Open Educational Resources for Environmental Education

Dana Perniu, Ileana Manciulea, Cristina Salca Rotaru, and Camelia Draghici(✉)

Transilvania University of Brasov, 500036 Brasov, Romania
{d.perniu,c.draghici}@unitbv.ro

Abstract. Although Open Educational Resources (OERs) and Massive Open On-line Courses (MOOCs) are more and more developed and available in European educational systems, there is a lack of MOOCs in the field of toxicology and environmental sciences. Starting from this fact, the "Learning Toxicology through Open Educational Resources – TOX-OER" project was granted and run between 2015 and 2018. Seven European High Education Institutions shared knowledge and skills and created seven toxicology-related OERs. The challenges and the experience gained during development of these OERs, especially the video presentations, supporting texts, additional documentation, and evaluation tests, are presented in the present paper. Our outstanding experience gathered during TOX-OER project, contributed to the decision to extend our initiative to a subsequent project, "Environmental Education – OERs for Rural Citizens" (EnvEdu – OERs). The new project aims to develop new OERs targeting rural citizens' life-long learning focusing on environmental quality. The lessons learned from the TOX-OER project are presented not only for an effective transfer to the new EnvEdu – OER project, and for an efficient rural community acceptance, but also for other audience facing similar challenges and experience in creating OERs.

Keywords: Environmental education · Open educational resources · Massive open online courses

1 Introduction

The first publication on Massive Open Online Course (MOOC) (Fini, 2009) announced that in 2008 a new concept emerged in the already crowded e-learning landscape: MOOC. Elite universities started to offer their own MOOCs, video based course, free of charge, credit-less and massively available to learners from all over, so that 2012 was declared The Year of the MOOC (Pappano, 2012).

Reviews are available in the literature, pointing out the growing interest in MOOCs, highlighting the large increase in the number of publications on the subject, publications evaluated during 2008–2017 period. Almost half of the studies were firstly presented at conferences, then published in conference proceedings, while the other half were published in journals (Yousef et al., 2014; Zancanaro, 2017; Mahmod et al., 2018; Shettar et al., 2019).

M. E. Auer and D. Centea (Eds.): ICBL 2020, AISC 1314, pp. 327–334, 2021.
https://doi.org/10.1007/978-3-030-67209-6_35

Of interest to our study are the publications presenting Open Educational Resources (OERs) and MOOCs developed in Romania, most of them published as conference papers, as well: a set of publications presenting the first initiatives of OERs and MOOCs in Romania (Mihaescu et al., 2014; Holotescu et al., 2014; Holotescu and Pepler, 2014; Vasiu and Andone, 2014; Mihaescu and Vasiu, 2015; Grosseck and Malita, 2015, MOOC for business education (Onete et al., 2014), a parallel presenting MOOCs in Romania and in Bulgaria (Grosseck et al., 2015), health care MOOCs for palliative care and zoonoses, project based developed, with funds from the Erasmus Program (Colibaba et al., 2015; Colibaba et al., 2019), open education initiatives and strategy in Romania (Holotescu and Grosseck, 2018). This is to underline that in 2014 Politehnica University of Timisoara started the development of the first Romanian MOOC, UniCampus, as a Moodle based learning management system (LMS) (Andone et al., 2017).

Another direction of MOOCs development, of interest for our study, is the one for environmental education (EnvEdu) as presented in Table 1., most of these MOOCs being developed in Europe. Figure 1A. and B. shows the evolution and distribution of MOOCs development in Europe until 2015.

Table 1. Developed MOOCs for environmental education.

MOOC title (host university)	Ref.
Greening the Economy: Lessons from Scandinavia (Lund University, Sweden)	Leire et al., 2016
Environment, computer science and society (Hochschule für Technik und Wirtschaft, Berlin, Germany)	Fuchs-Kittowski, 2017
Sustainable Energy in Education (University of Helsinki, Finland)	Kaul et al., 2018
Environmental Education: Transdisciplinary Approaches to Addressing Wicked Problems (Cornell University, USA)	Krasny et al., 2018
Marine Litter (University of Madrid, Spain)	Tabuenca et al., 2019
Environmental Sustainability of Organizations in the Circular Economy (Universidad San Jorge, Zaragoza, Spain)	Loste et al., 2020

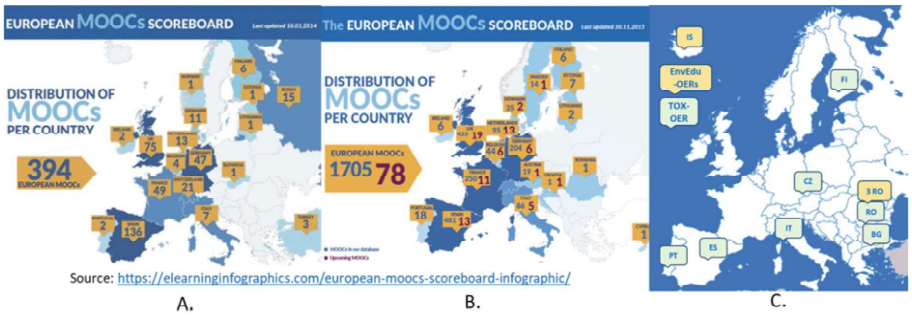

Fig. 1. Developed MOOCs distribution in Europe: updated on 10.01.2014 (A.); updated on 30.11.2015 (B.); TOX-OER and EnvEdu-OERs contributions to MOOCs in Europe (C.).

Taking into account this evolution, as well as the lack of toxicology related MOOCs, a partnership of universities from seven EU countries implemented the project Learning Toxicology through Open Educational Resources (TOX-OER) between 2015–2017, having as main target groups the students from higher education institutions (Fig. 1C.).

Our outstanding experience gathered developing OERs during the TOX-OER project, as well as the lack of EnvEdu related MOOCs contributed to the extension of our initiatives to a second project, Environmental Education – OERs for Rural Citizens (EnvEdu – OERs). The project aims to develop new environmentally related OERs, enlarging the target groups for adults education (mainly active in rural communities), as lifelong learning opportunity (Fig. 1C.).

The goal of this paper is to present part of our experience in creating OERs, based on TOX-OER project and to underline the lessons learned from this project to a better implementation of the OERs developed under the EnvEdu – OER project.

2 Experience in Open Education Resources Development in the Framework of TOX-OER Project

The partnership of the TOX-OER project was formed by University of Salamanca (Spain) as coordinator, and six European partners: Space Research and Technology Institute (Bulgaria), Charles University, Prague (Czech Republic), South-Eastern Finland University of Applied Sciences (Finland), University of Bologna (Italy), University of Porto (Portugal), and Transilvania University of Brasov (Romania). Seven OERs (modules – M) were developed, having as main target group the students from diverse study programs: M1: General Concepts; M2: Pharmaco-Toxicokinetics; M3: Principal Groups of Xenobiotics – Prescription Drugs and Drugs of Abuse; M4: Environmental Pollutants; M5: Target Organ Toxicity and Biomarkers; M6: Environmental Toxicology; M7: Patents and Patent Application. The created OERs are available on the TOX-OER MOOC platform (https://toxoer.com/).

For each agreed module/ topic, and for each ECTS (28 conventional hours), the OERs authors produced a series of courses contents: video presentations, supporting text contents and additional readings (papers, book chapters), tests for self-evaluation and final tests. As a novelty of TOX-OER MOOC, it was agreed that all the videos, texts and tests will be produced in English and then translated in all seven native languages of the seven partners (Bulgarian, Czech, Finish, Italian, Portuguese, Romanian and Spanish), being thus available in eight languages (Manciulea et al., 2019).

Our team, from Transilvania University of Brasov (UNITBV) was only involved in OERs production, and not in the MOOC development. Therefore, the actual communication will only focus on presenting the students perception on OERs created for the pollutants related topics, parts of M4, developed by the group from UNITBV: 4.1 Environmental Pollutants – Gaseous Pollutants (1 ECTS); and 4.3 Environmental Pollutants – Persistent Organic Pollutants (1 ECTS). For this purpose, we lunched a survey on Google Forms, for our actual and former students from the Environmental Engineering bachelor and master programs. The survey comprises questions related to:

– general information about the students and their actual online courses experience;
– the TOX-OER topics 4.1 and 4.3;
– final comments and recommendations.

The survey was completed by 50 respondents, as follows: bachelor students (29), master students (9), bachelor degree graduates (9), and master degree graduates (3). From the cohort of respondents, 88% of the students declared their openness towards online courses, but their experience until now is only based on the courses on the e-learning platform of the university and/or of the TOX-OER platform.

The OERs for topic 4.1 (Gaseous Pollutants) was taken by 64% of the students and 80% took the topic 4.3 Persistent Organic Pollutants. Most of them took the Romanian version, but 20% also followed the English version of the OERs. Two sets of questions were organized in order to verify the perception of the students on the OERs: (i) their interest to the OERs contents, videos, texts, additional documents, tests (Fig. 2A.), (ii) and the perceived usefulness of the OERs (Fig. 2B.).

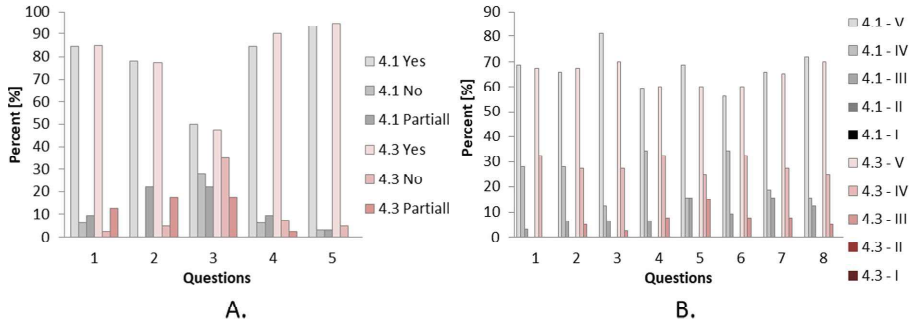

Fig. 2. Survey results after following the OERs for Module 4, topics 4.1 (Gaseous Pollutants) and 4.3 (Persistent Organic Pollutants): set of questions (1–5) related to the type of OERs followed by the students (A); set of questions (1–8) related to the perception of the students on the quality and usefulness of the OERs (B); legends for the two sets of questions/answers, see text.

The sets of answers to the questions related to the TOX-OER topics 4.1 and 4.3 are summarized in Fig. 2, where the following legends were used:

a. *for questions A.*: 1 – followed the video presentations; 2 – followed the supporting texts; 3 – followed additional documentation; 4 – solved the intermediary tests (self-evaluation); 5 – solved the final test (evaluation);
b. *for questions B.:* 1 – the scientific content of the OERs was accessible; 2 – OERs contributed to acquiring knowledge about pollutants as xenobiotics; 3 – the information was well structured; 4 – the course presentation was attractive; 5 – the video presentation was useful to understand the course content; 6 – the supporting texts were useful to better understand the subject; 7 – the self-evaluation tests helped with

fixing the information; 8 – the final test was easy after following all the OERs materials and the self-evaluation tests;

c. *for answers B., on a scale from V-I:* V – very high level, IV – high level, III – moderate level, II – very low level, I – low level.

Most of the students followed the video presentations (85%) and the supporting texts (78%); only 48–50 also followed additional documentation. This shows either that the available video and related texts are of high quality and well-structured for an adequate acquisition of new knowledge, or the low interest of the students for complementary information. For the evaluation, most of them solved the intermediary tests, 85% for topic 4.1, respectively 90% for topic 4.3, before the final tests (Fig. 2A.).

The students' appreciation on topics 4.1 and 4.3 revealed that the great majority of them evaluated the usefulness of the OERs with "very high level" (V on scale) and "high level" (IV on scale), in terms of accessibility, scientific content, attractiveness and efficiency, as shown in Fig. 2B. The "very low level" (II on scale) and "low level" (I on scale) answers were not selected.

The survey results about the students' perception on the OERs quality and usefulness are valuable feedbacks, and will be of great help to the developing team in their future activity to improve the OERs or create new ones, by providing contents that suit their students' needs (as also mentioned by Aharony and Bar-Ilan, 2016).

No relevant final comments were registered, except general appreciations on the OERs quality and usefulness. As recommendations, for the question "Which are your recommendations for future development of new OERs in the domain of environmental protection" we selected individual answers, considered to be relevant for our future intentions to produce more OERs:

a. OERs on the chemical and technical (best available practices – BAT) background needed for better understanding of the anthropogenic pollution phenomenon;
b. OERs on sustainable development and on strategies and techniques for the pollutants impact reduction;
c. OERs on the socio-economic aspects of the environmental protection;
d. OERs on how to write a project for companies or local authorities to receive financial support from different sources, envisaging environmental related activities;
e. OERs on the transposition of the EU environmental legislation to the EU member states, for a better understanding of the mechanism of environmental legislation dynamic development, and consequently, its transposition;
f. the OERs should be correlated and completed with the adequate environmental regulations, case studies, and good practice examples in our country as well as in other countries.

3 OERs for Environmental Education

There were two particular findings that determined us to propose a new project to be granted, aiming to develop new OERs for environmental education:

1. the requests formulated by the local authorities from rural area about their needs on environmental education (general aspects, legislation on waste management, writing projects to receive financial support to improve the environmental quality in their community);
2. our perception about the fact that citizens are not aware about the pollutants effects on their life and the environmental related consequences; this lack is mostly correlated with their legal access to the public debates with different occasions, like an environmental impact assessment report (EIA) presentation, but not being educated for such actions/ decisions.

Starting with the limited MOOCs available on environmental education (Table 1), with the identified needs for new OERs subjects, and also based on the previous TOX-OER experience, EnvEdu – OERs project was proposed, is already selected to be granted, and started in November 2020. The novelties of this project are:

- we enlarged the group of specialists in EnvEdu, a new consortium of High Education Institutions (HEIs), with Transilvania University of Brasov (UNITBV, Romania) as coordinator, and three more HEIs: Reykjavik University (RU, Iceland), Bucharest University of Economic Studies (BUES, Romania) and Gheorghe Asachi Technical University of Iasi (TUIASI, Romania), as also presented in Fig. 1C.);
- we will develop a new MOOC, on the university Moodle platform, as Moodle is one of the most popular learning management system (LMS) available today, also implemented at UNITBV level;
- we will develop new OERs for continuous training in EnvEdu, enlarging the target group to rural citizens, and non-academics; by this, we will also answer to the need of opening the MOOCs and OERs to socio-economically disadvantaged learners.

The new OERs (course modules – M) proposed to be produced during this project, as well as the HEIs responsible for their development, are:

- M1. Sustainable Communities and Social Communication (UNITBV);
- M2. Environment Quality (UNITBV);
- M3. Environmental Management, Impact and Risk Assessment (TUIASI);
- M4. Waste Management in Rural Communities (TUIASI);
- M5. Water Resources and Water Balance for Sustainable Community (RU);
- M6. Environmental Projects Management (BUES).

The development of the OERs in eight languages, in the framework of the TOX-OER project, seemed to be beneficial for the initial target groups, our students, from universities in different EU member states. In time, we can appreciate that this turned out to be a disadvantage, because any revision or amendment of the OERs will involve, once again, that all the project groups, will translate any OER content modifications (video, texts, and tests) in their native language. This was one of the lessons learned from the previous project, and one of the reasons why the EnvEdu – OERs will only be developed in two languages: Romanian, being useful for the majority of the future learners, and English, Icelandic language not being compulsory, as concluded by the RU representatives in the project.

4 Conclusions

We presented, at first, some general information about MOOCs and OERs and their reflection in specialized publications, especially those developed in Romania and those dedicated to environmental education. Part of our experience in creating OERs, based on Learning Toxicology through Open Educational Resources – TOX-OER project, a short description of the developed OERs by our project team, as well as some perceptions of our students after taking the TOX-OER modules were also presented. We showed how we transferred the TOX-OER project experience to extend our initiative to a second project, "Environmental Education – OERs for Rural Citizens" (EnvEdu – OERs). In the end, we are pleased to identify that now, after the EnvEdu – OERs project was selected to be granted, the recommendations collected from our students, future practitioners, were quite similar to the new OERs that were proposed to be developed on the new MOOC platform. The lessons learned from the TOX-OER project will be valuable inputs for the new EnvEdu – OER project outcomes, both for an efficient rural community acceptance of the environmental education through open educational sources, and for other audience facing similar challenges and experiences in creating OERs.

Acknowledgements. Project "Learning Toxicology Through Open Educational Resources" (TOX-OER), with Financial Support from the European Erasmus + Programme, KA2, Strategic Partnership, Project Code 2015-1-ES01-KA203-015957 and project "Environmental Education – OERs for Rural Citizens (EnvEdu – OERs)" with financial support from the European Economic Area (EEA) Financial Mechanism 2014-2021, Cooperation Projects in the Higher Education area, project code 19-COP-0038.

References

Aharony, N., Bar-Ilan, J.: Students' perceptions on MOOCs: an exploratory study 2016. Interdisc. J. e-Skills Lifelong Learn. **12**, 145–162 (2016) http://www.informingscience.org/Publications/3540

Andone, D., Vasiu, R., Ternauciuc, A.: UniCampus: the first courses in a romanian MOOC. In: 2017 IEEE Global Engineering Education Conference (EDUCON), pp. 1210–1214 (2017)

Colibaba, A., Colibaba, S., Gheorghiu, I., Ursa, O., Colibaba, C., Ionel, A.: Palliative care MOOC project research findings and the development of standardized protocols. In: The 5th IEEE International Conference on E-Health and Bioengineering - EHB 2015, pp. 1–4 (2015)

Colibaba, A.C., Gheorghiu, I., Antonita, C., Croitoru, I., Ursa, O.: Innovative strands in the ZOE project. In: The 15th International Scientific Conference eLearning and Software for Education Bucharest, pp. 1–4 (2019)

Fini, I.: The technological dimension of a massive open online course: the case of the CCK08 course tools. Int. Rev. Res. Open Distance Learn. **10**(5), 1–27 (2009)

Fuchs-Kittowski, F.: Integration of a MOOC into a traditional third-level e-learning platform. In: 3rd International Conference on Higher Education Advances, HEAd 2017, pp. 373–381 (2017). http://dx.doi.org/10.4995/HEAd17.2017.5216

Grosseck, G., Holotescu, C., Bran, R., Malinka, I.: A checklist for a MOOC activist. In: The 11th International Scientific Conference eLearning and software for Education, Bucharest, pp. 1–6 (2015)

Grosseck, G., Malita, L.: Do you MOOC? an exploratory view for Romanian academic landscape. In: 10th International Conference on Virtual Learning ICVL 2015, pp. 389–392 (2015)
Holotescu C., Pepler G.: Opening up education in Romania. In: SMART 2014 - Social Media in Academia: Research and Teaching, Timisoara, Romania, pp. 1–5 (2014)
Holotescu, C., Grosseck, G., Cretu, V., Naaji, A.: Integrating MOOCs in blended courses. In: The 10th International Scientific Conference eLearning and software for Education, Bucharest pp. 1–8 (2014)
Holotescu, C., Grosseck, G.: Towards a MOOC-related strategy in Romania. BRAIN – Broad Res. Artif. Intell. Neurosci. **9**, 99–109 (2018)
Kaul, M., Aksela, M., Wu, X.: Dynamics of the community of inquiry (CoI) within a massive open online course (MOOC) for in-service teachers in environmental education. Educ. Sci. **8**(40), 1–15 (2018).https://doi.org/10.3390/educsci8020040
Krasny, M.E., DuBois, B., Adameit, M., Atiogbe, R., Alfakihuddin, M.L.B., Bold-erdene, T., Golshani, Z., González-González, R., Kimirei, I., Leung, Y., Shian-Yun, L., Yao, Y.: Small groups in a social learning MOOC (slMOOC): strategies for fostering learning and knowledge creation. Online Learn. J. **22**(2), 119–140 (2018)
Leire, C., McCormick, K., Richter, J.L., Arnfalk, P., Rodhe, H.: Online teaching going massive: input and outcomes. J. Cleaner Prod. **123**, 230–233 (2016)
Loste, N., CHinarro, D., Gomez, M., Roldan, E., Giner, B.: Assessing awareness of green chemistry as a tool for advancing sustainability. J. Cleaner Prod. **256**, 120392 (2020)
Mahmod, M.A., Ali, A., Shah, A.: Massive open online courses as an augmentation of E-learning: a review. Int. J. Perceptive Cogn. Comput. **4**(2), 1–4 (2018)
Manciulea, I., Vasilescu, A., Girotti, S., Ferrari, L., Protti, M., Mercolini, L., Dumitrescu, L., Perniu, D., Draghici, C.: Massive open online courses (MOOCS) with open educational resources for toxicology learning – drugs and pollutants as xenobiotics. Environ. Eng. Manage. J. **18**(8), 1833–1842 (2019)
Mihaescu, V., Vasiu, R., Andone, D.: Developing a MOOC: the Romanian experience. In: Ørngreen, R., Levinsen, K.T., (eds.), Proceedings of the 13th European Conference on e-Learning ECEL 2014, Copenhagen, Denmark (2104)
Mihaescu, V., Vasiu, R.: Teachers' perspective into higher education and MOOCs in Romania. In: 10th International Conference on Virtual Learning, ICVL 2015, Timisoara, Romania, pp. 1–8 (2015)
Onete, B., Plesea, D., Teodorescu, I., Cirstea, A.: Evolutions and opportunities of business education in the context of educational reform from the digital age. Amfiteatru Econ. J. **16**(37), 746–758 (2014)
Pappano, L.: The Year of the MOOC. The New York Times, New York (2012)
Shettar, I., Hadagali, G.S., Bulla, S.D.: A scientometric analysis on the world literature on MOOCs. In: Library in the Life of the User (Proceedings of 9th KSCLA National Conference), Tumkur University, Tumkur, pp. 582–587 (2019)
Tabuenca, B., Kalz, M., Löhr, A.: Massive open online education for environmental activism: the worldwide problem of marine litter. Sustainability 2019, **11**, 2860 (2019).https://doi.org/10.3390/su11102860
Vasiu, R., Andone, D.: OERs and MOOCs – the Romanian experience. In: 2014 International Conference on Web and Open Access to Learning, ICWOAL, pp. 1–5 (2014).https://doi.org/10.1109/icwoal.2014.7009243
Yousef, A.M.F., Chatti, M.A., Schroeder, U., Wosnitza, M., Jakobs, H.: MOOCs a review of the state-of-the-art. In: Proceedings of the 6th International Conference on Computer Supported Education, pp. 9–20 (2014)
Zancanaro, A.: Analysis of the scientific literature on Massive Open Online Courses (MOOCs). Revista Iberoamericana de Educación a Distancia **20**(1), 59–80 (2017)