A New Programmed Learning Module in LMS Moodle

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Abstract

The contribution deals with the principles of programmed learning, specifically with implementing a new module to LMS Moodle. This study activity allows the construction of a new question type. If a student doesn’t answer correctly, the main question is substituted by a set of easier sub-questions. The order of these sub-questions is set by means of question maps suggested by the teacher. All processes related to displaying, answering and evaluating the questions are managed by the Moodle question-answering system. The new module extends the offer of question types in LMS Moodle. The paper briefly introduces the principles of programmed learning and it describes the method of branching learning that is used in the module implementation. Next the methods and the used tools for the module implementation are presented. The question map as a core of the module is explained, its function is described and the cooperation with the question bank is presented. The use of the module is explained on a simple example. Finally the results of the new module as tested by users are discussed.

Keywords


Introduction

A lot of e-learning courses are constructed on the basis of a common template. The study texts are presented and then the teacher examines the students’ knowledge and their understanding of problems by means of self-tests or tests. These two areas (study texts reading and testing) are generally divided from each other. A self-test as a teaching tool is an effective way of practising, but the use of programmed learning and integrating the practice straight to the learning process is a further approach to the problem of effective learning. The study problems are divided into a number of small parts sequenced in a logical order. Each part is controlled by a question and the correct or incorrect answer to this question navigates the student to the next selected part according to the correctness of the answer. This approach supports the student’s activity and makes the texts more comprehensible. If a student answers correctly she/he continues to the next problem. On the other hand, if the student answers wrongly, she/he can study the problem in a row of smaller and simpler sub-problems.

In the paper we present the implementation of an approach that is best illustrated by one of the study activities in LMS Moodle. The result of our effort is the new module of LMS Moodle that uses
the questions taken from QB to create a set of new questions and it is exclusively based on the Moodle mechanism of answering and evaluating the questions. The module allows constructing a new question type which can be related to simpler sub-questions from QB and the course teacher can determine the way of proceeding through the sub-questions.

Programmed learning principles

Programmed Learning (PL) as a learning methodology was introduced for the first time by B. F. Skinner in 1958. According to Skinner, the purpose of programmed learning is to "manage human learning under controlled conditions" (Pritchard, 2009). Programmed learning has three elements:

1. it delivers information in small bites,
2. it is self-paced by the learner,
3. it provides immediate feedback, both positive and negative, to the learner

The methodology involves self-administered and self-paced learning, in which the student is presented with information in small steps often referred to as "frames". Each frame contains a small segment of the information to be learned, and a question which the student must answer. After each frame the student uncovers, or is directed to, additional information based on an incorrect answer, or positive feedback for a correct answer. (Pritchard, 2009).

The Skinner’s ideas of linear programmed learning are developed by N.A. Crowder (1960) in a branching version of the Program Instruction approach. If the user makes a correct response, the program asserts the reasons why she or he was correct and moves on to a new material or a new task. If the user makes an incorrect response, the program informs the user about the error and then navigates the user back to the previous frame for another try or moves the user to a simpler task as a part of the main task solution.

Crowder’s approach was used in implementation of the programmed principles to LMS. Some contemporary works follow these principles in the development of an adaptive environment in LMS depending on the content (Kapusta, Munk and Turčáni, 2010). These principles were also applied in the current study activity “Lesson” in Moodle. The student reads study materials and at the end of each small part she/he is questioned according to the content of the study text. The question is in the multiple choice format and each choice navigates the student to the next part of the study text. The activity Lesson doesn’t allow the application of different question types. That’s why we focused on developing a new activity for the construction of questions. It is a new type of questions that consists of a set of sub-questions. These sub-questions are simpler and clearer than the main question and they explain the solution of the main problem in smaller steps. If the student doesn’t solve the main problem, she/he is moved to the first sub-question and if she/he solves this sub-problem, the solution process can continue by solving the main question or by solving the next sub-question.

Methods and used tools

In the first step of the implementation of the programmed learning module we looked for a suitable LMS that supports PL or supports the implementation of PL into the system. According to these findings we have selected LMS Moodle with respect to the following:

- Wide community of LMS users and developers worldwide
- Widespread use in many educational institutions
- Rich and useful documentation

Last but not least, LMS Moodle is used at University of West Bohemia and the implementation can be done in cooperation with the local lecturers and on the basis of their demands. We selected LMS Moodle version 2.0.2 and now the system is being prepared under the new version 2.1.

The developed module allows the implementation of the branching program according to N.A. Crowder. Each branched sub-question can be connected to the next question via two references. One of them is used in case of a correct answer to the question; the other one follows in case of a wrong answer. The student is guided to a suitable question in compliance with the prepared scheme (question map). The basic principle is shown in Figure 1.

Figure 1: An example of question branching (Source: own)

Figure 2 shows a graphical object that represents a sub-question as a basic building element in the construction of the main problem (question). The question creator can position the question as the first one in the chain of the sub-questions; she/he can then set the following question according to whether the answers were right or wrong and furnish them with possible control elements.

During the implementation of the module we followed the below principles:
- User friendly environment for students and course teacher
- Easy localization to other languages
- Maximum employment of the current program code of Moodle
- Possibility of controlling the students’ results and progress

The success of the basic programmed learning principles depends on the course teacher. It is necessary to prepare study texts and it is important to divide the problems into smaller and easier parts carefully. Thanks to the course structure it is possible to attach a short lesson or study text with an appropriate question or with a set of such questions.

We used LMS Moodle documentation (MoodleDocs, 2011) widely describing the implementation of the new module step by step. The support for a Moodle developer offers a pattern of the new module and it allows its modification.

PHP was used as the main programming language (PHP DTP, 2011). The new module was implemented on MySQL database. In the module the universal database adapter in Moodle code has been integrated and the module can cooperate with any database supported by Moodle. The important part of the new PL module is the question map (QM) that allows constructing and displaying the scheme of questions. This graphical user interface was developed by means of the JavaScript component jsPlumb (jsPlumb, 2011).
The component jsPlumb enables to insert the questions from the question bank to the QM and the setting determining how questions are interconnected. The teacher manages all these operations by means of mouse only. As a part of jsPlumb the jQuery JavaScript component is employed. We selected version jQuery 1.4.4 and version jsPlumb 1.2.5.

After saving QM the process has to detect the position of the question elements on QM and to detect the connections among them. These data are saved in JSON format (JavaScript Object Notation) from YUI2 library (JSON, 2011); they are then transferred to the server and then they are saved to the database. Moodle consists of a basic part of YUI2 library and the JSON part installed as an attachment of the library.

PL module proposal and implementation

The process of the new PL question creation starts by selecting a new student activity – a PL question. The creator fills in the name of the question and maximum grading as in the case of other questions. Then the environment of PL question construction opens.

The basic element of the environment is QM. This scheme consists of smaller and easier problems that explain the main problems (questions) and their solution. The QM allows inserting different questions and setting connections among them. During the implementation we used the current system of questions in Moodle and their evaluation. It means that the questions of all the offered types can be inserted to QM from the question bank, and, at the same time, all questions, i.e. both the main question and the relevant sub-questions are part of QB in any category. The graphical user interface of QM is shown in Figure 3. We used an example from financial mathematics – the calculation of the last irregular payment of annuity. This problem consists of several steps – sub-problems. First of all the student has to determine the number of periods, then she/he has to know how to calculate the future value of annuity and then she/he has to determine one of the two methods for the last irregular payment calculation. All of the described sub-problems can be practised by means of single questions that are prepared in the question bank. This QB is displayed together with the QM for the teacher (question creator) in the same form as it is during the quiz creation (see Figure 4).
The questions are moved from QB in the same manner as in the quiz creation. A new graphical object (see Figure 2) representing the question is created in the window of QM. Then the creator can move this object to any place on the QM and then she/he can connect the question to other objects by means of mouse dragging. Finally the QM and the whole PL question are saved.

**Evaluation of PL module**

We tested the use of the new module in cooperation with 8 users. They had to create a new PL question in the implemented module and to connect the sub-questions to one another. The PL question consisted minimally of 3 sub-questions. Finally the users tested and evaluated the new PL question from the student’s point of view. No users had known LMS Moodle as administrators before and that’s why the basic procedures in the administration of the system were explained to them, but the administration of the new module was not mentioned. The results showed the following conclusions:

- Despite the fact that the users had no previous experience with the administration of the system, 75% of them used the new PL module without any problems.
- Only one user met a serious technical problem, because she/he operated Moodle in an older web browser version.
- Most users (75 %) felt that using the new module would be interesting and useful for students.
- The users suggested only one innovation of the module, and that was improving the orientation in QM in case of a larger number of sub-questions.
Conclusion

The presented new module integrates the principles of programmed learning into the courses in LMS Moodle. The proposed mechanism of the question map allows the teacher to determine the way of solving difficult problems. Students can solve the question in smaller and easier steps. With respect to the determined scheme of the sub-questions the student can return back to the main problem after succeeding in the solution of any sub-problem.

Based on testing the module by users and on our experience the following improvements can be done:

- A detailed report about the progress of students in the course of solving the PL question,
- Clear management of sub-questions with respect to their number. The implementation of question maps as a separate window with an adjustable size is desirable.
- The implementation of a PL question in the form of a new question type under the Moodle question-answering system.

The next step in developing the new question type is the implementation of a recursive mechanism and improvements in the structure within the question map.

Despite the above mentioned imperfections the developed module proved a useful tool for enhancing the students’ learning efficiency. At last the quality of learning depends solely on the way how the teacher proposes the structure of all the sub-questions.

References


