

ODL

Open Discovery of STEM Laboratories

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OPEN DISCOVERY
OF **STEM** LABORATORIES

Exploitation and Sustainability Plan

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Contributors

Name	Institution	Role
Olga Dziabenko	FD	editor
Eugenia Kypriotis	EA	contributor
Dominique Persano Adorno	UNIPA	contributor
Vida Žvinienė	LieDM	contributor
Elise-Marit Kippar	HITSA	contributor

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ODL Consortium

Beneficiary Number	Beneficiary name	Beneficiary short name	Country
P1	FUNDACION DEUSTO	FD	Spain
P2	ELLINOGERMANIKI AGOGI	EA	Greece
P3	HARIDUSE INFOTEHNOLOOGIA SIHTASUTUS	HITSA	Estonia
P4	LIETUVOS NUOTOLINIO IR E.MOKYMOŠI (LIEDM) ASOCIACIJA	LieDM	Lithuania
P5	UNIVERSITA DEGLI STUDI DI PALERMO	UNIPA	Italy

Executive Summary

The Open Discovery of STEM Laboratories (ODL) project is initiated to introduce to school sector an innovative pedagogical approach of merging microMOOC structure with virtual and remote laboratories in curricular. The microMOOC is adapted scenario of the massive open online course (MOOC), which is widely employed in university education of Europe, America and Asia. Because of online nature, this methodology allows teachers and students of rural area to use the best practice of STEM education developed by university faculty staff and teachers-pioneers in the field.

The ODL success and sustainability of the intellectual outputs and tangible results depends on if the developed products and method can reach the target groups appointed in the proposal. The report introduces the target audiences external and internal during and after project life. Their benefits as well as impact of ODL results on them are described in this document. The implementation action is presented to show how we are planning to exploit the ODL intellectual outputs to inform and encourage target group to apply them on a permanent basis. The sustainability action developed by each consortium partner is demonstrated as well.

The Exploitation and Sustainability Plan consists of Introduction, 3 Chapters, and Conclusion. The Introduction introduce the exploitation and sustainability definition and their difference between each other. Chapters outline main information about the project, such as goal, aims and objectives; target groups; exploitation actions and sustainability plan for ODL partners. The summary of the document is presented in the Conclusion.

1 Introduction

Exploitation and sustainability of results are crucial part of the Erasmus+ project. It responsible for communication and share outcomes and results with the target audiences short-term and long-term, therefore extending the impact of the projects, improving the longstanding and stable use of the tangible outcomes and justifying the European added value of Erasmus+. The purpose of this document to create the mid and long-term sustainability strategy and makes realistic projections beyond the EU funding period [Erasmus+ Programme Guide, v.2 (2018)].

Exploitation is associated with the use of the project's results at different levels, during the implementation of the project. It needs a necessary action that will bring project visibility in order to involve the target groups, end-users, stakeholders and transfer the results/products into their professionals' scope. The idea of exploitation is to convince the key actors to use the intellectual outputs of the project. Exploitation activities should ensure that the project results will be used by its target audiences after project life cycle, and, possibly, will be transferred to other contexts, e.g. other countries, pedagogical areas, sectors, etc. Exploitation is closely associated with and transformed to the sustainability of the project after its conclusion.

Sustainability is the capacity of the project intellectual outcomes to continue its existence and functioning beyond the project and, therefore, EU funding end. The project results will be used and exploited continuously, e.g. via commercialisation, accreditation or mainstreaming. Sustainability of results implies use and exploitation of results in the long term. We can suggest that the project is sustainable if it or its results could be extend beyond the duration of the project, and into the future.

2 Project Summary

2.1 Goal, Aims & Objectives

The project goal is to enhance a digitalization of learning, teaching, and training by improving accessibility to high quality learning through MOOC methodology, use of OER, and teacher and in-school collaboration in modernization of STEM school curricula.

Open Discovery of STEM Laboratories" project aims to offer a teacher collaboration in creating innovative STEM school curricula by open discovery of remote & virtual laboratories and their application in education.

In order to reach this aim, the consortium is conveying to teachers the innovative approach - school MOOC methodology. micro-MOOCs (short version of MOOC) will maintain the principles of open teacher collaboration in STEM curriculum development and will be finally collected under one topic MOOC umbrella maintaining diverse national practices.

For this purposes the project has the following objectives:

- To adapt the existing MOOC methodology for school curriculum;
- To establish the MOOC platform adapted for STEM curriculum designing;
- To train at least 300 school teachers to develop micro-MOOCs for STEM education;
- To create 50 national (10 in each country) micro-MOOCs and 5 transnational ones for STEM education complemented by remote and virtual laboratories;
- To implement/test the developed STEM micro-MOOC(s) in a school curricula;
- To disseminate the intellectual outputs to a wide range of EU audiences including sector of school education, stakeholders, the scientific community as well as general public.

That is a new and innovative way to help schools to transform their curriculum emphasizing an academic excellence.

The ODL project involves both internal and external stakeholders in project activities as contributors and active participants. The school teachers, instructional designers, school students, as well as lab owners and educational providers will be invited to contribute to the project tangible outputs and, at the same time, to be “end-users” of the project results using provided instruments and e-facilities to extend learning and teaching activities.

2.2 Short and Mid External Target Audiences

STEM SCHOOL TEACHERS will benefit from the participation in the project by:

- expanding their digital skills and competences which can increase their professional development, and therefore, contribute efficiently into objectives of

their schools. The provided infrastructure motivate their daily work by encouraging students into learning process;

- created guidelines support their teaching practices;
- competence and knowledge to create innovative and engaging education instrument - micro-MOOC;
- experience of collaborative work with colleagues from partners EU countries;
- OERs in national languages facilitate especially in rural areas;
- analytics provided by moospace platform will help to evaluate the student performance and interaction for the purposes of enhancing educational practices and techniques.

PRE-SERVICE TEACHERS in addition to above mentioned impact:

- opportunity to collaborate with representatives of faculties and university students communities from other EU countries bringing transnational component in their future teaching;

SCHOOL STUDENTS (12-18 years old) might benefit from the project outputs by:

- applying MOOC methodology as an instrument of lifelong learning and STEM labs available over the project platform;
- developing their competences - scientific, technological and digital;
- improving their capacity in solving challenging real-life problems by working in STEM labs;
- increase their interest in self-educating using MOOC methodology, novelty with STEM labs by developing the necessary skills for forming learning strategies (combining different micro-MOOCs).

OTHER STAKEHOLDERS:

Instruction and curricula designers will get new pedagogical approach of employing the MOOC methodology with STEM laboratories in a classroom.

Policymakers at local, and regional and **schools** as an education institution:

- reinforce the usage of pedagogical, technological and educational innovation, and promotion of STEM for youth;
- initiate and support their experience in transnational cooperation by opening new ways of collaboration beyond the local or regional levels;
- expand MOOC methodology for other school subjects.

2.3 Short and Mid Internal Target Audience

STAFF OF THE CONSORTIUM represent the internal target group. The work together on the project impacts our team in different ways:

- strengthen a transfer of knowledge and technology to society;

- relate their research & innovation to the practice & society demands; incorporate the society needs in new studies and projects;
- employ transnational teamwork, different working styles, and exchange of knowledge to heighten the quality of project's intellectual outputs;
- publish scientific articles about these project's results in relevant journals and conferences.

2.4 Long-term Target groups

Besides mention above short and mid target group, the ODL consortium believe that general public will be the long term target audience. Although we do not expect that we will impact this target audience directly, we definitely will introduce them the STEM approach for the science in school.

Science/polytechnic/technical museums on regional, national and EU levels can be interested to have the STEM labs as a part of their exhibitions; individual young persons, seeking to learn more about science; artists who can find inspiration in technology for their work.

3 Main Project Outcomes and Results.

3.1 IO2. MOOC Platform

MOOC Platform is the ODL MOOC platform (moocspace) offering needed tools, guides and info to create well-designed microMOOC. These OERs assist educators to author and use microMOOCs in class. The ODL team applied cloud technology and adapted the Open edX for the project purposes.

The platform integrates the following modules:

- Base system including data analytics recording
- Scenarios container
- Teaching /Learning Zone
- OER Collection Space including remote and virtual laboratories list
- Social network
- Data management and data visualization for analytics
- Help and Tutorial

The MOOC Platform will use the cloud technology to support massive component. The Intellectual Output results will be used by the consortium in E1-E10 in short-term.

3.2 IO4. microMOOC: from scenario to educational resource

The work in this activity includes:

- (1) adapted MOOC methodology and 4D model by N.Sonwalkar (2013) for a school environment. MOOC characteristics, implementation challenges, and structure were employed for the project use;
 - (2) collected STEM materials include OER, videos, remote and virtual labs;
 - (3) created microMOOC (OER) scenarios. The designed microMOOC scenarios templates differentiate level of teacher guidance; difficulty of the involved remote/virtual labs; the requested student's cognitive skills.
 - (4) microMOOC guidelines to support teachers in process of microMOOC scenarios.
- (1) – (4) are needed activities for competent microMOOCs production.

Besides this, scenarios developed will be transferred to real micro-MOOCs –educational resources. The micro-MOOC set available on the ODL platform consists of 5 transnational micro-MOOCs, presented in all consortium national languages and

English, and overall 50 micro-MOOCs – 10 connected to each STEM national curriculum.

The Intellectual Output results will be used by the consortium in E6-E10 in short-term. In long-term pedagogical faculty in Universities and Organizations that train STEM teachers, school teachers and students of EU including partners' countries, school administration, decision-makers in departments of education on local, regional and national and European levels, education researchers, can benefit from this intellectual output.

The output will be available on the ODL MOOC platform. Teachers can compile the built and provided educational blocks to create their own micro-MOOCs. The merging different micro-MOOCs allows the teachers to build personalized learning paths.

3.3 National Workshop: MOOC in school sector (E1-E5)

This National workshop will be organized by each ODL partner in its country. It aims to introduce to the teacher the MOOC approach in the school environment and offer the adapted MOOC methodology. A special learning activity will be organized for teachers to train them how to design the micro-MOOC scenarios and use the STEM remote and virtual laboratories in a classroom. The goal of this activity is training at least 30 national teachers on designing micro-MOOC scenario as well as discovering the STEM laboratories and MOOC potential. The additional task of the workshop is opening the teacher to ODL project circle, expanding project to as much as possible schools and stimulating the consortium-stakeholders dialog.

3.4 National Workshop: MOOC in school sector (E6-E10)

This National workshop will held in each ODL partner country. It aims to make a teacher familiar to deploy the micro-MOOC scenario into the ODL MOOC platform. The main features of platform will be presented. At least 30 national teachers will attend this workshop. During the workshop teachers will have a chance to convert their idea to education resource. The method how to incorporate their micro-MOOC into curriculum will be provided.

Some of the participated teachers will be invited to work together with consortium members on an implementation micro-MOOC in curriculum. Intervention in classroom will be occurred. At least 50 school students will be involved in this activity. The further growing of ODL project community is expected.

3.5 Teacher Summer School

The training activity – 5 days Teacher Summer School - is an essential part of the project assuring the achievement of its objectives. The main added value of this activity is an exchange of knowledge, experiences and best practices due to the transnational

collaborative work of the teachers from five EU countries on design of the micro-MOOCs fitted to a national curricula. Teacher School is idea-generating training that shows to school teachers a new way to make STEM teaching more exciting and accessible to students. The main objective of the School is to introduce to teachers the use of online virtual experimentations and remote laboratories in combination with MOOC methodology. Teachers will collaboratively work on creation of microMOOCs, and discovering remote & virtual laboratories and their application in education, that fit to their microMOOC scenario. The course will also strengthen its social connection and European dimension - five teams structured from teachers of Italy, Estonia, Greece, Lithuania and Spain will present the microMOOC created by them during the training. The collection of STEM labs, inquiry MOOC scenarios, and the educational tools complemented by hands-on activities will facilitate the participants to innovate everyday teaching practice and share own-developed open education resources.

4 ODL Sustainability Plan

The project sustainability during project time bases on three levels of organizational capacity: project, institutional and national/European levels.

PROJECT level the process of project implementation is monitored by two bodies - Executive Board and Quality Control Group (QCG).

The Executive board will be in charge of project management decisions, monitoring the project planning, e.g. , the fulfillment of deadlines for activities and intellectual outputs.

The QCG will control and monitor quality assurance of project performance. The close cooperation will be achieved by delegating the leadership on intellectual outputs to consortium members based on their expertise and experiences.

On the project level partnerships bilateral agreement is created and signed. Partnerships agreement provides a description of beneficiaries' role and responsibilities in carrying out the work, management and governance modalities, financial management and related rules, reporting mechanisms, conflict management mechanisms in case of problems or tasks/activities not properly implemented, communication strategy.

INSTITUTIONAL level, the process of the project implementation is controlled by institutional administration. The each partner organization determine contact person, project participants, persons responsible for the administrative and academic part of the project. The ODL consortium members maintain a constant interaction and cooperation on all issues and tasks of the project.

NATIONAL/EUROPEAN level by merging knowledge and ODL resources, the consortium will place ODL activities communicating with decision makers at local, regional, national and European level. With this we will encourage the use of the project tangible outcomes in other education sectors as well as other subjects exceeding STEM.

4.1 Sustainability after project life period.

FD: The main activity will be towards to offering the training to school teachers on the local , national and European levels. The ODL 3 day sessions will participate in the call of the projects that support a professional development of the school teachers. The microMOOC methodology will be presented on seminars and incorporated in a frame of the project MoPED (586098-EPP-1-2017-1-UA-EPPKA2-CBHE-JP).

EA plans to combine exploitation activities, linked to the dissemination effort already made, in order to guarantee that sustainability is embedded even after the completion of the project. The strategy planned to be followed is based on an action-learning approach that will endeavor to link the project products with future activities to be carried out by our team. The key aim and intent are to create a virtuous cycle of activities which will make ODL results more sustainable in order to maximize their impact and, at the same time, to conceivably advance the learning programme. By merging knowledge and ODL resources, EA will attempt to feed back the outcomes into policy and practice decision

making. Towards this direction, the focus will be placed both on mainstreaming ODL activities, addressing decision makers at local, regional, national and European level, and on scaling up ODL activities, addressing individual educators and organisations in the educational sector and more specifically in the field of science education, with the purpose to achieve the maximum impact of the ODL service and to establish connections between ODL and its results, other projects and the wider educational community.

LieDM: Lithuanian Association of Distance and e-Learning implemented ODL microMOOCs with virtual laboratories in follow schools of Lithuania:

- Prienai “Žiburio” Gymnasium, Prienai, LITHUANIA,
- Visaginas Technology and Business VET Centre, Visaginas, LITHUANIA,
- Šiauliai Simono Daukanto Gymnazium, Šiauliai, LITHUANIA.

These schools will continue to implement ODL micro-MOOCs in the school curriculum with their learners. LieDM association will continue to disseminate ODL platform and micro-MOOCs with virtual laboratories during the events of association.

HITSA: Digital competences, web-based learning materials and e-courses are becoming increasingly popular in the Estonian educational landscape. The strength of the ODL project was certainly the combination of a lot of good and comprehensive teaching materials together in one environment, with the integration of different subjects. We hope that the MOOCspace platform/environment will be used more widely, as it provides a good opportunity for creating, storing and sharing learning materials. It is also a good tool to use in non-formal education. Maybe it is even possible to integrate this experience and platform into future projects.

For future, it is good that the environment is free of charge, it is working well and instructions as well as methodology how to use it and implement with students are available. So there is no need for extensive prior knowledge – only a will and some time to test it, and the teacher can create a suitable micro-MOOC for his/her students.

UniPA: In the next year the UniPA plans to organize new workshops on the ODL methodology in order to increase the number of trained teachers, where micro-MOOCs will be presented as good examples of resources to be used in the teaching practice. During these events, teachers will have the chance to start to convert their scenarios into educational resources. The method on how to incorporate their micro-MOOCs into curricula will be also provided;

Thanks to the ODL project, a very good network of STEM teachers has been established in Palermo; they will continue to explore the micro-MOOC potentialities also after the end of the project and in the next scholastic year they will carry on about ten pilot studies involving students of different ages, from Primary up to Secondary School;

On the wake of the ODL project, a STEM regional network has formed (including schools of Palermo, Monreale and Catania). The teachers applied for a Project of the Italian Ministry for the Education on Sustainable Development by choosing an Inquiry-

based methodology grounded on an effective use of micro-MOOCs;

UniPA will also continue with the dissemination to a broad international audience, presenting the results of the project to important Conferences, via Webinar on the EU e-twinning platform, seminars in the school, etc;

For what concerns the assessment of the results, the UniPA partner will collect and analyze teachers/students reports and feedback from future pilot studies; then will edit the recommendation for practical incorporation of micro-MOOCs into school curricula, based on the feedback.

5 Conclusion

The ODL consortium partners develop the clear and transparent implementation programme to reach the project objectives. The Exploitation stages are established. The Sustainability plan is developed. The adoption of a sustainability programme will create a significant number of benefits from the project

Although Sustainability Plan is comprehensive, and includes many activities for initial achievements, and future exercises. All of the tasks would help make ODL more sustainable, and some are critical, especially on the stage of implementation.

The last section looks at these most significant suggestions from different perspectives of each institution, which may help guide decision making and further scientific, research and human investments in this topic. Finally, the conclusion shows the expectations for success based on the desire to build a sustainable impact project in a sustainable STEM motion.

