Activity “lesson” on Moodle for the teaching and learning of mathematics to engineers

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Abstract

Moodle is a class management system to promote interactive and collaborative learning activities. One of the most complex and interesting activities in Moodle is “Lesson” which facilitates the formation of theoretical thinking, based on reflection, analysis and planning, which in turn leads to psychological and intellectual development.

This Moodle activity was used in Calculus I on the Electromechanical Engineering Course in Coimbra Institute of Engineering. The main purpose of its use was to improve the students’ motivation and increase the success in Calculus I. By using this activity in a creative way, it is possible to build contents that really overcome the normal limitations of contents pages and transform them into motivating and effective tools.

Introduction

It is widely known that, currently, demotivation, lack of interest and educational underachievement levels in higher education are very high (Arman 2008, Marçal 2009, Wagner 2008, Woodill 2004). That is why it is essential to increase the motivation of each student. For that propose, along with the intention of increasing the teacher-student interaction by enabling a more flexible learning, the project e-MAIO (Interactive Online Learning Modules) was created. The e-MAIO is a project developed over the Moodle platform for mathematics teaching and learning, and was applied to the engineering courses in Coimbra.

The activity “Lesson”, available in e-MAIO, is a set of pages containing not only text and multimedia material but also a number of questions concerning the relevant content. The development of the lesson is based on the answers given by the students to the questions. These lessons have a number of alternative pathways, through which certain content becomes available, depending on the student’s answers. This allows for the tailoring of the content to each student’s study rhythm. For example, students with greater knowledge are conducted through a shorter pathway, without having to go through the more elementary topics. Each question has different answer options, each one connected to a different progress phase of the lesson. This leads the student either to another page or returns to the same page, so that the answer choice determines the sequence of the lesson. As not all the students have the same study rhythm or even the same way of interiorizing the discussed themes, the use of this tool encourages them, enhancing the learning and increasing its success.

This article describes the application of the activity “Lesson” in Mathematics teaching to Engineering courses as well as the feedback received from the students involved in this experience.
At the end of the first semester of the school year 2013-14, an online inquiry was given to the students from the Electomechanical Engineering course, aiming to get to determine the satisfaction level of the students regarding the utilization of the activity “lesson” on e-MAIO.

**Activity “lesson”**

More and more, motivation is a key factor in student achievement (Lourenço 2010). Because students do not have the same learning pace, nor the same way of absorbing the contents, the use of different teaching methodologies according to each student may be an important motivation element and therefore a promoter of the students’ learning success (Cury 2000, Zhang 2006). The use of Moodle (Modular Object-Oriented Dynamic Learning Environment) provides its users (students) an individual learning environment that can be customised (Penny 2011).

Many learning models, based on Moodle, have been developed for the teaching and learning of mathematics in engineering (Coan 2011, Fujimoto 2010, Madeira 2012, Reali 2012, Rodrigues 2010).

“Lesson” is one of the most interesting Moodle activities and is similar to a textbook with pages and exercises. The big difference between “lesson” and a textbook is the available resources. A Moodle lesson may have audio, video and web links, whereas a book does not. A “lesson” allows the presentation of contents in an interesting and flexible way. Basically, a “lesson” is made by a set of contents pages where there is a theoretical exposition of the subject matter and pages of questions about the subject matter on contents pages. These questions may be, for example, of the true/false type, short answer type, multiple-choice, formative or numerical. The questions are on pages which may include different response options, each option being associated with an advance (or retreat) in the lesson. This advance (or retreat) guides the student to another page, or back to the same one. It is the student’s answers that define the lesson sequence. The student goes forward in a sequential way or is guided onto different paths, so that the content is always adapted to the student performance.

The figures below illustrate examples of this potential:

![Figure 1 - Lesson navigation](image1.png)  ![Figure 2 - Lesson navigation](image2.png)
In Figure 2, if the student answers correctly the question on page 1, it will lead him to page 2, skipping the entire set of intermediate pages. As the student verifies the knowledge that he has acquired in a particular subject matter, the student then progresses along several pages related to this same subject matter. So it possible to adapt the learning path of each student to the level of knowledge that he demonstrates he has already acquired.

The level of complexity that a lesson can reach is unlimited and the professor can create lessons with a much more complex navigation, as is illustrated in Figure 3.

![Figure 3 - Lessons with complex navigation](image)

In a much more complex scenario, each answer option to a question may guide the lesson to a completely different page sequence. These possibilities offer several pedagogical advantages, as the content fits entirely to the students' knowledge and performance.

Another capability of the content page is to use it as a menu, so that the student can choose, according to his needs, different sets of lesson pages, as shown in Figure 4 below.
Page 1 is lesson’s first page and it presents three options. The first two allow movement to different sets of pages, whereas the third option ends the lesson. Note that the last page of each set of pages, is set to go to page 1, to allow the student to return to the initial choice where he can then make new choices.

One of the purposes of this kind of structure is to allow the student to choose the order that he wants to consult the pages and present him with alternative ways of learning so that he can choose the one that best fits his way of learning. It also makes the student more responsible for his learning process.

**Feedback from students that use Lesson on e-MAIO**

The lessons on platform e-MAIO were used by Calculus I students from the courses of Electromechanical Engineering during the first semester of 2013-14 as a complement to regular classes. Students used them optionally, most of the times more than 2 to 3 times a week, which shows the interest and the motivation for this kind of activity.

For the Lesson operation and pedagogical organization (Table 1) students evaluated all the items very positively. It was adopted to a Likert scale, where each item was evaluated with a degree of concordance between 1 to 5, as follows: 1-Strongly Agree, 2 - Agree, 3 - Neither agree nor Disagree, 4 - Disagree 5 - Strongly Disagree.

<table>
<thead>
<tr>
<th>Question</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The activities are relevant to learning</td>
<td>1.73</td>
<td>0.452</td>
</tr>
<tr>
<td>The texts available in lesson are useful in clarifying the content of the discipline</td>
<td>2.08</td>
<td>0.628</td>
</tr>
<tr>
<td>The solved / proposed exercises in lesson are useful in the consolidation of subject contents learning</td>
<td>1.62</td>
<td>0.496</td>
</tr>
<tr>
<td>The proposed tests are useful for the self-evaluation of the acquired knowledge of the subject contents</td>
<td>1.85</td>
<td>0.543</td>
</tr>
</tbody>
</table>
It is clear that the students valued this activity. As for the lesson benefits on e-MAIO, it is possible to see that students had a very positive appreciation to the questions (Table 2).

Table 2: Evaluation of the benefits of existing lesson on e-MAIO

<table>
<thead>
<tr>
<th>Question</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-MAIO lessons are clear and require little effort to deal with its structure</td>
<td>2.23</td>
<td>0.863</td>
</tr>
<tr>
<td>e-MAIO lessons allow student to use it anywhere</td>
<td>1.73</td>
<td>0.452</td>
</tr>
<tr>
<td>e-MAIO lessons allow the student to use it at any time</td>
<td>1.65</td>
<td>0.485</td>
</tr>
</tbody>
</table>

The main advantages of the existing Lessons on e-MAIO, from the students’ point of view are: the fact that they are always available (anytime and anywhere); being an incentive to study and solve exercises; being an excellent addition to taught classes.

**Future Work**

For future work, it is necessary to analyse the results of the surveys during the school year with a more representative sample of students to better identify the advantages and disadvantages and try to better adapt this moodle tool to the needs and expectations of the students, and so contribute to the increasing improvement of the teaching/learning process. It would also be desirable to apply this tool to other disciplines beyond Calculus I.

**References**


