



QUESTION OBJECTS – SOURCE OF ELECTRONIC QUESTIONS

Miroslav Hrubý, University of Defence, miroslav.hruby@unob.cz

Abstract

The high quality electronic tests and self tests should be an indispensable part of modern study materials and study environment. The described theory says that the items of electronic tests and self tests are electronic questions and that every electronic question is generated by the so called question object. Each question object belongs to one of the defined types. The main goal of this paper is to introduce a prepared formal description and describe the set of useful types of electronic question objects regardless of their connection with the existing software. The author tries to bridge the possible gap between the educational needs and the range of various types of available software.

Keywords

education, electronic question, electronic test, electronic self test, question object

Introduction

Modern technologies penetrate not only into teaching methods (Hrubý and Janáková, 2011), (Staňková and Bušínová, 2010) but also into methods of assessment (Ventouras et al, 2011). The important role is played by the standardisation efforts, especially by the Sharable Content Object Reference Model (SCORM) (SCORM web pages, 2012). It can also be useful to be familiar with the Question Markup Language (QML) which provides the training and education sectors with their own open and platform independent method of maintaining questions for use in tests and assessments (QML web pages, 2012). The important role in this process is played by students' acceptance of computer based assessment (Terzis and Economides, 2011). On the other hand the accessibility of electronic self tests plays a key role in required students' study activities (Hrubý and Dvorský, 2009). Some interesting approaches can be found (Mullins et al, 2001). The useful technology for the teaching and learning processes can be based on (Carmel et al, 2000).

From the general point of view a question object can be the most important term of the modern electronic testing. The question object is a special object which has a capability to generate electronic questions. The type of a question object determines the type of questions which this question object can generate. The collection of electronic questions forms an electronic self test or electronic test.

It can be said that especially high-quality electronic self tests can strongly motivate students in all fields of study. Various educational institutions, companies and individuals use various authoring software to produce electronic self tests and electronic tests. The resulting products can often vary greatly from the point of view of the achieved useful value for learners.

For instance, ToolBook II Instructor can serve as an example of a good authoring tool with rich possibilities for electronic testing. Nowadays latest version of this software can be found at ToolBook web pages (ToolBook web pages, 2011).

The main goal of the paper is to support a sensitive use of ICT in education in the field of electronic testing and to open this problem domain for wider range of takers. The author presents a possible approach to creating a formal description of the basic concepts of the area in focus. He defines basic terms, such as Universal Question Object (UQO), Question Object (QO), Electronic Question (Q) and Life Cycle of a Question Object (LC_QO). The proposal of all stages of the LC_QO is given.

Materials and Methods

The main terms of the article Universal Question Object (UQO), Question Object (QO), and Electronic Question (Q) can be generally described by the following definitions.

Definition 1

Universal Question Object (UQO) is a generic concept that can be described as a structure

$$\text{UQO} = [\text{assgn}, \text{defr}, \text{evalr}, \text{fdb}] \quad (1)$$

where

assgn is the assignment;

defr defined reactions;

evalr evaluation of reactions;

fdb is feedback.

Firstly, the assignment (assgn) can be a structure of various types. The assignment should be given in a form suitable for the tested person. For instance, in foreign language testing the concrete assignment can consist of a video file with a discussion of two persons which is followed by a question and an offer of a set of possible answers.

Secondly, defined reactions (defr) are possible reactions by the tested person which can be expected. These will be evaluated in compliance with the evaluation of reactions (evalr).

Thirdly, feedback (fdb) is the system response on the user's reaction to the given assignment (assgn).

UQO is the most abstract term of electronic testing. It is a source core object and term for deriving and defining all special types of question objects templates. Each question object type template is connected with specific authoring software. Each question object is formed on the basis of a question object type template. Question object type template can be changed into a unique question object after getting all necessary data from its creator. Question object can be defined as follows.

Definition 2

Question Object (QO) is a structure

$$\text{QO} = [\text{id}, \text{qf}, \text{ans}, \text{sco}, \text{fdb}] \quad (2)$$

where

id is the name of the question object type template;

qf is the question formulation;

ans are answers;

sco is scoring,

fdb are feedback conditions (feedback can be immediate or delayed).

Answers (ans) can be a small database that consists of various possible answers which differ in number of points that a tested person can receive. Scoring (sco) can use positive and also negative points connected to every possible answer that is defined. Good scoring setting is often a very sensitive and difficult task.

Definition 3

Electronic question (Q) is a structure

$$Q = [QO, as] \quad (3)$$

where

QO is a question object;

as is the list of answers that were generated from QO.

It is necessary to say that 'as' is a subset of 'ans' from the previous definition 2.

ToolBook Instructor (ToolBook web pages, 2011) can serve as a good example of authoring software which is suitable in the field of electronic testing. Nowadays electronic testing needs to define the set of useful types of electronic question objects (electronic question object type templates). This chapter covers, from the author's point of view, the most important ones. They are as follows:

- Multiple Choice;
- Multiple Choice Multiple Correct;
- True-False,;
- Matching;
- Short answers.

Results

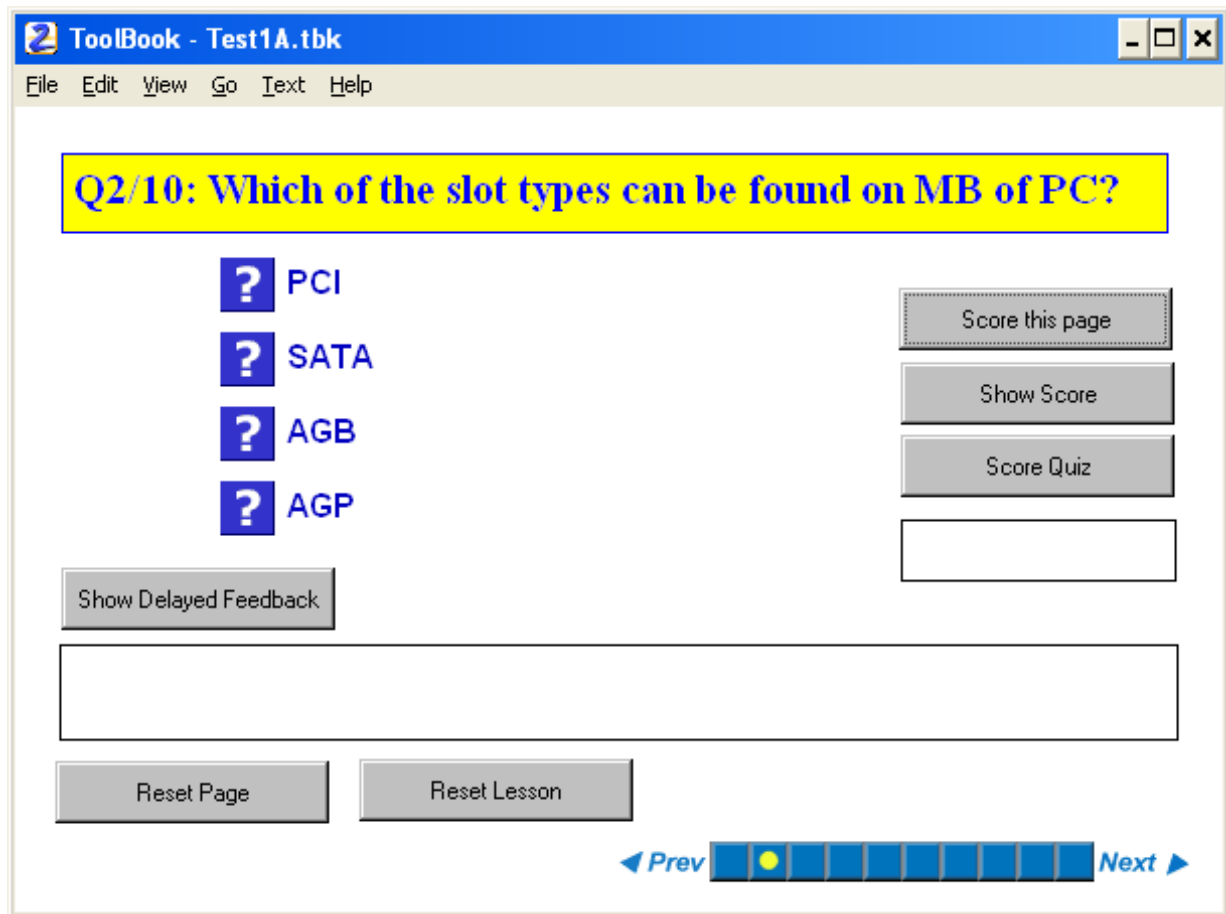


Fig 1. The example of a Multiple Choice Question

The multiple choice question seems to be the most useful common object for electronic testing. That is the reason why it was selected for more detailed description. It can be used in an ‘anatomic description’ of the question object.

Anatomy of the Multiple Choice Question and its Extended Properties Setting

After user adds a question object to a page, they can specify its appearance and behaviour in the Properties for Question dialogue box. This dialogue box differs slightly for each type of question object. The Properties for Question dialogue box consists of five Tabs as follows:

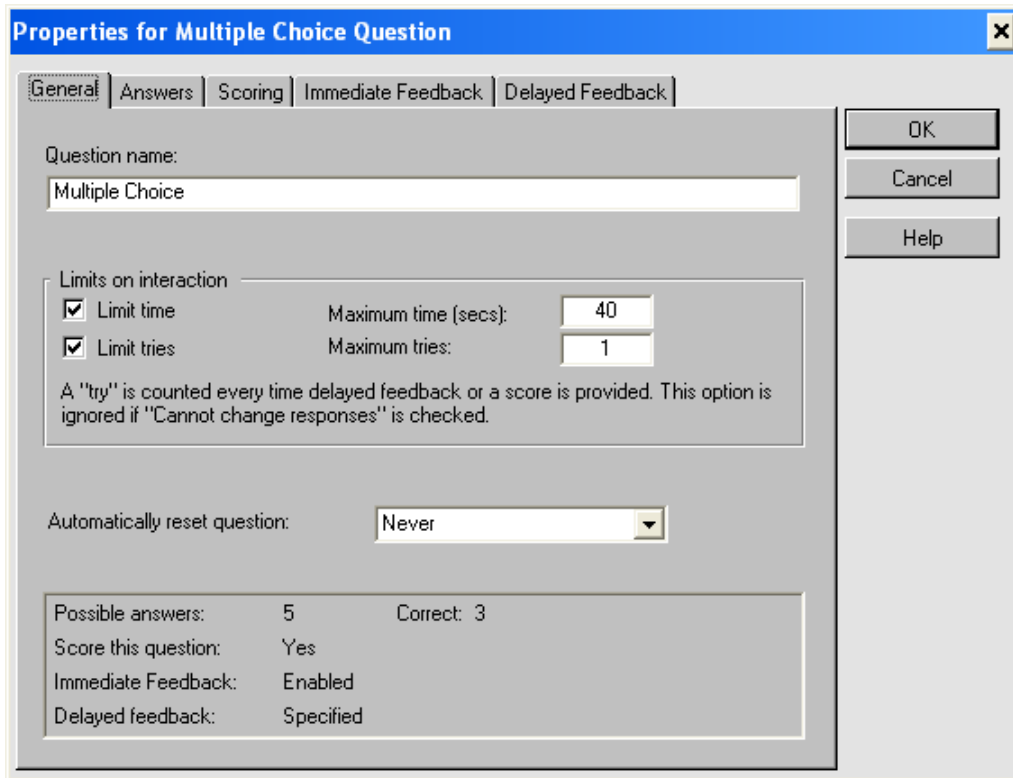


Fig 2. The Extended Properties for Multiple Choice Question – General Tab

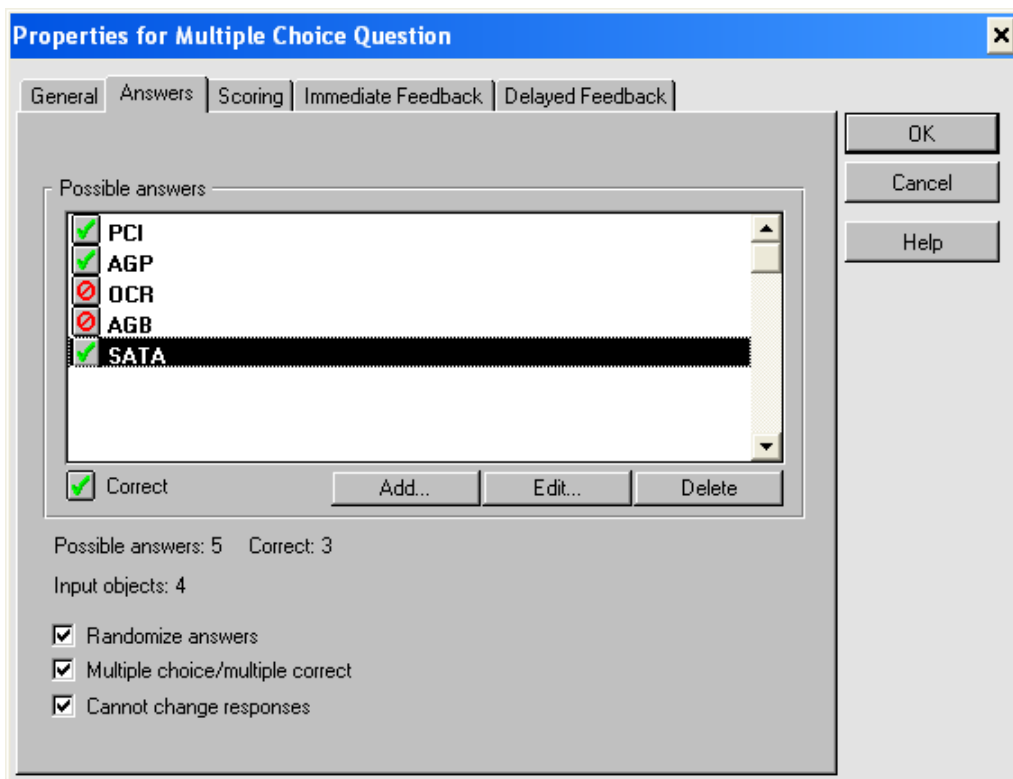


Fig 3. The Extended Properties for Multiple Choice Question – Answers Tab

The simplest scoring is a tally of the questions the student has answered correctly. For more flexibility, it is possible to assign different point values to different questions. It is also possible

to assign a weight to each correct answer by specifying a correctness factor within any question object. Points can be also subtracted from the student’s score for incorrect answers.

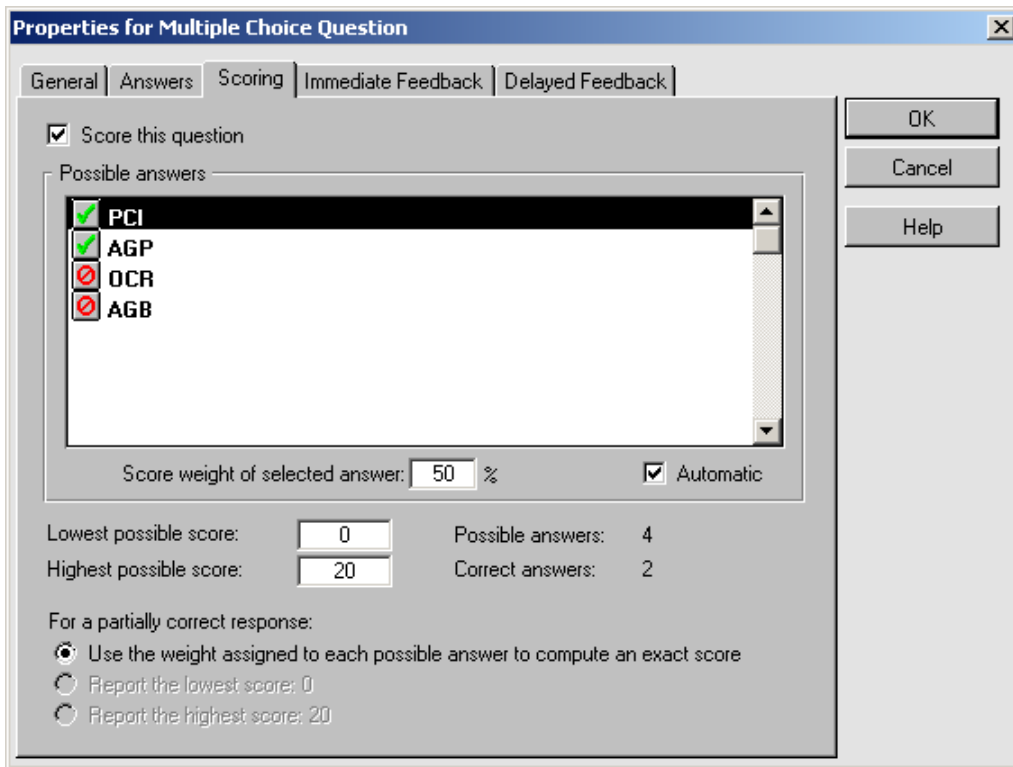


Fig 4. The Extended Properties for Multiple Choice Question – Scoring Tab

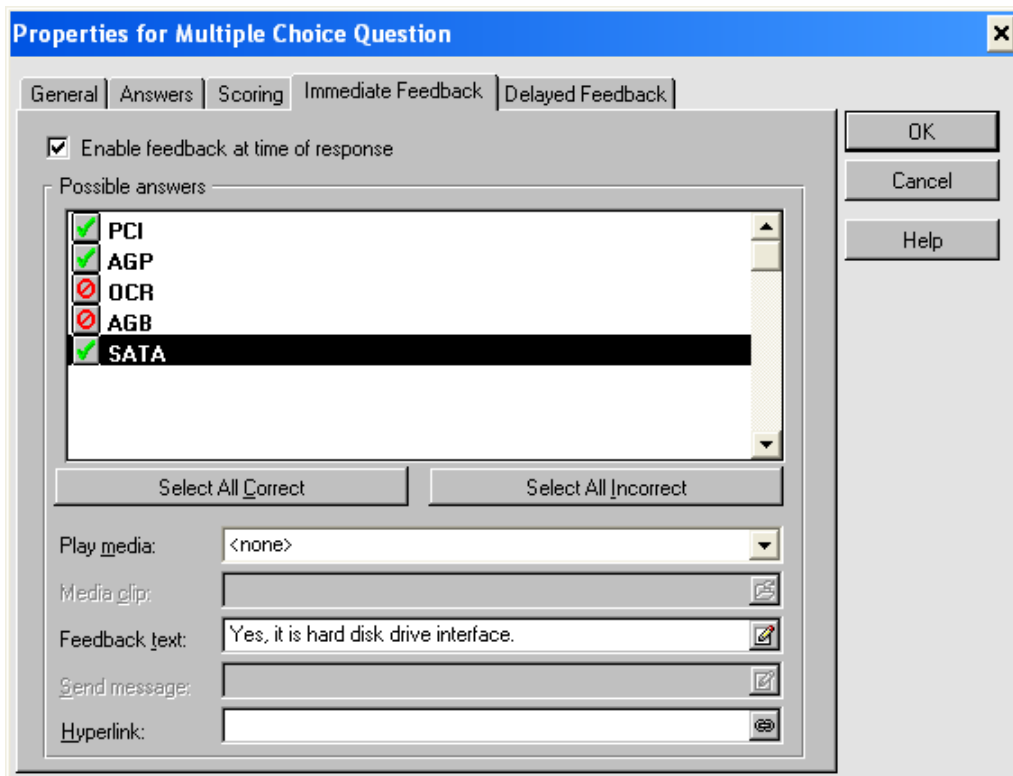


Fig 5. The Extended Properties for Multiple Choice Question – Immediate Feedback Tab

ToolBook Instructor provides several types of feedback that user can specify for question objects. For example, user can play a sound or media file, display text, navigate to another page, navigate to a URL (a Web address). It is possible to combine these methods and use more than one type of feedback in response to the user's choice. Feedback for a question object can be immediate or delayed. Delayed feedback is useful for providing feedback on multiple-choice/multiple-correct questions where we want the student to select several correct answers and then click a button to receive feedback on the selected set of answers.

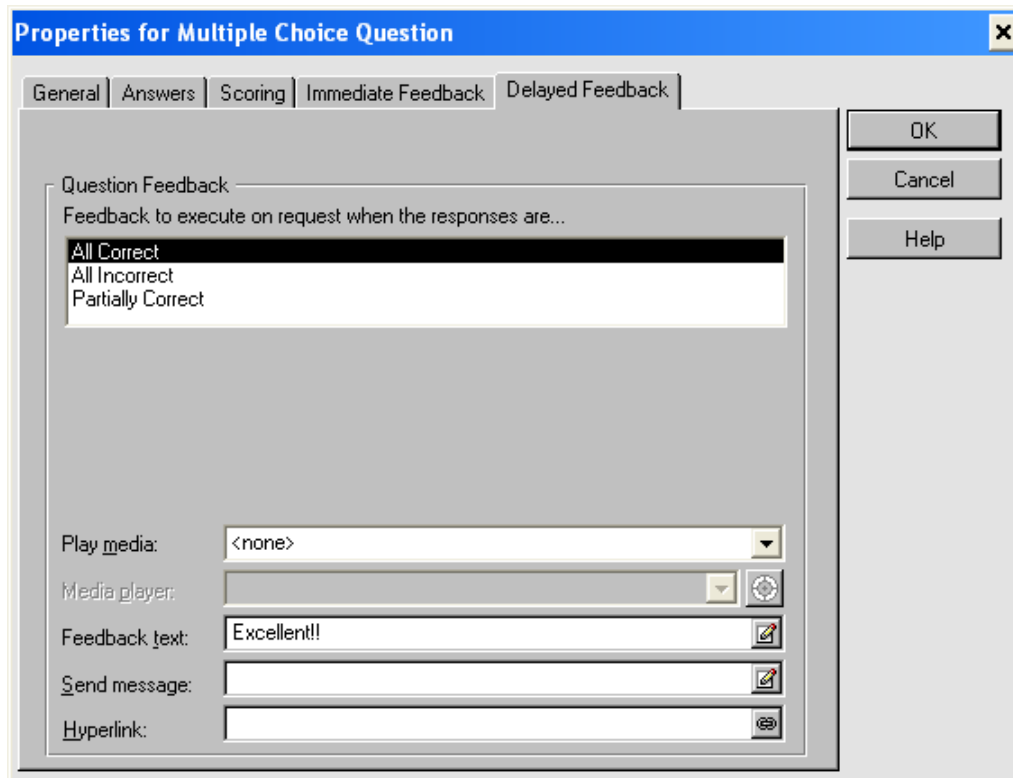


Fig 6. The Extended Properties for Multiple Choice Question – Delayed Feedback Tab

Discussion

Life cycle of an electronic question object can be defined as a sequence of particular stages.

Definition 4

Life Cycle of an electronic Question Object (LC_QO) is a structure

$$LC_QO = [S1, S2, \dots, S8] \quad (4)$$

where

- S1 is creation of the main idea of the question object proposal;
- S2 is making a standardised description of the question object proposal;
- S3 is discussion and adjustment of the question object proposal;
- S4 is creation of the accepted question object in chosen authoring software;
- S5 is discussion and adjustment of the overall design and especially the graphic design of electronic questions;

- S6 is question object usage;
- S7 is maintenance of the question object;
- S8 is discarding of the question object.

The Main Idea of the Question Object Proposal

This proposal should be created by the course supervisor, some of the course teachers or students. The goal is to prepare a primary description of the appropriate idea. The author of the proposal should formulate the suggestion of the type of QO, its purpose and its future use.

Making a Standardised Description of the Question Object Proposal

The goal of this second stage is to prepare a standardised proposal with the help of standardised description tools. It should be a task for a team supervised by the course supervisor or other responsible person who is closely connected with the course and their grasp over the course issues is sufficient, close to the role of the course supervisor.

Discussion and Adjustment of the Question Object Proposal

The standardised description of QO should be discussed in a team of three persons (at least) led by the course supervisor. This team should discuss the standardised description from the expert, pedagogical and psychological point of view. The result should be the final QO description.

Creation of the Accepted Question Object in Chosen Authoring Software

The creation of the accepted QO in selected authoring software should be made by a person who has a very good knowledge of appropriate authoring tool and has a very good sense for graphics. Improper graphic representation of future electronic questions generated from QO could prevent students from using them and debase the value of a high-quality description of the QO.

Discussion and Adjustment of the Overall Design and Especially the Graphic Design of Electronic Questions

Assessment of QO creation, suggestion of possible modifications and their step by step inclusion can be called 'QO debugging'. The final assessment should be done with the participation of students. Expert, pedagogical and psychological approaches should be used. At the end of this period the QO will be released for practical use in the course teaching. This QO will be a member of a list of active QOs.

Question Object Usage

Every question object from the list of current question objects is then used for the generation of electronic questions. These questions can be used in self tests and tests according to the course supervisor's instructions. The use of the QO lasts until it is discarded from the list of active QOs.

Maintenance of Question Object

The maintenance of the QO is based on the realisation of small changes in the QO according to the requests of the course supervisor. These requests are specified by the course supervisor in accordance with the permanent feedback from the teachers and students of the respective course.

Discard of Question Object

The discard of the QO means the removal of the QO from the list of active QOs. It stops the use of this QO in teaching and learning processes connected with the specific course. This QO can be used as an inspiration for creators of new objects in the future.

Conclusion

The paper describes the necessity of a global point of view on electronic testing. That is the reason why some terms were defined and the life cycle of a question object was formulated. The electronic testing should be based on the formal description of question objects which are needed in actual teaching and learning processes. One of the most important notes is that the formal description of the useful types of question objects should be developed and improved independently on the existing software. Software creators should then be inspired in this theory.

The recommendations for the further development of electronic tests and self tests are as follows:

- Electronic tests and self tests should be the necessary supplement of study materials at educational institutions.
- List of available and recommended QO type templates should be prepared and known at the educational institution.
- Every department of the educational institution should have a contact and responsible person for the electronic question objects creation. This contact person should be interested in both the theory and also practical usage of electronic tests and self tests.
- Close cooperation with students is a key for a high-quality tests and self tests creation and usage.
- Electronic self tests should always be used without monitoring the students.

The electronic testing issue deserves more attention than it has been paid so far. This difficult work is sometimes underestimated. Design and implementation of high-quality QOs, based on study texts, is a difficult process but it is a very useful activity. The process of creation of the QOs should be opened to a wider range of people; the course supervisor's contribution is always irreplaceable. High-quality electronic tests and self tests available to learners will undoubtedly strengthen their motivation.

Acknowledgements

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