

LEARNING ENVIRONMENTAL QUALITY REGULATIONS BY OPEN EDUCATIONAL RESOURCES

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Abstract: *This article will present the context that conducted to the Massive Open Online Courses (MOOCs) and OERs created in partnership under the TOX-OER project, and part of the project outcomes, especially the OERs created for learning about environmental quality regulation, for the development of which our team was responsible. Further, the perception of learners regarding the developed MOOC and OERs was the subject of a recent survey launched among the students from our university.*

Key words: *environmental legislation, environmental quality regulations, massive open online courses, open educational resources.*

1. Introduction

Since the World Open Educational Resources (OER) UNESCO Congress, held in 2012 in Paris, when the “Paris OER Declaration” was adopted with 10 recommendations (points a. to j.) for governments and institutions to promote the use of OERs (UNESCO, 2012), an increased interest in producing open educational materials to be released in a freely reusable form was registered. In a report of the Joint Research Centre, of the European Commission, discussing open learning there are three accepted meanings of the “openness”: (i) Open Education in Open Universities; (ii) Massive Open Online Courses (MOOCs); (iii) Open Educational Resources (OERs). Moreover, the differences in the “openness” types are presented at five levels: definition of open, certificates, degrees, target groups and main objects (Witthaus et al., 2016). All these make it difficult to define and to delimit OERs from MOOCs, but some key ideas can be pointed out:

- MOOCs are online courses designed for a large number of participants that can be accessed by anyone having internet access, from anywhere; are open to everyone without entry qualifications, and are offered for free;
- OERs are teaching, learning, and research resources available in the public domain; OERs include full courses, course materials, modules, textbooks, streaming videos, tests,

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software, and any other tools, materials, or techniques used to support access to knowledge (Witthaus et al., 2016).

Taking into consideration the lack of MOOCs and OERs for toxicology learning, the European project “Learning Toxicology through Open Educational Resources (TOX-OER)”, aiming to share toxicology-related knowledge and skills, including OERs presenting pollutants as xenobiotics.

The TOX-OER project was coordinated by University of Salamanca (Spain – USAL), and working groups from six institutions shared their scientific and educational knowledge to develop a new MOOC platform where new OERs in the field of the Toxicology are uploaded. The partnership was completed by: Space Research and Technology Institute (Bulgaria – SRTI-BAS), Charles University, Prague (Czech Republic – CUNI), South-Eastern Finland University of Applied Sciences (Finland – XAMK), University of Bologna (Italy – UniBo), University of Porto (Portugal – Uporto) and *Transilvania University of Brasov* (Romania – UNITBV), as mapped in Figure 1.



Fig. 1. Mapping the TOX-OER partnership as contribution to MOOCs in Europe.

The aim of this study is to present the development of OERs for learning environmental quality regulations, and their impact at institutional level, evaluated as the students' perception on the learning materials.

2. Methodology

This study will present the methodology that was followed in order to develop a new learning environment, during the TOX-OER project: (i) design of the new syllabus, the basis for toxicology learning on the MOOC platform; (ii) development of OERs to be accessible on the new MOOC platform; (iii) evaluation of the impact of the online learning materials at students' level. Thus, the following sections will present the new MOOC platform based on the agreed syllabus for toxicology learning and part of the developed and available OERs. Additionally, the results arisen from the evaluation of students' perception on the OERs produced for learning environmental quality monitoring will be presented.

3. Design of the New Syllabus for Toxicology Learning

TOX-OER project not only brought together universities from seven European Union countries, but also allowed and promoted the collaboration between different groups of researchers (Girotti et al., 2018). Thus, the group of academics coming with different professional experience like toxicology, biology, pharmacy/ pharmacology/ medical pharmacology, physiology, chemistry/ medicinal chemistry, environmental science, law, system engineering, was completed with those having experience in social sciences, ICT, didactics, pedagogy and educational sciences (<https://toxoyer.com/>).

The key point of the TOX-OER project being the production, adoption and reuse of OERs in toxicology related subjects (Guerra & Ferrari, 2018), the TOX-OER MOOC platform was designed to improve access to learning in toxicology related domain, active learning, virtual and blended mobility (Guerra et al., 2018). The MOOC platform (<http://moodle.toxoyer.com/>) was installed and customized by the team from University of Bologna. It contains a modular sequence of 7 modules, for the designed syllabus for toxicology. From this platform, students from the seven partner universities and different other learners can complete, by choice, various OERs (Guerra et al., 2018). Credits according to the European Credit Transfer and Accumulation System (ECTS) were allocated for the seven modules (M1-7) of the new syllabus, developed in a different number of topics, as presented in Table 1.

Developed modules and related topics, number of transferable credits and contributions

Table 1

Modules names (number of topics)	ECTS	Partners contribution
M1: General Concepts (1)	1	UPorto
M2: Pharmaco – Toxicokinetics (4)	6	UPorto
M3: Principal Groups of Xenobiotics (2)	4	UniBo
M4: Environmental Pollutants (5)	7	UNITBV, CUNI, SRTI-BAS
M5: Target Organ Toxicity and Biomarkers (5)	8	CUNI, USAL, UPorto
M6: Environmental Toxicology (4)	7	UNITBV, XAMK
M7: Patents and Patent Application (1)	2	UniBo

According to the, the Definition Massive Open Online Courses, (OpenupEd, 2015), “one criteria for a course to be called a MOOC is that total study time of a MOOC should be at least 1 ECTS”. In the European educational system, the amount of study time is measured in units of ECTS: 1 ECTS unit being equivalent to 25-30 study hours. The new Toxicology syllabus was designed for a total number of 35 ECTS, differently allocated to the seven modules/ topics. More details about the development of the Toxicology syllabus, the TOX-OER MOOC platform and the related OERs were elsewhere described (Manciulea et al., 2019).

For this study, one topic of the M6 Environmental Toxicology is of interest, as being part of the contribution of UNITBV to the OERs production, and will further be described: T6.1 – European Union and National Regulations Related to Environmental Quality, for 2 ECTS.

4. Development of Accessible OERs

The types of the available OERs produced on the TOX-OER platform are: video lessons and commented slides (with transcripts and subtitles), text-based learning resources (and/ or additional suggested readings), quizzes (tests), case studies, and interactive games (Guerra et al., 2018). These types of new OERs constituted a great challenge for the TOX-OER team, not only because for most of the contributors it was for the first time to produce video lessons and/ or commented slides with transcripts and subtitles, but also because the TOX-OER team has decided that all the OERs will be produced in English and then translated in all native languages (Bulgarian, Czech, Finish, Italian, Portuguese, Romanian and Spanish) of the partner countries, being thus available in eight languages. Making OERs available in the local language is one of the novelties of the TOX-OER MOOC. Table 2 presents the workload for the OERs production of the topic of interest.

Description of the topic T6.1, by learning units (U) and by types and numbers of produced OERs.

Topics and units	Types of OERs		
	Video ^(a)	Text ^(b)	Test ^(c)
T6.1. European Union and National Regulations Related to Environmental Quality	1+4	3+1	4+1
U1. Establishing the European Union legislative framework and specific toxic pollutants	2	1	2
U2. National harmonization of UE legislation on toxic pollutants	1	1	1
U3. Legislative correlations	1	1	1

Legend: ^(a) introduction video for the topic + video presentations/ learning unit; ^(b) text-based learning resources + selection of EU regulations and directives (English versions) and their transpositions in the seven languages of the partner countries (BG, CZ, FI, IT, PT, RO, ES); ^(c) text-based learning resources + additional reading; ^(d) self-evaluation tests + evaluation tests (final).

4.1. European Union and National Regulations Related to Environmental Quality

Since 1987, when the Report of the World Commission on Environment and Development: Our Common Future, known as “Bruthland Report” was issued, the environmental regulation was imposed to move beyond the usual menu of safety regulations, zoning laws, and pollution control enactments (Bruthland Report, Chapter 2, 1987a). In the same report, it is also underlined the role of environmental education, that should run throughout the other disciplines of the formal education curriculum, at all levels, in order to foster a sense of responsibility for the state of the environment and to teach students how to monitor, protect, and improve it (Bruthland Report, Chapter 4, 1987b).

In this respect, the new OERs related to the Topic 6.1, European Union and National Regulations Related to Environmental Quality, was designed to facilitate understanding of the complexity of environmental related legislation and to open windows for the

students who want to deepen their understanding of the field, thus ensuring the novelty of the OERs on EU environmental regulations.

The European Union legislative framework related to specific toxic pollutants as xenobiotics was presented in the U1 related OERs. A selection of all EU regulations, directives and decisions, only for the pollutants presented in Module 4 Environmental Pollutants, was presented: gaseous pollutants, heavy metals (in air, water and soil), pesticides and persistent organic pollutants (POPs). As additional learning resources, a collection of EU regulations is uploaded on the MOOC platform, the English versions, as well as their transpositions in the seven languages of the project partners: Bulgarian, Czech, Finish, Italian, Portuguese, Romanian and Spanish, as given in Table 2.

Taking into consideration that OERs of Topic 6.1 are addressed to students and specialists in fields other than the law, the second learning unit (U2) presents the national harmonization of EU legislation on toxic pollutants. It starts with a general introduction of legal terms and harmonization rules, about national legislation, EU legislation (regulations, directives, and decisions) and international regulations (treaties, conventions, agreements). The unit continues with the presentation of the transpositions of different directives related to the pollutants of interest for the TOX-OER modules to the EU member states legislation.

Considering the environmental related regulations as "legislative correlations", completing the general legislative framework by detailing obligations, including exceptions, or linking different domains, the third learning unit (U3) gives some examples of such legislative correlations.

4.2. Evaluation of the Impact of the Developed OERs at Students' Level

The impact of the OERs developed for the environmental legislation and monitoring courses is of great interest not only for the general evaluation of project outcomes, but also for future developments. Therefore, we wanted to find out (i) the students' ability to use and capitalize on the OERs contents; (ii) the students' perception of the TOX-OER MOOC and the OERs developed for learning environmental legislation and monitoring.

An updated survey on the TOX-OER MOOC platform was used for the evaluation of the final results of our learners, students in Environmental Engineering study program, thus giving an overview of their capacity to acquire knowledge and capitalize on the learning resources. The survey showed that an average of 50 students/ year (since 2018) were enrolled on the platform for each topic (6.1) and most of them completed (compl.) the OERs (videos and texts, as well as the evaluation tests), quite a few were enrolled but did not totally finalized the evaluation test (uncompl.) and the rest only completed the OERs without being interested in evaluation, as shown in Figure 1. The grades registered on the MOOC platform, as final evaluation test, for the environmental related topics (Figure 1) show that most of them received very good grades (9-10), quite a few received good grades (7-8), a limited number of students got satisfactory grades (5-6).

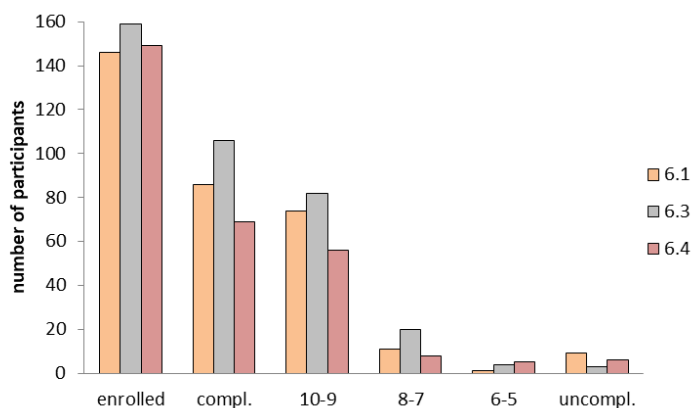


Fig. 1. Evaluation of the number of students enrolled on the TOX-OER MOOC platform and the grades they received after completing the OERs related to Topic 6.1.

The students' perception on the use of MOOC and the OERs created for EM learning is most valuable for the OERs authors and give them the required feedback for future development of OERs. Therefore, we launched a survey on Google Forms, for the students and alumni of UNITBV from the Environmental Engineering bachelor and master programs to evaluate the OERs in terms of: (i) the platform accessibility; (ii) accessibility of the OERs scientific content and structure; (iii) OERs usefulness. Thus, the survey was organized in sets of questions related to:

- general information about the students' experience and openness to online courses;
- their interest in the contents (videos, texts, additional documents, tests) and usefulness of the OERs developed for Topic 6.1, (Figure 2);

The sets of questions and answers related to the experience of students completing the TOX-OER Topic 6.1 are summarized in Figure 2, and the explanation of the legends is:

- for questions A, students completed: 1 – the video presentations; 2 – the text-based learning resources; 3 – the additional readings; 4 – the self-evaluation tests; 5 – the final evaluation test; answers to questions A were: yes, no, and partially;
- for questions B, students appreciated: 1 – accessibility of the OERs scientific contents; 2 – contribution of the OERs to acquiring knowledge; 3 – organisation/structure of the OERs information; 4 – attractiveness of the OERs presentations; 5 – usefulness of the video presentations to understanding the course content; 6 – usefulness of the text-based learning resources to better understand the subject; 7 – usefulness of the self-evaluation tests to consolidating the information; 8 – usefulness of the final evaluation tests;
- for answers to questions B, on a scale from V-I, students' perception was: V – very high level, IV – high level, III – moderate level, II – low level, and I – very low level of interest.

Most of the students completed the video presentations (89.48%) and the supporting texts as well as the additional documentation (84.21%). For the evaluation, 94.74% of the students completed the intermediary tests, before the final tests (100%) (Figure 2A).

The students' perception of Topic 6.1 revealed that the great majority of them evaluated the usefulness of the OERs as "very high level" (V on the scale) and "high level" (IV on the scale), in terms of accessibility of the scientific content, attractiveness and usefulness, as shown in Figure 2B. The "low level" (II on the scale) and the "very low level" (I on the scale) answers were not selected.

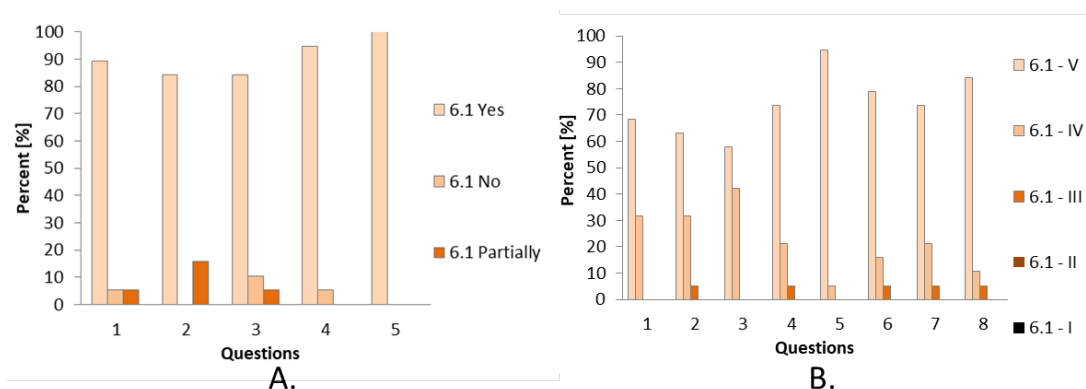


Fig. 2. Survey results following the completion of the OERs for Module 6, Topic 6.1 (European Union and National Regulations Related to Environmental Quality): set of questions A (1-5) related to the type of OERs completed by the students; set of questions B (1-8) related to the perception of students on the accessibility, attractiveness and usefulness of the OERs; legends for the two sets of questions/ answers are given in the body of the text.

5. Conclusions

This study presented part of the work done for the MOOC and online learning materials production, OERs, in the framework of the TOX-OER project. We consider that developing the OERs was not only a collaborative initiative, but also an innovative, and progressive one. There was a lot of knowledge shared; the partners completed each other experience, competences and expertise, thus producing high quality new OERs.

The students' perceptions of using the TOX-OER platform and the available OERs will be considered, their recommendations reflecting on how this experience could be transferred for other possible OERs development. The survey findings give food for thought to the OERs developers to reconsider the presentation of the additional readings, in the sense of having a better organised and more attractive material, and also of explaining the need for supplementary information to complete the one already included in the video and text presentations.

Acknowledgements: This work was supported by the European Erasmus+ Programme, key action KA2, Strategic Partnership, under the project Learning Toxicology through Open Educational Resources (TOX-OER), grant number 2015-1-ES01-KA203-015957.

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