Virtual Education for Environmental Engineers

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Abstract

The present paper describes the main components and the most important issues concerning the e-Learning system called EnvYJobs. This tool was developed across the implementation of the Erasmus+ project entitled *Environmental learning innovation for more knowledge and better jobs*. One of the main objectives of the project is to enhance students' knowledge in environmental engineering and to make their skills and competencies more attractive for the labor market. The e-Learning system supports both the students and tutors/teachers communicate with each other in order to allow students the access new and interesting knowledge on various environmental issues. In this way, it becomes possible the mutual learning in the field of environmental engineering between important and experimented actors in European higher education system by using the exchange of good practice and implementing innovative tools and instruments.

Keywords: e-Learning; EnvYJobs; Educational Intelligent System; Online Platform.

1. Introduction

Nowadays, there are different resources used in a constructive manner in the framework of the educational systems. One exemplification in this regard is given by the use of the e-Learning approach. This is an approach that already proved its utility and importance in different educational fields as medicine, engineering and others (Delf, 2013; Pintz and Posey, 2013; Granpeesheh et al., 2010; Tauceana & Tamasilaa 2014; Bradac & Walek, 2017).

In the framework of these kinds of systems, students and teachers can be registered and have access to courses contents in different formats. In addition to this pedagogical form, the interaction between the members of the platform can vary from real-time conversation to message boards, charts or offline messages. Advantages of using computer-based learning courses are: i) decrease costs and time of travel concerning to off-campus students, ii) allow students to choose the learning materials that are suitable to their interest but also to their level of knowledge; iii) could be updated continuously in a facile manner; iv) offer the possibility of flexible learning in order to improve learning processes and outcomes; v) induce self-confidence and self-knowledge and others (Hubackova, 2014; Bradac & Walek, 2017; Mahmoud, 2008). Even if e-Learning represents a great opportunity for learning, there are also disadvantages that could arise together with the provided advantages. These kinds of disadvantages could be: i) e-Learning dependence on technology (for instance the computer performances or simultaneous connections supported by servers); ii) some

students are not good in self-organization and sometimes they can fail in knowledge acquisition; iii) practical skills are not always easy to be self-evident from online resources, iv) students may feel isolated or v) by using the computer for a long time can do harm to the user's health (Nazarlou, 2013).

Besides the above mentioned advantages of the e-Learning approach, there is another aspect that should not be neglected by the institutions that intend to provide effective e-learning programs. It is about the psychological consequences that can occur and which are generally closer to the disadvantages of the e-Learning approach. Even if it was demonstrated that, concerning the achieved results through face-to-face activities students can lead to similar levels of academic performance respect to the face-to-screen activities (Kemp and Grieve, 2014), there are some issues that must be considered. For instance, sometimes it is about solitude with consequences on behaviors and relationships, or negative impact on student engagement/motivation. These kinds of considerations are necessary to be taken into account as the E-learning is a complex human learning phenomenon (Yan et al., 2003), in order to achiveve desired benefits.

The present work illustrates an exemplification of how an e-Learning platform could be used in order to provide knowledge to students in the academic field. The present paper presents results of EnvYJobs project coordinated by University POLITEHNICA of Bucharest (UPB) that implements innovative learning and training solutions aiming to enhance student's knowledge in the environmental engineering field by combining improved and tailored skills to the labor market demands. The project offers to bachelor, master's degree students and PhD candidates the opportunity to attend six courses provided by four international partners of the project.

2. The Moodle software platform

The e-Learning software platform that was considered in the present work is known as the Moodle platform: Modular Object-Oriented Dynamic Learning Environment. The platform was developed by Martin Dougiamas and the first version-Moodle 1.0 was released on 20th August 2002 (Benta et al., 2014). The latest version, Moodle 3.4, was released on November 17, 2017.

The success of applying the Moodle platform came up firstly from the fact that it is easy to be used, being the most considered platform in the higher education system with a great impact on both society and the educational system (Songkram et al., 2015; Songkrama, 2015; Popovici and Mironov, 2015). The coursework in the structure of the platform could be synchronous (real-time learning) and/or asynchronous (participants are not all online at the same time). The benefit of the platform is the adaptation on almost all system platforms, supporting lots of useful functions and customization, thanks to its modular structure (as illustrated in Figure 1).

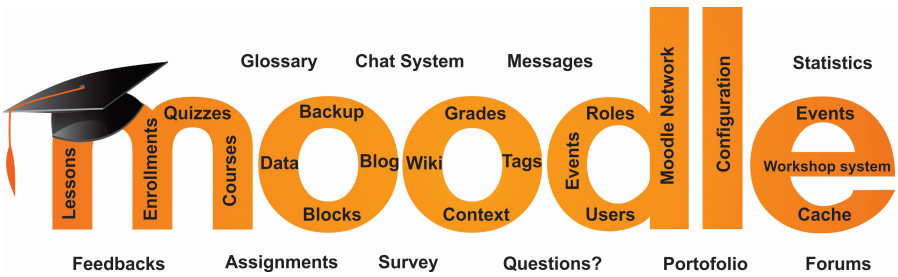


Figure 1. Modular structure of Moodle platform

Important facilities such as upcoming events, recent activity, latest news or search through the entire platform help the user to easily find what he is looking for. Moodle e-learning platform ensures a simpler connection between students and teachers (see Figure 2). Through the Moodle e-learning platform installed in schools or universities, students can communicate with teachers via simple messages or offline messages. On the other hand, teachers can collaborate with other teachers, reply to student messages or even send useful information in no time. All that it is

necessary is to have internet access, login to the platform and collaborate through the message system.

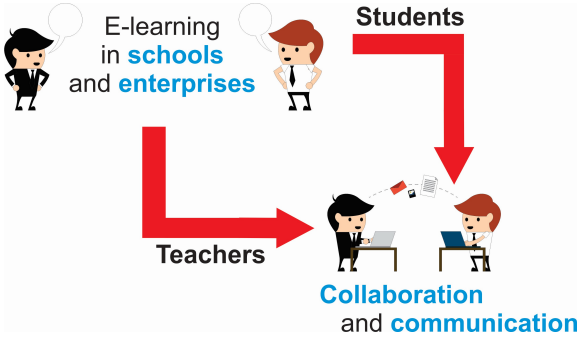


Figure 2. Student – Teacher: communication system along Moodle platform

The use of Moodle platform is vast and covers an important area of facilities such as: 1) online courses; 2) enrollment and divide students into classes; 3) chat session with open forum threads; 4) uploading of files and lessons; 5) online tests with deadlines and feedbacks. There are different Moodle advantages to which a student may have access to, but the most important ones for the user can be evidenced as following: the simultaneous enrollment to multiple courses; attending courses as provided by the teachers; uploading homework with different files; attending to test sessions; chatting with the coordinator/professors on different topics; taking part into public discussion and consult the grading table. Last, but not the least, teachers are able to interact with the platform on a higher level, being empowered to: 1) create courses/lessons or quizzes; 2) manage students and grading upon their results; 3) opening chat with students and give feedbacks to tests; 4) preparing lessons by uploading live laboratories, examinations or video courses; 5) downloading the statistics regarding each test, creating a small rapport with the students results.

In the framework of EnvYJobs project, the Moodle platform was chosen by University POLITEHNICA of Bucharest (UPB). UPB firstly accessed the Virtual Learning Environment (VLE) (specifically the Moodle platform) starting with 2009. The EnvYJobs platform was implemented in a web server as an open-source web application in order to create interactive online learning sites with educational purposes.

3. Results related to EnvYJobs working on e-Learning platform

The rationale of EnvyJobs project is the environmental learning innovation for more knowledge and better jobs. A balance between education – innovation – employability is trying to be ensured claiming that by using innovative education tools the chances of being employed grows considerably.

Starting from Moodle e-learning platform, across the implementation of an Erasmus+ project, EnvYJobs open-source platform dedicated for teaching purposes targeting students from 3 different countries was developed. There are four universities involved in the project: Technological Institute of Central Macedonia - Greece, University of Trento -Italy, Saxion University of Applied Sciences – The Netherlands and University POLITEHNICA of Bucharest –Romania. Each university provided knowledge related to the environmental engineering field across six courses. UPB is involved in the implementation of the courses entitled *Design, Modeling and Simulation Techniques for Wastewater Treatment Processes* (Course 1) and *Soil and Air Quality Monitoring Techniques* (Course 2*)* (see Figure 3).

Figure 3. Courses provided by UPB in the framework of EnvYJobs module

The EnvYJobs open-source platform was developed in such way that it allows to upload lessons, divide them by chapters, create slides, use different movies with web lessons, divide by e-labs, create web labs, upload books, showcase exams, statistical estimations, retrieve results from exams and others (see Figure 4).

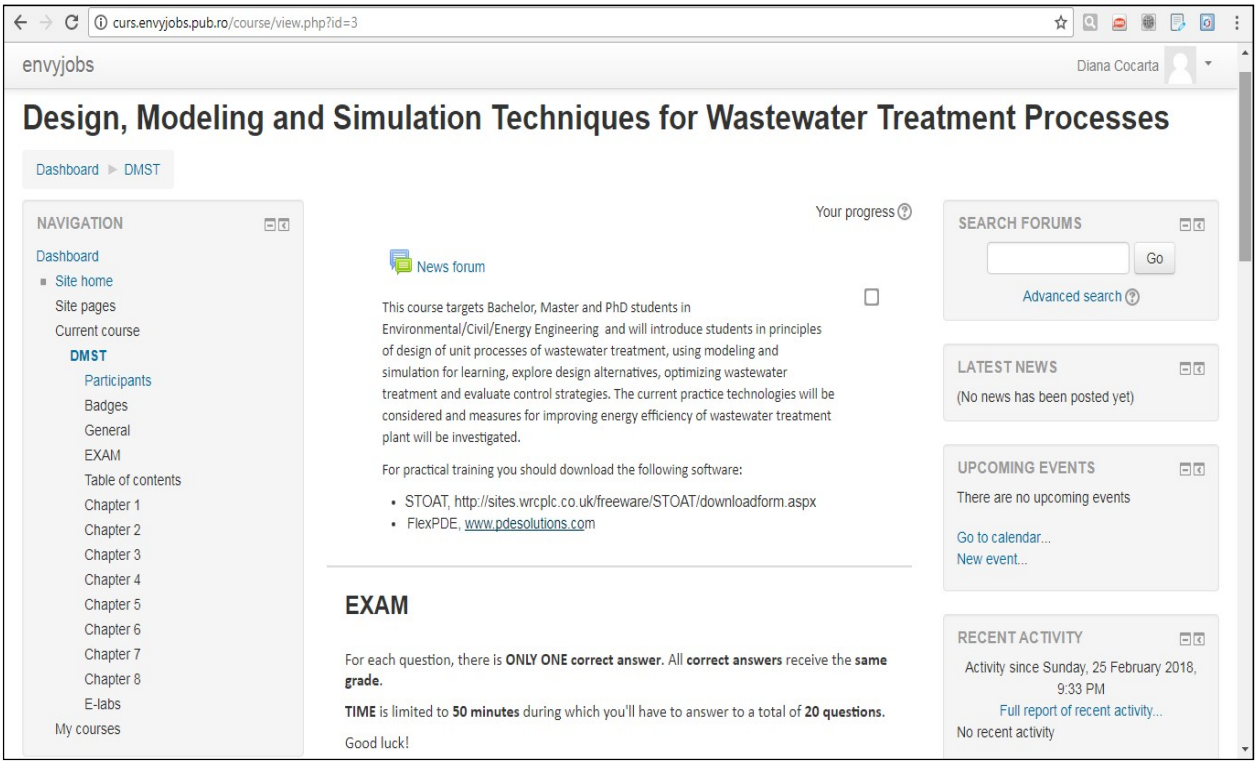


Figure 4. The User Interface (UI) related to Course 1

Across the EnvYJobs project implementation, the students and teachers involved in the project were trained for 5 days in order to achieve information about how to use the platform. Teachers learned how to upload lessons, enroll students, edit quiz, view results etc. and students were informed about how to download lessons, do quizes, view results etc. (see Figure 5).

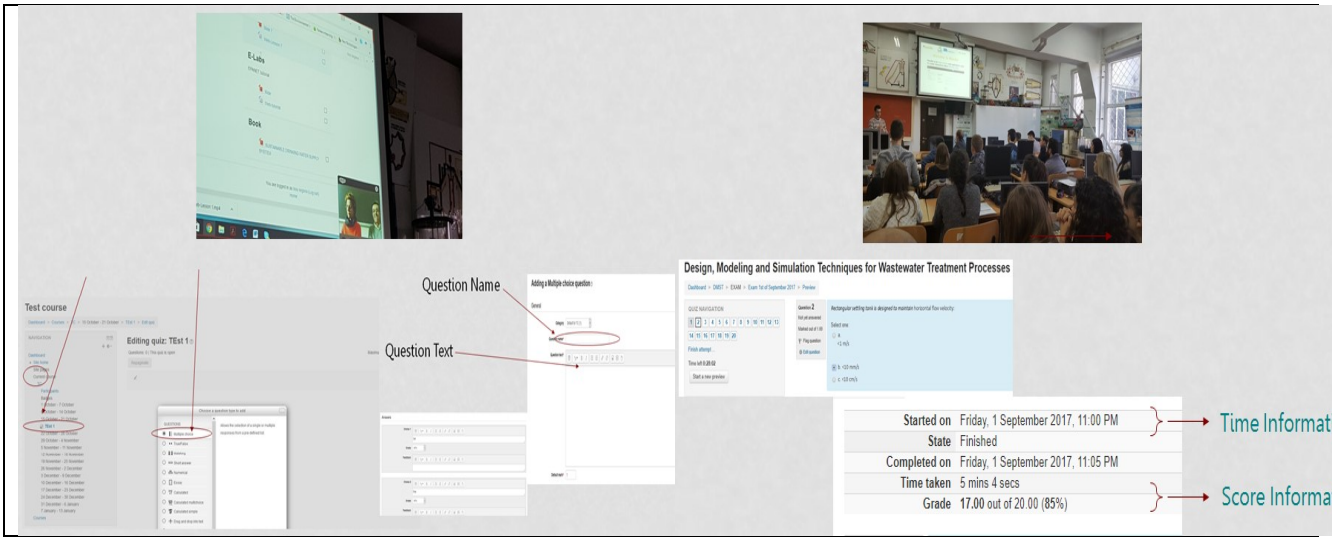


Figure 5.Using EnvYJobs e-learning platform – teachers information

Courses provided by UPB are making available, besides the course's content, e-Labs tutorials, webminars, video labs and evaluation option. In this regard, knowledge achieved by students with the virtual lectures across the e-learning module was assessed through the EnvYJobs open-source platform using evaluation section (see Figure 6).

Results concerning grades for two examinations that were done in the framework of the project are illustrated in Figure 7. This kind of representation of final grades is provided by the section Results – Grades from the User Interface on EnvYJobs platform.

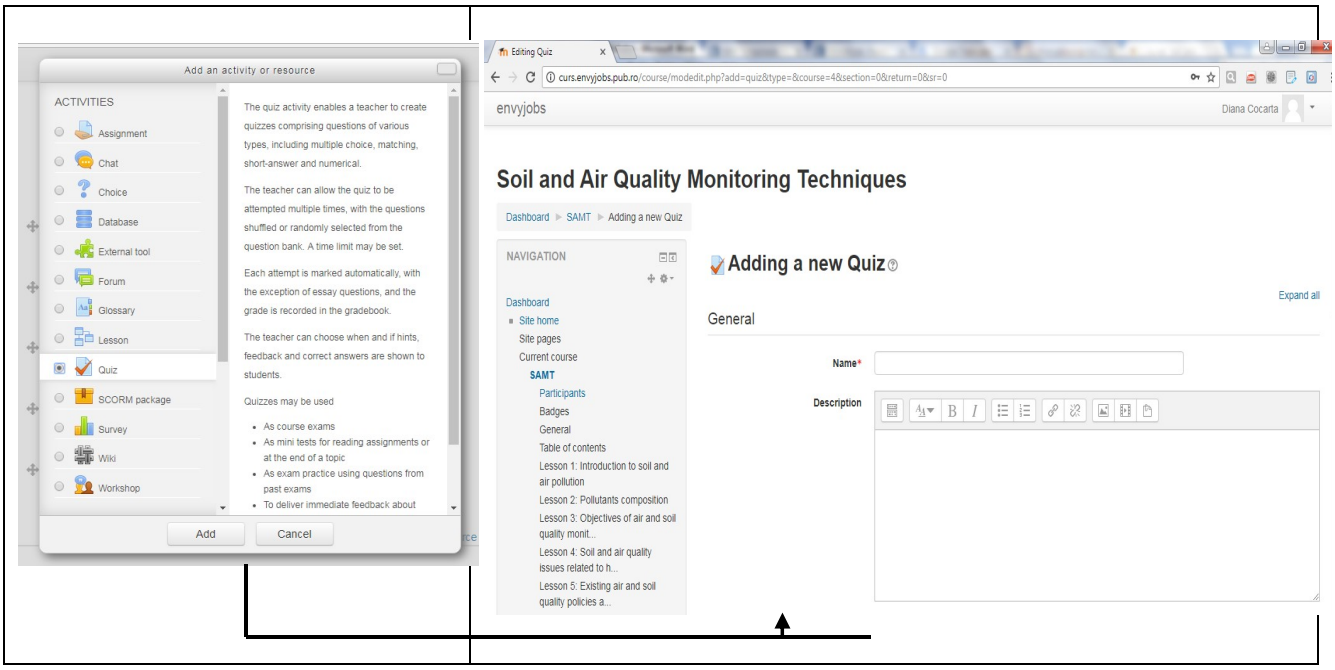
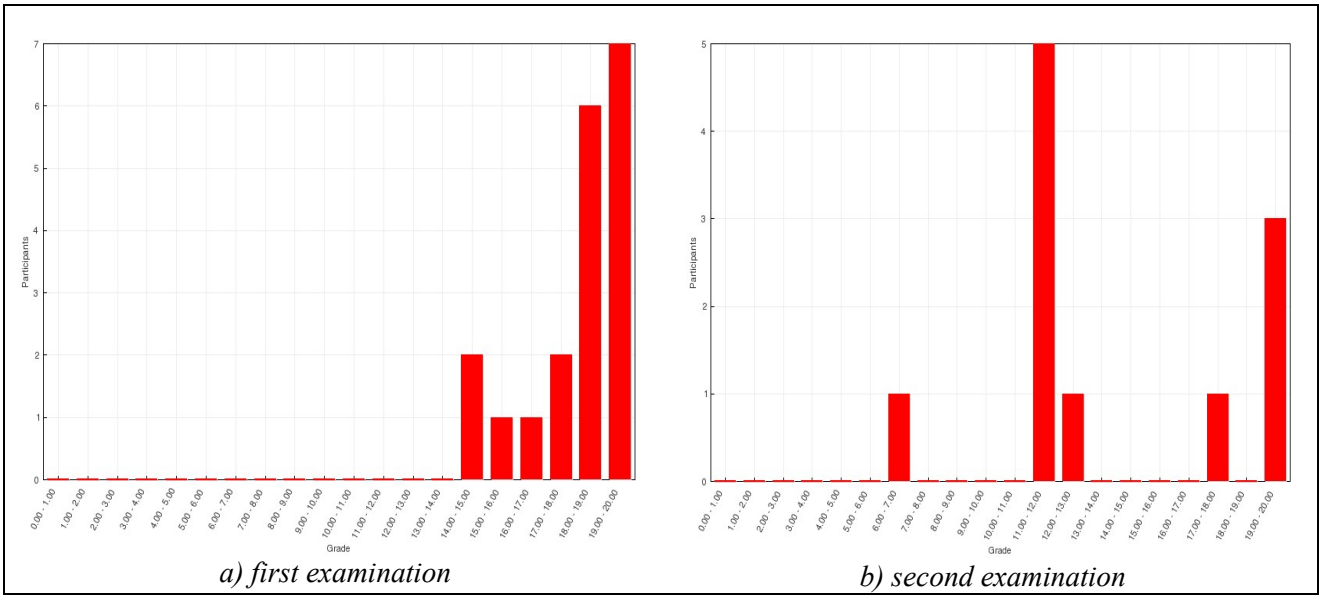


Figure 6. Adding a new Quiz in the framework of the EnvYJobs open-source platform

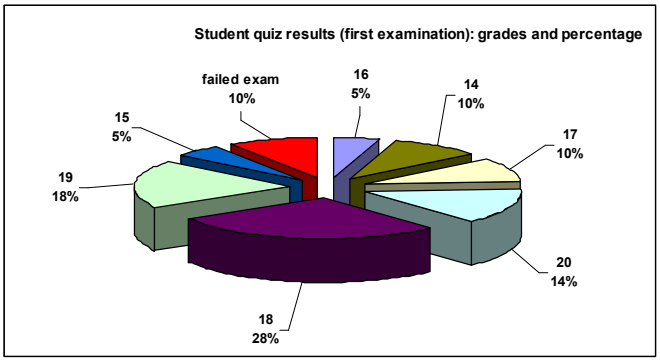
For the evaluation of the knowledge that students achieved together with the implementation of EnvYJobs Erasmus+ project by using e-Learning tools, 33 students participated in the final examination. The final examination for the course *Soil and Air Quality Monitoring Techniques* was organized in two different sessions and consisted of a quiz with 15 questions with one right answer and 2 attempts. Questions were considered from the theoretical and practical content of the course.

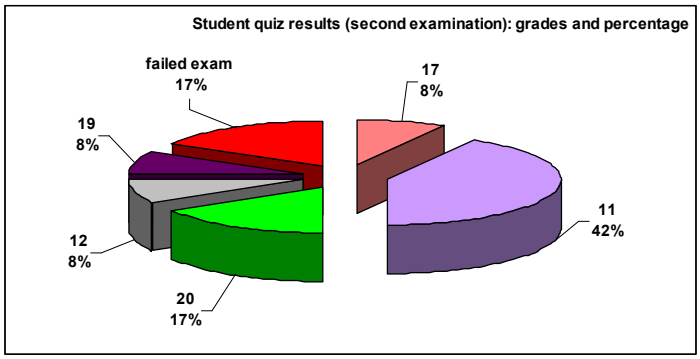
For the first session were enrolled 21 students, while for the second one, 12 students were involved. Students who participated in the Quiz are from University POLITEHNICA of Bucharest, Romania, Saxion University of Applied Sciences, The Netherlands and University of Trento, Italy. Students attended the examination in a classroom, at the same time, being present in each university involved in these kinds of activity, related to the project.



a) first examination *b) second examination*

Figure 7. Students' results for the quizzes in two examination sessions for Course 2





a) first examination *b) second examination*

Figure 8. Students' results for the quizzes in two examination sessions for Course 2: grades and percentage

Different kinds of representations related to the results of the students that participated in the quizzes in the two examination sessions for Course 2 are illustrated in Figures above. Figure 6 indicates the number of the students who received the same grade across the final examination; the graphs are provided automatically by the platform. Figure 8 illustrates the grades and percentages of students who received the same grade. It can be observed that the number of the students who failed the exam increased from the first examination session to the second one by 7%. The same trend could be noticed also with regard to the number of the students who achieved the maximum grade: the number of the students with maximum rating increased by 3% from an examination to another. On the other hand, if we want to have an overall framework of the evaluations' results reported to the total number of students, it can be said that their success rate is 88%. There is an average of 15% for the students who received 20 points, 15% for the students who received 19 points, 19% for the students who received 18 points. The rest of 39% received between 11 and 17 points.

5. Conclusions

The present work presents the first results that were achieved across the implementation of the EnvYJobs e-learning module at one of the partners' universities involved in the EnvYJobs strategic partnership. The first tests realized by using the EnvYJobs open-source platform facilities (virtual lectures, virtual laboratories and live laboratories) indicate that the students are interested on using innovative tools for acquiring knowledge on various environmental issues. It was evidenced in this way an encouraging relationship between the innovative uses of eLearning tools and students' perception on using these facilities with real positive consequences on students' training and important benefits to labor market. As the first key aspect of the market is to provide solutions for teachers, education staff and students with aim of their immersion in the remote experimentation environment through innovation ICT technologies and mutual learning. The provided tools together with the EnvYJobs project offer easier understanding of complex environmental engineering issues. In the framework of the work there are also underlined the benefits of using platforms, as the provided one (the EnvYJobs platform), in a modern society.

Acknowledgment

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