E-learning system designing - module for testing and evaluating knowledge

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Abstract: Knowledge tests by means of computers are extremely important for evaluating students' knowledge. Static quiz includes implementation of tests in which a student is given a set of static questions, made by a teacher, based on static questions templates, defining their own elements. Students' knowledge is evaluating afterwards. There are six templates for constructing questions and answers. The paper describes implementation and functionality of the module for building a static quiz in a Web oriented authoring shell xTEx-Sys (eXtended Tutor-Expert System). C*opyright © 2005 IFAC*

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1. INTRODUCTION

Information and Communications Technology (ICT) has become the technology which progresses into all areas of human activity in the actual world, so therefore into educational system, where it especially enables access to the process of learning to those persons who have been kept away from it by the traditional way of education. Moreover, in the future ICT will tend substitution the traditional classes, and not only serve as its assistance. What contributes to this is also the development of e-learning systems, which have been gaining on importance with the expansion of ICT, because e-learning includes apart from education end everything ICT carries. Moreover, e-learning systems include intelligent authoring shells. Extremely important are Web oriented intelligent authoring shells, like xTEx-Sys (eXtended Tutor-Expert System) (xTEx-Sys, 2005) intended to generate Intelligent Tutoring Systems (ITS). Intelligent tutoring systems are the generation of computer systems meant to back-up and improve the process of learning and teaching in a chosen subject matter, taking into consideration the individuality of person who is accessing the process of learning and teaching, as in traditional classes (Stankov, 2005). ITS enables delivery of knowledge, so it is quite important to test and evaluate that knowledge, apropos important is the component of ITS which provides testing and evaluating knowledge, the so-called "quizzing", which is generally known as the quiz. So it is particularly relevant to design the system that will provide building a high-quality quiz.

There are various systems for construction quizzes, but it is considerably to make them a constituent part of some e-learning system which enable delivery of knowledge, and in that way enable the users the testing in accordance with the delivery of knowledge. Some of the systems which are not a constituent part of any authoring shell or some other e-learning system can, besides being able to function individually, be integrated into more e-learning systems. Respondus (Respondus, 2005) and Questionmark (Questionmark, 2005) are such systems.

Respondus is a powerful tool for creating and managing exams that can be printed to paper or published directly to Blackboard (Blackboard, 1997), WebCT (WebCT, 2005), eCollege (eCollege, 1999) and other e-learning systems. Exams are created offline in a familiar Windows environment and the software provides many time-saving tools, such as the ability to import existing exams from word processor files.

Questionmark include learning needs assessment, placement test, surveys and course evaluations, certifications and online quizzes. Questionmark can also be integrated into the already existing e-learning systems (Blackboard, WebCT).

CQuest Assessment Software is a suite of tools used for authoring and administering computerized knowledge assessment tests, exams, and quizzes. Powerful and multi-media capable, this easy to use, flexible software package provides rapid question banking and test generation. CQuest records student responses, test times and scores and provides statistical analysis and reports (Cogent Computing Corporation, 2005).

However, when the user already uses some e-learning systems, it is a far better solution for the system to enable him a module for testing and evaluating knowledge. That is one of the reasons I approached creating such a module, which will eventually become an integral part of e-learning system - authoring shell xTEx-Sys, which is at the same time my degree essay at the Faculty of Natural

Sciences, Mathematics and Education University of Split.

2. MATTER OF TESTING AND EVALUATING KNOWLEDGE

Evaluating knowledge is extremely powerful, because it enables us (based on the mistakes, which appear in the process of testing) to indicate ourselves and to others those areas that have to be studied more thoroughly. In that sense, it is important to evaluate the tested knowledge, for we can determine (based on the achieved results) what more we need to achieve a certain level of knowledge. Testing and evaluating knowledge become even more significant when put in the surrounding of information and communications technology. Questions have been raised about how to develop high-quality programs for writing tests with the support of a computer, and how to evaluate the achieve results. The more the computer-based questions are closer to those asked in a traditional classroom, the higher quality the quiz questions are. Static questions, i.e. the questions created by a teacher using a computer, can be included in that category. Evaluation based on computers keeps distance from the teacher's subjective assessment of knowledge.

This paper offers five traditional grades (from insufficient to excellent) for evaluating a solved test, while the teacher is given free hands to determine criteria for each grade. The three functions of different types of evaluation are:
Diagnostic: -to identify strengths and weaknesses
Formative: -to provide feedback to students
Summative: -to estimate performance for the purpose of (formal) evaluation at the end of a course or unit of study (Mogey and Watt, 2005). The here described module meets all three functions, because it identifies the strengths and the weaknesses during the delivery of the feedback to the student, just like it gives student an insight into his final score.

3. WHAT IS THE STATIC QUIZ?

General, term of quiz implies implementation of tests, which distribute a set of questions to a student. Based on the achieved results, the knowledge of the student is evaluated. Depending on architecture of questions, static or dynamic, the quiz gains a special meaning, while dynamic questions are generated randomly, and refer to the apprehensions of subject matter, static questions are created by teacher based on the templates for static questions, defining the elements of questions, so the quiz based on the questions which are designed in a static way is called the static quiz. As opposed on the dynamic quiz, the static quiz is closer to the traditional way of testing knowledge exactly because the questions are not generated randomly, but are written by a teacher. Considering the fact that the theme of this paper is description of the module for testing and evaluating knowledge, which will enable construction of the

static quiz, I will further describe its implementation, structure and functionality.

4. MODULE FOR TESTING AND EVALUATING KNOWLEDGE

The module is implemented by using a programming language Visual Basic .NET and is based on the communications Web Forms and Web User Controls in ASP .NET Web application, and can be regarded at from two different points of view, the teacher's and the student's. When discusses about the module from the teacher's point of view, it refer to the elements required for forming questions and answers, which will constitute the static quiz, while from the student's point of view discusses about those elements necessary for demonstrating the questions and answering them.

4.1. Structure and functionalities of the module for testing and evaluating knowledge

4.1.1. Module for testing and evaluating knowledge from the teacher's point of view

Module for testing and evaluating knowledge from the teacher's point of view provides the teacher to form the questions and answers according to the templates which here has five and which are:
- Yes/No: choosing one of two offered options Yes or No, it is required to select correct answer
- Multiple Choice-Single Answer: it's given several capabilities, but only one of them is correct, possible cases are two or three capabilities
- Multiple Choice-Multiple Answers: it's given four capabilities to select, but required to select only correct answers, those can be two or three
- Accessory-Single Choice: it's given two words to complete the sentence, but only one of them is correct
- Accessory-Multiple Choice: it's given three words to complete the sentence, where two of them are correct or it's given four words to complete the sentence, but three are correct

Notable facility given to the teacher is an opportunity to choose arbitrary the number of question cycles and the number of questions in a cycle, because, afterward from the student's point of view, these questions will be displayed in cycles. However, the teacher does not necessary have to operate with cycles, but he can choose a single one and a chosen number of questions in it, so in that way it's avoided displaying questions in cycles. After the teacher has finished the registration for a module, a frame with the list of all the made quizzes will appear, altogether with possibilities to choose operations to design a new quiz, to edit the already existing one, to add

evaluation for quiz or to delete the existing quiz. If he chooses creating a new quiz, all the options whose enable that will be offered to him. The first step in creating a new quiz is shown in figure (Figure 1.).
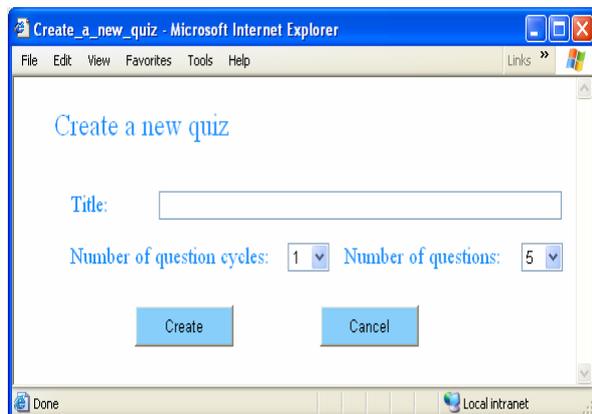

Fig. 1. Teacher-creating a new quiz

The teacher entering the name of the quiz and, as already explained above, selecting the number of question cycles, and the number of questions in a cycle. Having chosen the option "Create" the system generates the chosen number of questions contained in the new quiz, and offers assortment of templates for each question (Figure 2.).
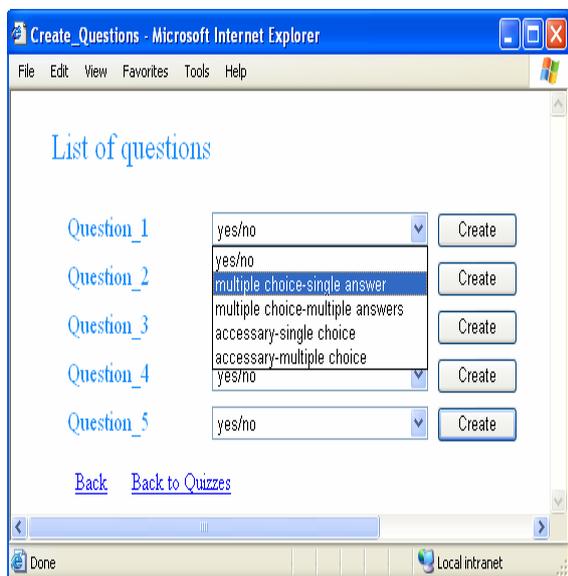
Fig. 2. Teacher-choosing a template for creating questions

There is an editor for creating questions to the each template with all the particularities of chosen template. If e.g. is for creating "Question_1" selected a Multiple Choice-Single Answer template a window presented in figure will be opened (Figure 3.).
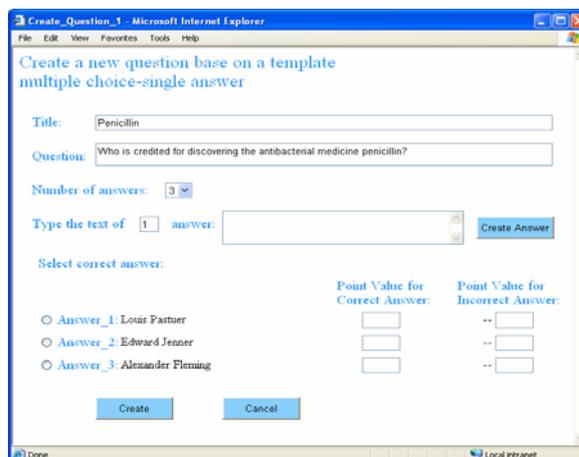

Fig. 3. Teacher-creating question by the chosen template

Besides the fields for entering the name of the question, text of the question and selecting the number of answers to the question by means of which it is entered appropriate number of answers there is also a fields for entering the value point for the correct and the incorrect answer. Each answer appreciates. If answer is correct positive points value raising, and there are at the same time a points value which will be used for evaluation, if answer is incorrect negative points value raising, and there are at the same time a points value which taking away from total positive points value. Those fields are important because evaluating of the achieved results thereafter testing knowledge will be based on the final score, and it's total positive points value, which will be discussed later. It's provided three answers for selection of correct answer, because it's from the possibilities of two or three answers sampled possibility from three answers, but it is possible to choose only one answer as correct because the template is defined in such a way. Notice on the figure (Figure 3.) that the answers are put in the order of creation, which means that the chosen window presents the text of the answer after creating every single answer. Whence the first question has been created, the window in figure (Figure 2.) looks just like the one in figure (Figure 4.).
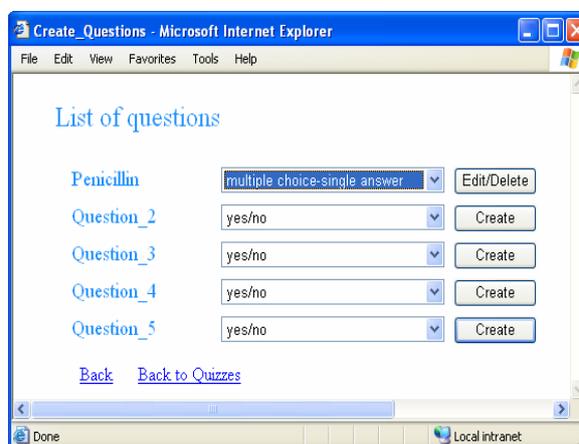

Fig. 4 Teacher-selecting a template for creating questions, the possibility of editing and erasing the created question

It is possible now, besides creating new questions, to edit and erase already existing ones. Let's assume that the teacher has written all the questions and answers according to chosen templates, namely he has designed a quiz. What more he has to do is to evaluate the created quiz, naturally if it wants. It is a special option, which doesn't have to be added to the quiz i.e. teacher can generate a quiz that will not provide the evaluation of the achieved result. When he, however, chooses to evaluate the results selecting the option "Add Evaluation" a workspace will be opened to him (Figure 5.).
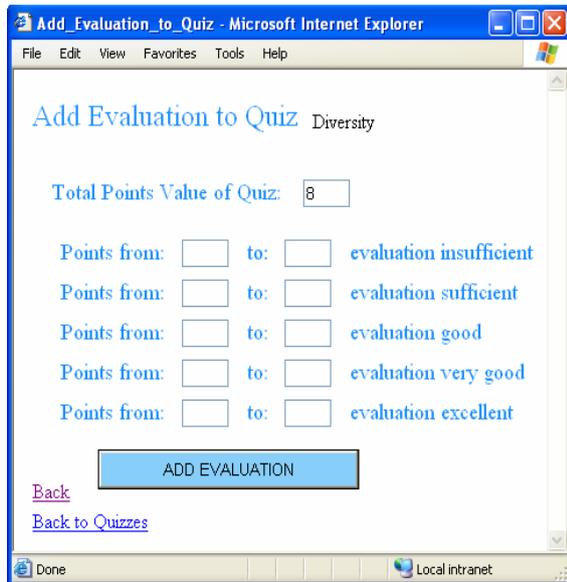

Fig. 5. Teacher- entering scores for evaluating the achieved results thereafter testing knowledge into the Quiz Diversity

As already described before every answer requires entering positive or negative point value, based on that the system will generate the total score of positive points value for the chosen quiz (Figure 5.). Total points value of quiz represent maximum sum of points value of all correct answers in quiz. The teacher is given an opportunity to determine which score corresponds to which evaluation. Based on his notes in the upper form, the knowledge of a student will be evaluated from the student's point of view. This describes all options available to the teacher as a designer of the static quiz, which itself enables students to be "quizzed", i.e. to answer the questions and get the results of their accomplishment, if the teacher makes it possible.

4.1.2. Module for testing and evaluating knowledge from the student's point of view

Module for testing and evaluating knowledge from the student's point of view enables the student an access to the quiz generated by the teacher. It doesn't mean that the student can change the settings of the quiz. Mainly, when the student registers into the module and chooses the quiz, in which he wants to test his knowledge, a window will be opened to him with the list of questions and possible answers.

Based on the way the quiz has been created, the questions will be displayed in cycles, or, if required by the teacher, in a single cycle, which has been discussed before. In that case all the questions will be shown in one window. Let's assume that the teacher has made a quiz with one cycle of five questions, in this circumstance the student will be confronted with an open window like in the figure (Figure 6.).
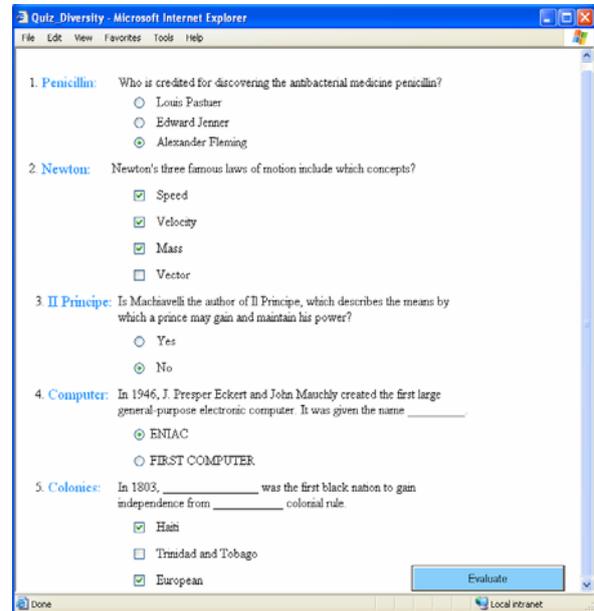

Fig. 6. Student-answering questions

The student does not have the right to change the settings of the quiz, but can only answer the questions. Afterwards the window will be opened showing the questions he has answered both correctly and incorrectly, also presenting positive and negative points value which he has collected and the final evaluation he got (Figure 7.).
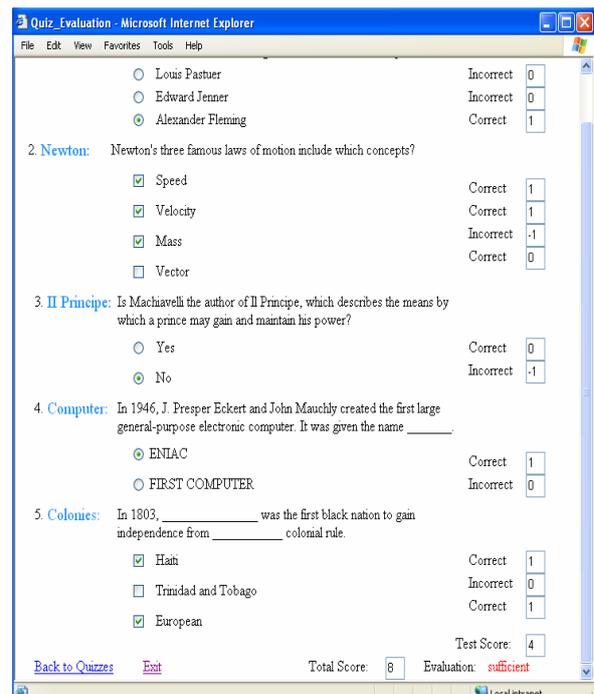

Fig. 7. Student-evaluating the achieved results thereafter testing knowledge

5. FLOWCHART DIAGRAM OF THE MODULE FOR TESTING AND EVALUATING KNOWLEDGE

For all described operations in chapter 4. there is, on the figure (Figure 8.), a graphic presentation of sequence of their execution during the implementation of the module itself.
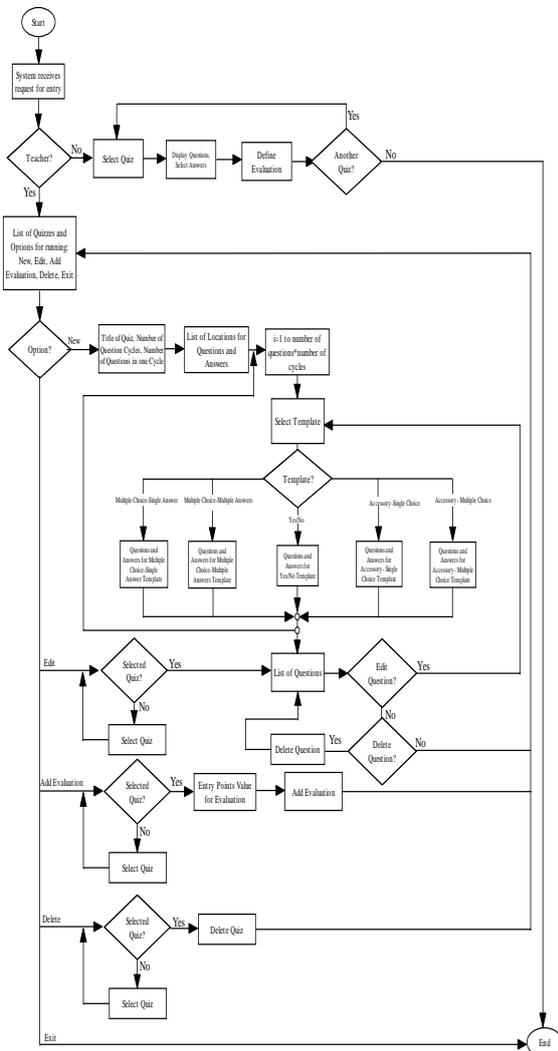

Fig. 8. Flowchart diagram

Having finished the signing-in into the module, based on the fact whether the submitter is the teacher or the student, the system will offer the individual different operations in a workspace. When the submitter is the teacher, i.e. when the condition "Teacher?" in the first step of branching is fulfilled, options for working with quizzes will be presented (New, Edit, Add Evaluation, Delete, Exit). After that, the branching is conducted by the options chosen by the teacher. Options "Delete" and "Add Evaluation" are some simpler, namely selecting options "Delete" or "Add Evaluation" after it's assuredly that is chosen the quiz which wants to delete or add evaluation to, executing the operation of erasing or whence the teacher enters score for evaluation, evaluation is adding for selected quiz. When the teacher decides to design a new quiz, the operations from the branch "New" are executing, and the process of entering the name of the quiz, determining number of questions in one cycle and number of

question cycles begins, also a presentation of the entire number of the locations for questions and answers is made (number of questions times number of question cycles) which enables starting designing questions and answers according to chosen template. Questions and answers are generated in a different way for each template, so there are five branches for condition "Template?". When teacher wants to edit something in the existing quiz, the operations from the branch "Edit" are executing. The system checks whether the quiz is chosen, and the next step is the listing of the questions. When the condition for changing questions is fulfilled ("Edit Question?" Yes) branching is conducted according to the templates in the same way as in option "New". Also it's allowed to delete questions. Option "Exit" is used for exiting the module.

When the condition "Teacher?" in the first step of branching is not fulfilled, it means that the system was not approached by the teacher, but by the student. In that case, it's executing the next: student chooses the quiz, then the system lists the questions and answers which student have to select, then defining the evaluation, and finally do the branching according to the fact whether or not the student is going to approach another quiz. If not, then exit the module.

6. APPLIANCE

The described module for testing and evaluating knowledge can function independently, as described, but, that I propound at the beginning of this paper is matter that the e-learning system unless of the delivery of knowledge enable testing and evaluating knowledge. xTEx-Sys is the system which enables both components, but testing in xTEx-Sys system is done by dynamic questions which were generated by the computer randomly. The practice has, however, confirmed that the students have more problems answering the questions generated by a man than a computer and exactly because of that there is tendency to range xTEx-Sys from dynamic to static questions. The described module meets all requirements to fulfill that tendency.

7. CONCLUSION

Developing the systems for testing and evaluating knowledge increases the level of e-learning systems because it is also important to evaluate and everything e-learning offers, but this cannot be done without high-quality tests. This is what makes the systems for creating quizzes so important. In described system, the student doesn't have any contact with the way of creating questions and answers. From the student's point of view it is important the content of the questions. The static way enables the teacher to formulate questions according to his own will, and that is what makes it so particular. In that way, the quiz in the "electronic

classes" becomes closely related to the quiz in the traditional classes.

ACKNOWLEDGEMENTS

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