

MOOC Methodology in School Context: The “Open Discovery of STEM Laboratories” Experience

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Abstract. The Open Discovery of STEM Laboratories-ODL has been an Erasmus+KA2 project aimed to implement teacher collaboration in creating and using microMOOCs (very short version of MOOCs) for the insertion of STEM-remote/virtual laboratories into the lessons. The challenge of the project was to impact on teaching process and inspire pedagogical innovation by means of OER, teaching/learning tools and exchange of best practices via the ODL-platform. Here we discuss the setting-up of the pedagogical scenarios for the design and creation of the microMOOCs, their dissemination to a wide EU-audience and the results of the first pilot-studies on their embedding in school environments.

1 The ODL Project

While there already are lots of internet resources to fulfil many theoretical aspects on education, scientific studies need more specific ICT-based tools to cover the practical part of their teaching. The processes of making observations, performing systematic and quantitative investigations, data collection, analysis and logical interpretation of results and drawing relevant conclusions, are fundamental skills to the training of all science subjects. Teachers should gradually replace the old lecture-based method of instruction by adopting innovative teaching strategies taking into account the practice of experiments. New online experimental laboratories should fulfill the lack of real equipment and be included within innovative teaching/learning paths [1]. The inclusion of these laboratories in the curricula should be done within a framework of strategies that add value to teaching processes, giving real chances for the building of learning experiences [2]. The Massive Open Online Courses (MOOCs) are high quality online courses delivered from the world’s best universities aimed at unlimited participation and open access via the web. In addition to traditional course materials such as filmed lectures, readings, and problem sets, many MOOCs provide interactive user forums to support community interactions among students, professors, and teaching assistants. Although MOOCs have proved to be helpful in University and adult education [3], until now their impact and effectiveness in school education has not been explored.

The “Open Discovery of STEM Laboratories” (ODL) project, co-funded by the European Community Erasmus+ KA2 program (Cooperation for Innovation and the Exchange of Good Practices - Strategic Partnerships for school education) for 30 months, starting from November 2015 (Project Number: 2015-1-ES01-KA201-016090)^{*}, was aimed at introducing the use of MOOCs in school curricula. In particular, it fostered teacher collaboration in creating and using microMOOCs (very short version of MOOCs with activity of about 20-40 min in the classroom) for the inclusion of STEM (Science, Technology, Engineering and Mathematics) online remote/virtual laboratories in the everyday teaching practices (<http://opendiscoverylabs.eu>). Thanks to the project, teachers had the opportunity to improve both digital skills and pedagogical competences, experience international collaborative work, explore attractive open education resources, helpful to design creative lessons on STEM topics. The ODL project involved five partners from different EU countries: (1) Deusto

Foundation, Bilbao-Spain; (2) Physics Education Research Group, Department of Physics and Chemistry, University of Palermo-Italy; (3) Ellinogermaniki Agogi, Pallini, Athens - Greece; (4) Hariduse Infotehnoloogia Sihtasutus -HITSA, Tallin - Estonia; (5) Lithuanian Association of Distance and E- Learning, LieDM, Kaunas - Lithuania.

2 Discussion of ODL achieved goals and conclusion

In order to support educators on creating innovative STEM school curricula by employing new technological tools, the ODL consortium offered the teachers the opportunity for acquiring both technological and pedagogical skills for assembling separate educational materials within coherent lessons developed within an inquiry-based approach of science education. The most innovative aspects include the use of online remote and/or virtual laboratories, the development and re-use of open education resources (OERs), the sharing of teaching/learning good practices. First, the consortium defined a methodology for the MOOC-based lesson by adopting an inquiry-based approach within the well-known 5E model of instruction. It also established the inclusion of online laboratorial work, theoretical and practical content, assessment and discussion phases, but allowing the fitting of a single microMOOC within the typical lesson time [4]. Second, the ODL partners have created an edX open platform in order to meet teacher's needs for STEM curriculum designing. During the project, the team has created several multidisciplinary microMOOCs and, in occasion of multiplier events and teacher schools, has introduced about 300 school teachers on the design and implementation of the MOOC approach in their schools. In the last year, the ODL partners organized in each country the Multiplier Event "Micro-MOOC in your classroom", whose activity was aimed to make teachers familiar with the microMOOC scenarios and the ODL platform. Micro-MOOCs were presented as good examples of resources to be used in the teaching practice and were really appreciated by the teachers. During the workshop, teachers had the chance to start to convert their scenarios into educational resources. The method on how to incorporate their microMOOCs into curricula was also provided. So far, around one hundred microMOOCs for STEM education are freely available on the ODL depository for secondary school teachers and students. Recently, several pilot studies of microMOOC experimentation in classroom started in different countries.

More than half of the currently available microMOOCs are on Physics subjects. With the aim to investigate the effectiveness of MOOC methodology in the school environment, we administrated, to both teachers and students, a satisfaction questionnaire. At the GIREP Conference, we will introduce the ODL project and discuss our findings from the first pilot studies on the classroom experimentation of microMOOCs focused on Physics topics, showing the collected teacher and student feedback, highlighting strengths and possible weaknesses of the proposed methodology. In particular, Physics teachers highlighted that the use of microMOOCs enrich the lessons and raise students' interest in the subject, encouraging and motivating them to learn. The feedback from students was also very positive, in particular for what concern the exploration phase by the use of online virtual/remote laboratories. Globally, the students enjoyed very much the MOOC-based class, wishing to attend similar lessons in the future.

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