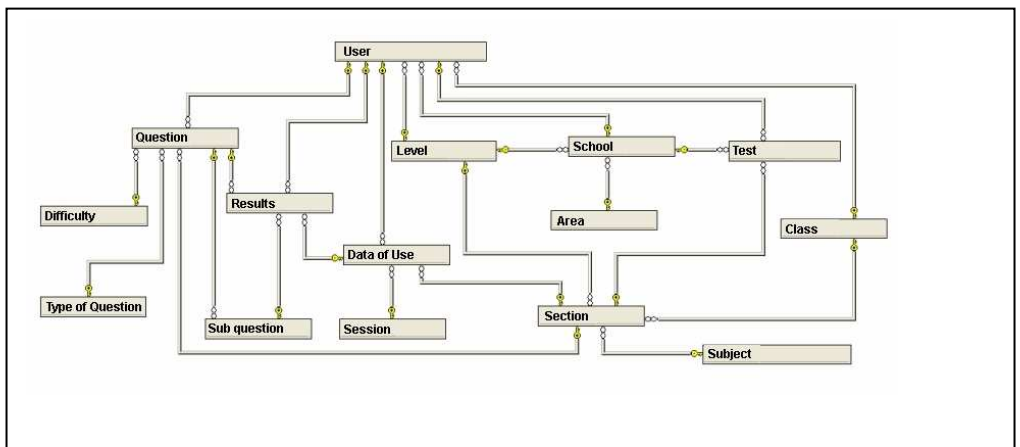


Diagram 2.: Data Base Structure

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