Knowledge assessment improvement in Moodle environment

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The purpose of this contribution is to present an application that was developed within the frame of HP-funded project implementation to support Specification and description languages course. In this course the students should comprehend the methods and techniques used in digital system design, and gain the skills in digital systems modelling using HDL languages. The exams in this course used to be done in pen and paper even when students’ practical skills were to be evaluated. Although this type of exam gives the minimum chance for cheating, it is not very suitable especially when testing practical skills. That is why the testing module was designed, suitable for online skills based examination in the area of digital systems modelling. The module can easily be incorporated into the Moodle Content Management System and supports not only HDL but other (programming) languages as well.

Keywords knowledge assessment; HDL; programming languages; Moodle; Drag&Drop technology

1. Introduction

Web based training is currently a very popular method of education. It represents modern trends in application of new educational forms, based on convenient utilization of capabilities, provided by IT technologies. An integral part of education and learning process is the verification of gained knowledge. The classical type of exams - pen and paper is not suitable especially when students’ practical skills have to be evaluated. This is also the case in the course Specification and description languages. In this case there are number of disadvantages concerning pen and paper exam. The students have no chance to test the correctness of their designs before handing them out for evaluation. This type of exam also does not allow the verification of student’s ability to debug the created model, which is substantial part of student’s practical skills. What is more, pen and paper works are very difficult to read, correct, and evaluate. It is really demanding and time consuming work for teachers.

To ease this work, various Content Management Systems can be used to evaluate student’s knowledge in the form of test. The problem is that non of these systems supports skills based assessment. Above mentioned problems forced us to develop special module for Moodle Content Management System that will improve the Moodle assessment capabilities.

2. Assessment improvement specification

The system functions were derived from the activities that have to be done when student’s knowledge has to be verified. The diagram of these activities is shown in Fig. 1.

The activities are divided into 3 categories. The activities in a blue field are carried out by teacher. The activities in the red field are carried out by students. The activities in yellow are usually also carried out by teachers, but these are the activities that will be carried out automatically by developed application.

The application will also assist in performing other activities. This means that Drag&Drop module will be used by two types of users – student and teacher.

The following functions of Drag&Drop modul will serve the users to perform these activities:

**Fill in the assignment** - serves the student to fill in the required data to get the solution. The assignment can be filled in only when the examination is going on. The date and time of filling is the part of the completed assignment.

**Submit exam** - serves the student to upload the completed assignments.

**View evaluated assignments** - serves the student to review the rates of previously completed assignments.

**Create assignment** - serves the teacher to create a new assignment.

**Modify assignment** - serves the teacher to change any data of the assignment that was already created.

**Delete assignment** - serves teacher to erase an assignment from Drag&Drop modul.

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Create exam - serves the teacher to create a new exam. Part of the exam is the date, time and place where the exam will take place, as well as the duration of the exam. It is also necessary to specify the students who will participate in the exam and to choose, in general several, (already created) assignments for the exam.

Modify exam - serves the teacher to change any data relating to the existing exam.

Delete exam - serves the teacher to remove an exam from Drag&Drop modul.

Activate exam - serves the teacher to switch the exam to active mode. The students who participate in the exam can fill in the assignments only in case the exam is activated. Drag&Drop modul automatically deactivates the exam when the time expires. Time and date of the exam is not taken into account in the process of activation/deactivation. This is just the information for students to see, when the exam will take place.

Deactivate exam - serves teachers to deactivate an exam immediately. In case the students are just in the process of filling in the assignments, Drag&Drop modul stores the current state of in-process assignments.

Evaluate assignments - this function serves teacher to make Drag&Drop modul assign rates to solutions based on the rules stated at the time of assignment creation. These rules are part of each assignment.

View filled assignments - this function serves teacher to review the student’s solutions either rated or not yet rated.

Re-grade one student - the function enables teacher to change the grade of specific student regardless of the evaluation rules of the completed assignment.

Change evaluation rules - the function enables the teacher to alter the evaluation rules of specific assignments in the exam. After applying these changes the rates of students on the exam will be changed accordingly.

### 3. Special Moodle environment modul design

The testing system was designed in the form of module that could be easily incorporated into the Moodle Content Management System and is based on Drag&Drop technique, that is especially suitable for tablet PCs’ touch-screen and stylus.

#### 3.1 Drag&Drop module data model

Drag&Drop module is the web application, which was created as an extension of an existing application Moodle. The interface between the Drag&Drop module and Moodle are database tables that are part of Moodle and will be accessed by Drag&Drop module as well. The Data model diagram, given in Fig. 2, captures the core entities of the system, their mutual relations, and its integration into the external system.

The database representation can be divided into three parts: active, archive and Moodle part. Active section contains data that are actually in use. Archive section contains the entries that should remain unchanged in the future. Part Moodle contains the tables with external data such as information about logged in students and about actual course. Only the information about the assignments needs to be backed up. Therefore, the tables mdl_dd_job, mdl_dd_codebox, mdl_dd_dragers, and mdl_dd_join_exam_job will be duplicated in the system, once as an active table, and once as an archive record.
3.2 Drag&Drop module user interface

Figure 3 shows the student interface used to fill in the assignment. On the right hand side there is the pool of possibilities that can be used to replace the gaps in VHDL code on the left hand side.

![Drag and drop test](image-url)

Fig. 3 The screen of user interface – student part.
3.3 Drag&Drop module behaviour

The behavior of Drag&Drop module from student's point of view is given in Fig.4. The diagram describes the process of exam completion.

On the teacher side, the assignment creation starts from the working design or program, prepared by teacher outside the system in a development environment specific to selected language. This ensures the correctness of the solution. The teacher then decides and marks in the text, which rows will be excluded from the code and replaced by the gaps. Any number of rows can be excluded from the code. This gives the teacher possibility to prepare the test on various levels of difficulty. This program code is the main input of Drag&Drop module. The excluded rows will appear on the right hand side of teacher screen and can then be enriched by any number of incorrect/confusing statements, allowing thus to make the test even more difficult. There is also the possibility to change the weight of the excluded rows to make some of them more important. The rows are then mixed together and presented in one pool, were students will pick out the rows to replace the gaps in the code.

![Fig. 4 Drag&Drop module behaviour EPC diagram](image)

3.4 Drag&Drop module implementation

The Drag&Drop module inherited the requirements that are imposed on the software into which it will be integrated. Moodle requires a web server and database server and can work either with MySQL or PostgreSQL database. User interface and management system are implemented in HTML and PHP. So the proposed module had to be implemented in these languages as well. The core of the module was implemented using the scripting...
language PHP on server-side. In addition to this language the client technologies - JavaScript and Ajax have been used. To implement the user interface the class of YAHOO - UI Framework technology was used. This is the Framework written in Javascript.

4. Results and experiences

The course assessment redesign in Specification and description languages course has already started and the pen and paper tests were partially replaced by online tests. Various types of questions were used including multiple choice single and multi answer, true-false questions, cloze questions, missing words questions etc. Thanks to this assessment redesign there was a big increase in students’ success in this course – almost 40 %. Unfortunately this did not reflect the increase in students’ knowledge. On the contrary, these tests have just proved, that the online exam was much easier then the pen and paper one.

These were the main reasons, why we concentrated our work especially on using HP technology to enhance the course assessment. In order to support the course, the testing module was designed, suitable for online skills based examination in the area of digital systems modelling, using VHDL, Verilog, or SystemC environment. Although the testing system was primarily developed to support HDL languages, it can directly be used to test the skills in using other (programming) languages as well.

The first results have proved, that this kind of online test provides more realistic image about the students’ knowledge in the area of digital systems modelling, compared to the types of questions commonly used in online tests. The results of Drag&Drop module are comparable with previously used pen and paper tests.

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References