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BOOK 5

"MATHEMATICS, INFORMATICS AND PHYSICS"

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"MATHEMATICS, INFORMATICS AND PHYSICS"

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DESIGN AND IMPLEMENTATION OF A KNOWLEDGE CONTROL TEST SYSTEM

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Abstract*: The paper describes a test system designed for students' knowledge control. The system is composed of three modules: Administrator, Teachers and Students. It contains intuitive, convenient, easy-to-use interface developed in VBA Access environment, as well as relevant tools for tests generation and students' assessment.*

Keywords*: test control of knowledge, subject area,object, feature, property, method, event.*

INTRODUCTION

For each training system, including computerizing, the main problem is how to achieve an adequate control of knowledge. For a qualitative control of knowledge it is important to take into account several special features, namely:

- each teacher uses different methods of control, different scales and criteria of evaluation. This necessitates the possibility of selecting different types of questions when constructing the test;
- establishing a strategy of fair and accurate evaluation dependending on the type of the questions;
- analysing the level at which the studied matter has been acquired.

These features require the selected system to be adaptable to the personal characteristics of teachers and students.

According to Dovgyaldo and many other authors [3, 4] there are four different types of control: prior (pretest) control, current control, border control and final control (posttest).

Prior control is usually used for determing initial level of knowledge before the training has started. Current control is used to determine the level of knowledge, reached at a certain moment of studying able particular subject area (SA). Border control is carried out after study of individual topics or sections of the SA. Final control comes after mastering of a whole SA [3, 4].

The control questions must satisfy the requirement of a complete dialogue there is a confidence that the basics are learned. To perform assessing properly the teacher creates a template pattern of true answers and the system compares the responses of the students with this template. If the student's answer does not satisfy the standard, then the knowladge control test system doesn't provide the specified number of points. This system allows the generation of questions of the four types of control. For creating such a system different programs could be chosen but here we decided to use Visual Basic for Applications (VBA).

Visual Basic for Applications is an object-oriented pogramming language. It was built on the basis of Visual Basic language and is applied for working with the MS Office package-Word, Excel, Access. It has media-controlled pattern of programming, too. In substantial media-managed applications the program doesn't follow a pre-determined model. The program threated different parts of code as a response to a certain action. The events could be caused by the user actions, system performance or another application. Therefore, the sequence of execution of the program code is determined by the sequence in which various events occur [5].

In such a way the flow of the program code executed will be different each time. VBA

is an object-oriented environment, which provides a comprehensive range of objects, each one having its own properties and methods.

In an object-oriented system almost everything is composed of objects. In VBA each element of the application is an object and we call it tool. The properties describe how the object looks (its size, colour, place position) or what its behaviour is (whether you can change its size or not, is it visible, is it active, is it points to another object). The method is an action which could be performed on the object and is realized in the course of its running – member of the class. The Method is get by writing the name of the object and the name of the method, separated with a dot between them. Any user upon an object is threated as an event. All the possibilities, VBA offers makes it convenient for the construction of a system for test control of knowledge [2,5].

QUESTIONS GENERATION FOR THE TEST CONSTRUCTION AND ANALYSIS OF THE ANSWERS

Traditionally the quality in formation of elementary teaching tasks is determined by the erudition of the educator and the level of his training. This way has a number of disadvantages. The most important disadvantages are: much labour intensity in the process of the tasks creation, limited number of the tasks variants. This reduces the degree of reliability and objectivity of control, due to an increased probability of guessing the correct answer. Other disadvantages are: difficulty in circulating the assignments and in collecting statistics. The questions generation and the test construction are first steps towards incorporation of artificial intelligence in Intelligent Systems for Test Control of Knowledge. They provide didactic requirements for multi-variability of, tests with economy of intellectual labour and computer memory at the same time.

Attempts for summarizing experience in this field and to present the existing forms for responses submission and known methods of analysing them are being made. Moreover, a text response is used sometimes, but without analysis, meaning that the answer which fully matches the standard is considered correct [3].

There are several different types questions in the system for test control of knowledge:

- response of choice from several options - the most common form of response is election. The question is accompanied by several variants of ready answers from which it is necessary to choose one, rarely several, correct responses;
- arithmetic and logical response by a formula - the second most popular is response by a formula or numeric response, usually as a result of a decision of the proposed task - numerical answers, which require implementation of a set of interrelated actions. For answers of that kind a template (correct meaning) must be given.
- questions - free-response is the most natural and the same time complex task of organizing the control of knowledge of training. One of the common ways to verify the correctness of free-constructed answers is to control the keywords. Another way of organizing the work with text questions are templates, containing empty spaces with explanations about the way they should be filled;
- questions – “connect with the true meaning”, again using a template to which the given response is compared;
- questions with graphic answers – the usage of graphics (drawings, graphics, etc.) as a response significantly enhances the control system of knowledge. In some cases it is the only possible way of response.

DESIGNING THE USER INTERFACE AND AN APPLIED PROGRAM ENVIRONMENT

The application requirements are determined by the subject it is designed for and the

users who will work with it. The main purpose of this Annex is to provide an opportunity for qualitative evaluation of the students knowledge by their teachers through solving tests electronically using computers [1]. For this purpose the following basic requirements could be determined:

- quick and easy way of composing various tests, depending on the subject of study;
- quick and easy access to students tests.

Concerning basic requirements, a plan of the application opportunities is drawn up. It should:

- be easy to use in terms of navigation and should offer plenty of indications;
- be simple, fast and interactive;
- limit the access to side-issue functions, depending on the permissions of the user groups;
- retain entered information, test and the answers structure after solving them in the database;
- prevent input incorrect information in the database;
- provide an opportunity for quick and easy search of necessary information by relevant audiences;
- perform correct evaluation regarding the student choices and the criteria specified by the teacher.

To design the knowledge control test system we use a uniform style of forms and apropriate controls, that create a sense of integrity and make the system stylish and pleasant to work and navigate with her.

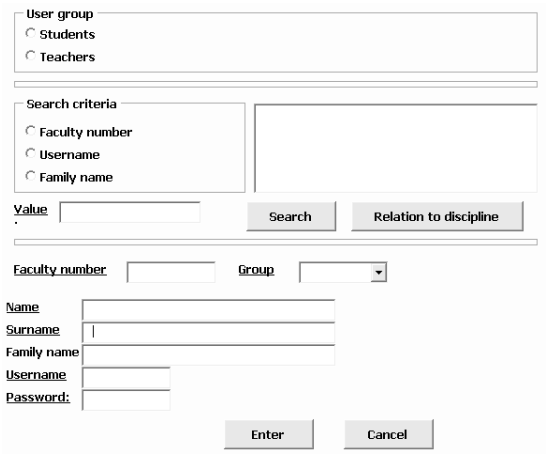

Fig. 1. Module Administrator - create new user.

Three modules are designed for the separate user groups – “Administrators", "Teachers” and “Students” to meet the requirements of the application. The user has to enter his username and password, then choose the group he belongs to. After pressing the "Enter" button, he gets access to the functions which correspond to his group.

Module "Administrator" - this group of users can create accounts for all other user groups, enter and edit database for all other users, provide validation of data before its retention in the database, add and edit data for the disciplines, in which tests will be created, add or mould groups of students who conducted the test. This module provides a simple interface for creating links among the objects in the database so that the work of the administrator could be much simplified and the requirement for having special professional skills in working with databases falls away. Fig. 1. shows working form to edit a user that at the same time provides an option for searching a definite user on a given criterion.

Fig. 2. Module Teacher - construct a question with one correct answer

Module “Teachers”- these users have rights to create or edit tests in a specific discipline. Each teacher determines type of questions to be included on his own test. The system supports all the types of questions. In the

creation of choice questions of one or multiple answers are used CheckBox controls or OptionButton respectively. Fig. 2. contains the elements needed to edit a question of the appropriate type. Such elements are: a field for writing down the question; fields for the possible answers, elements which determine the number of the possible answers; elements for determining the correct answer. For each of selected types of questions, the system allows teacher to set the number of points corresponding to a correct answer to a certain question and also offers an opportunity of keeping the information in the database.

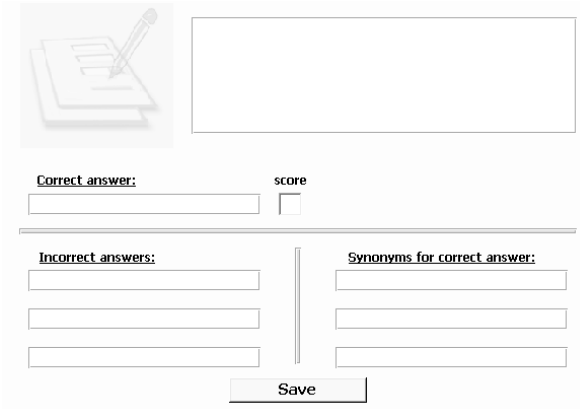

Fig. 3. Modul Teacher - construct a questions in form "free answer"

For questions in form "free answer" (Fig. 3.) the system uses tool - TextBox control when entering the text of the question and fields for entering the question; for entering the answers – one for the correct answer, three for entering variations answers and three for giving synonyms of the correct answer and the parts to be connected plus elements for defining the correct connections.

For question of type connecting the issue with the response, the system provides: a fields for entering the question; entering the answers and comparing their parts (connection) in addition elements to determine the correct connections.

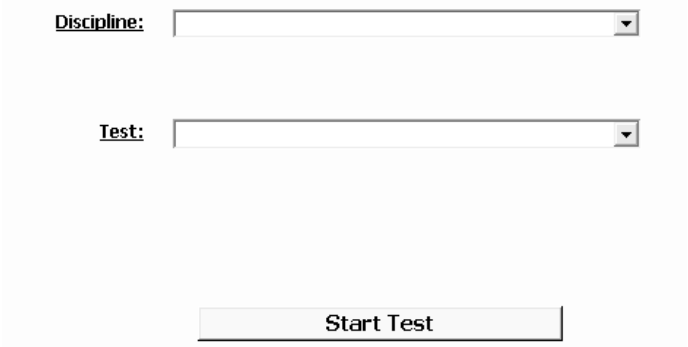

Fig. 4. Module Teacher - constructing test

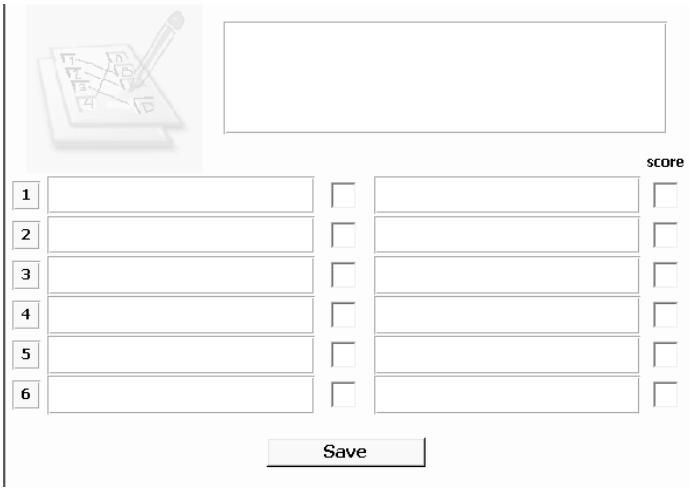

Fig. 5. Module Teacher - simulation of the final test

Users with rights of Teachers are allowed to set separate criteria for evaluating each test. They also determine time given to the students for fulfilling it and have rights to simulate its happening. By selecting the "Start Test" button in Fig. 4. other items this screen contains are displayed shown in Fig. 5. These are: an elements showing the time past from the beginning of simulation, visualizing current issue, moving to the questions and finishing the test. By choosing the "Ready" button a screen appears which gives information for the reached result, given evaluation and criteria on which the assessment was made.

Module "Students" – for users of that group, the system provides opportunity of choosing the discipline and the test they are going to make, after entering their username and password. By selecting the "Start Test" button they start the set time, as well. After answering a question the user goes to the next one by pressing the "Confirm" button and selecting the next issue from the navigation panel (Fig. 6.).

When selecting the "Ready" item or after the time finishes, a screen, visualizing the result, the evaluation and the assessment criteria, appears (Fig. 7.).

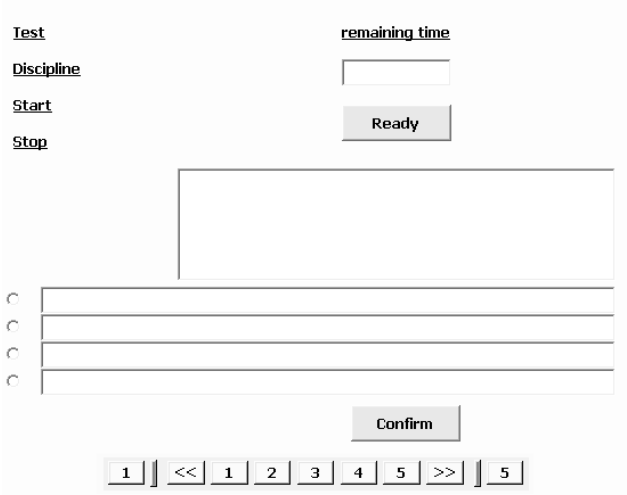

Fig. 6. Module Student - start Test

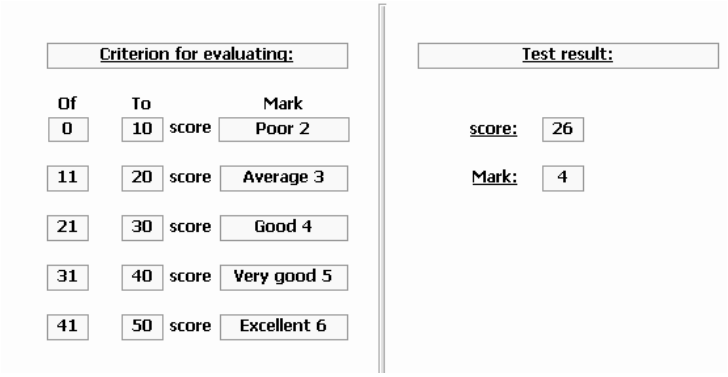

Fig. 7. Module Student- form for test rezults

Details of three Modules of test control system of knowledge are shown in Fig. 8.

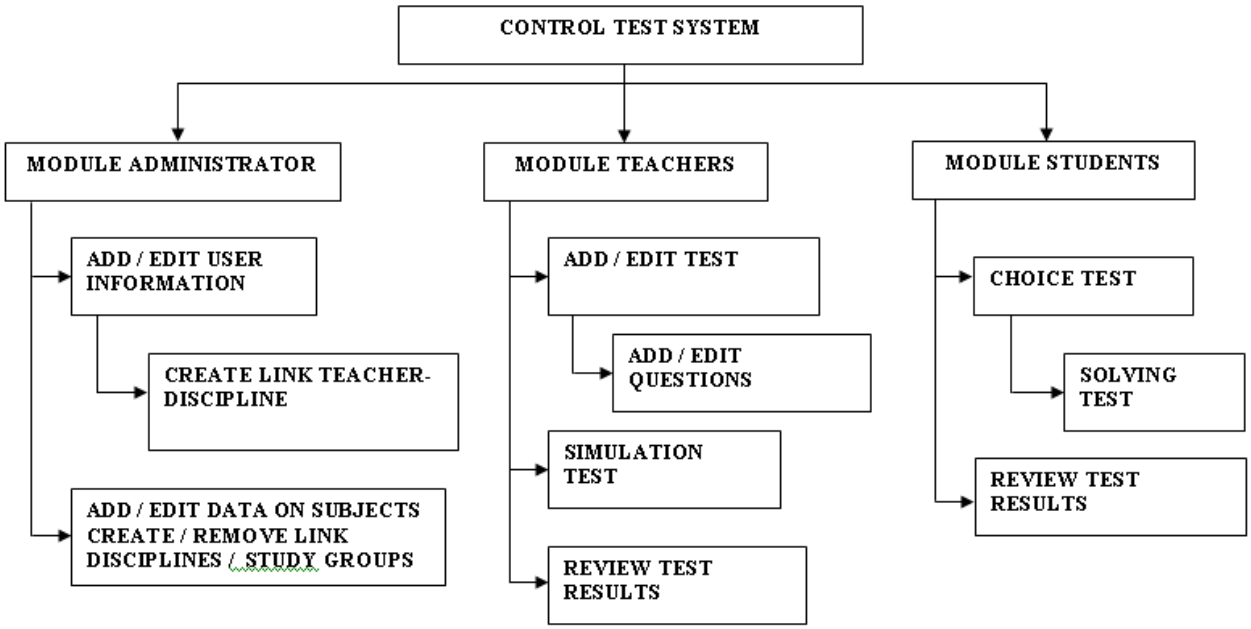

Fig. 8. Module in test control system of knowledge

INTERIOR DESIGNING OF THE INFORMATION SYSTEM

The inner interface of the application consists of Class Module for each form, which contains the procedures for processing the events, which occurred after users handled the application. In MS Access the forms are defined as objects of class "Forms" and the program automatically creates a blank Class Module for each new form, whether it will be used or not. In MS Access the forms could be directly connected to a table from the database thus avoiding another additional programming. The inner interface includes four more standard modules containing common procedures for all forms and application. Such are some of the following procedures: for checking the validity of data, for extracting and storing data in the database, for performing calculations.

Since the system is designed to work as a client-server application, in design of the system to take into account following features:

- When recording information involving the simultaneous update of several tables in the database, we use transactions for record data or in case of an error to prevent from loss of information;
- Queries to the database should be very simple in order to reduce for their implementation time. Also, only the information needed should be extracted, so that the network traffic could not be overloaded.

After creating the forms in the applied environment of MS Access, a code is added to the relevant procedures for handling events. Such procedures include: procedures performed by pushing the button, procedures performed by modifying a text box or a certain list, procedures performed after the time is finished. All basic procedures are contained in standard modules and are being declared as public, providing access to them from anywhere in the application code. This way of organizing the code in VBA helps creating a single procedure at first, and running it as many times as necessary later. If well designed VBA provides the opportunity of performing multiple actions with a few codes only.

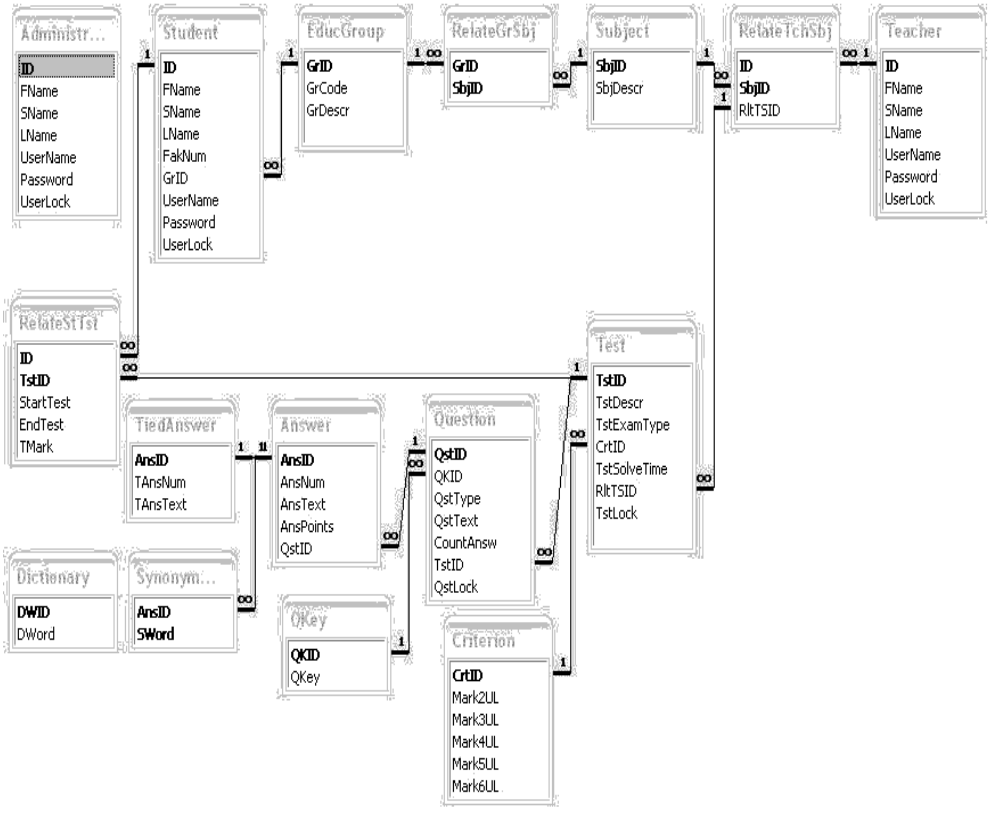

Fig. 9. Relational databases

The test control system of knowledge is created using relational databases. It is shown in Fig. 9.

CONCLUSION

The so designed system for test control of knowledge makes it possible to construct tests containing various types of questions. Since the system is built, in Access environment through VBA, it does not require the installation of an additional software but only the copying of the working file and the database needed. This particular test control system can be used by all teachers and students. It is designed to work with client-server systems and can evaluate up to 20-25 students simultaneously.

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ПРОЕКТИРАНЕ И РЕАЛИЗАЦИЯ НА СИСТЕМА ЗА ТЕСТОВ КОНТРОЛ НА ЗНАНИЯ

Виктория Рашкова

Русенски университет "Ангел Кънчев"

Резюме: *В статията се описва разработената система за тестов контрол на знания. Тя включва три модула: Администратор, Преподаватели и Студенти. Състои се от лесен, удобен и интуитивен интерфейс, създаден на език VBA в среда Access и всички необходими средства за изготвяне на тестове и оценяване на обучаемите.*

Ключови думи: *тестов контрол на знания, предметна област, обект, свойство, метод, събитие.*

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