



**OPEN
SCIENCE
HUB**

**EMPOWERING CITIZENS
THROUGH STEAM
EDUCATION WITH
OPEN SCHOOLING**

DELIVERABLE 3.1

Report on existing Open Standards

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LIST OF ACRONYMS

ACRONYM	DEFINITION
CC	Creative Commons
EC	European Commission
EU	European Union
FAB	Onl’Fait
GLOBE	Global Learning and Observations to Benefit the Environment
HE	Higher Education
ICT	Information and Communication Technology
JRC	Joint Research Centre
LRE	Learning Resource Exchange
MOOC	Massive Online Open Course
MS	Member States
ODS	Open Discovery Space
OER	Open Educational Resources
OSHub	Open Science Hub
OSHub.Network	Open Science Hub Network
STE(A)M	Science, Technology, Engineering (Art) and Mathematics
ULeI	Leiden University
WP	Work Package

GLOSSARY OF TERMS

Open Education

The European Commission working definition of open education is “a way of carrying out education, often using digital technologies. Its aim is to widen access and participation to everyone by removing barriers and making learning accessible, abundant, and customisable for all. It offers multiple ways of teaching and learning, building and sharing knowledge. It also provides a variety of access routes to formal and non-formal education, and connects the two.”¹

Open Educational Resource

According to UNESCO: “Open Educational Resources are teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions.”²

1 Open Education – OpenEdu Framework, European Commission, <https://ec.europa.eu/jrc/en/open-education>

2 UNESCO – Open Educational Resources (OER), <https://en.unesco.org/themes/building-knowledge-societies/oer>

EXECUTIVE SUMMARY

**This document corresponds to
Deliverable 3.1:
Report on existing Open Standards.**

This document focuses on the state-of-the-art regarding Open Education and Open Educational Resources, including its relevance and challenges for its effective implementation, the policy approaches across the European Union, and a (living) compilation of Open Educational Resources initiatives. In addition, it prepares the ground to devise the strategy on how Open Science Hubs can support schools opening-up education, namely through the use of Open Educational Resources and other open standard resources in school's daily life and institutional culture.

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1. INTRODUCTION

1.1 Background: about OSHub.Network

The Open Science Hub Network (OSHub.Network), a consortium of nine partners across Europe, engages schools and local stakeholders in research and innovation as a tool for sustainable community development.

More specifically, the OSHub.Network is establishing a European network of community hubs – OSHubs, in communities that traditionally do not engage with research and innovation due to various barriers, geographical location, socio-economic status, or ethnic minority group background. OSHubs inspire, empower and engage citizens – from school children to senior citizens – in STEAM (Science, Technology, Engineering, Arts and Mathematics) learning and research opportunities, grounded on collaboration with societal agents.

As such, local OSHubs work as mediators in their local communities, positioning schools as active agents for collaboration between civil society, enterprises, research institutes, and families. This is performed by promoting an open schooling approach grounded in community-based participatory research practices: throughout this process, schools and communities identify local relevant challenges, which are then be transformed into relevant research and innovation projects, led by students and teachers, in collaboration with local stakeholders.

The OSHub.Network is developing a common methodological framework, that allows each OSHub to identify and analyse local needs, issues, opportunities and relevant actors, in order to address socio-economic, geographical, gender equity issues, and untapped growth potential. Inspired by the “Mission-Oriented Research & Innovation in the European Union”³ approach, developed by Mariana Mazzucato, OSHub.Network will define a set of Open Schooling Missions, aimed at addressing local relevant challenges linked to the Sustainable Development Goals. These Open Schooling Missions will then constitute the basis for the creation and development of the open schooling projects, enabling real collaboration across communities. Importantly, to ensure diversity, inclusion and sustainability, in each OSHub location, there will be a local management board with representatives from local stakeholder groups – schools (including students), families, research institutes and universities, enterprises, industry, media, local governments, civil society organizations and wider society – which will be involved in all key processes and decisions regarding local OSHub programmes and initiatives.

By supporting local schools and communities with the tools and network to tackle relevant challenges, OSHub.Network aims to create local impact while simultaneously promoting an active global citizenship attitude, thus contributing to community development, innovation and well-being. To

3 Mariana Mazzucato (2018), Mission-Oriented Research and Innovation in the European Union – A problem solving approach to fuel innovation-led growth’, European Commission, Retrieved from: https://ec.europa.eu/info/sites/info/files/mazzucato_report_2018.pdf

encourage usage and maximise impact in Europe and beyond, all resources, products and solutions developed by OSHub.Network will be fully based on Open Standards, such as open education, open technology, open science, open hardware, open design and open architecture. Also, OSHub.Network will create an online platform to share OSHub expertise, resources, and best practices with all OS Hubs, their partners and the communities they serve. To ensure the legacy and reach of the project, all OSHub.Network resources will also be shared on existing large online educational repositories, and relevant national networks and repositories.

Finally, OS Hubs will develop a legacy and sustainability plan, and will work closely with local governments, to ensure that each local OSHub has the tools and resources to continue beyond the lifetime of the project, and that the Open Schooling approach is incorporated in the school vision and organizational structure.

By the end of the project, it is expected that the OSHub.Network will have impacted 25 000 students, 1 250 teachers and 4 000 members of the community, through involvement in more than 150 school-university-industry-civil society partnerships in open schooling projects and activities.

In the long-run, we envision OS Hubs as education brokers in their local communities, supporting local school networks to incorporate Open Schooling in their vision and organizational structure, leading to sustainable quality of education. Most particularly, OS Hubs will facilitate the bridge between the needs and realities of schools and their local context and resources, as well as brokering for implementing national/regional policies, passing along signals from schools when policies are failing and advocating for context-sensitive policies.

1.2 Purpose of this report

Open Schooling promotes learning environments where “schools, in cooperation with other stakeholders, become an agent of community well-being”⁴, by engaging in real-life projects that meet societal needs. In order for Open Schooling to create a real and effective impact, it is fundamental to open-up education, creating the conditions “to widen access and participation to everyone by removing barriers and making learning accessible, abundant, and customisable for all” and by offering “multiple ways of teaching and learning, building and sharing knowledge”⁵.

This document prepares the ground to devise the strategy on how OS Hubs can support schools opening-up education, namely through the use of Open Educational Resources and other open standard resources in school’s daily life and institutional culture.

This is a living document and will be reviewed and updated during the project’s lifetime in order to reflect new opportunities and new understandings for the needs of schools and community stakeholders.

4 Directorate-General for Research and Innovation – European Commission (2015) Science Education for Responsible Citizenship (2015), ISBN 978-92-79-43636-9, doi:10.2777/12626, retrieved from: http://ec.europa.eu/research/swafs/pdf/pub_science_education/KI-NA-26-893-EN-N.pdf

5 Inamorato dos Santos, A., Punie, Y., Castaño-Muñoz, J. (2016) Opening up Education: A Support Framework for Higher Education Institutions. JRC Science for Policy Report, EUR 27938 EN; doi:10.2791/293408, retrieved from: <https://publications.jrc.ec.europa.eu/repository/bitstream/JRC101436/jrc101436.pdf>

2. OPENING-UP EDUCATION

2.1 Open Education and Open Educational Resources

Going open can provoke a profound change in the way education systems are organised and education is carried out.

In particular, opening up education:

- can help to reduce or remove barriers to education, making it more accessible and inclusive for all (e.g. cost, geography, time, entry requirements), giving learners the opportunity to up skill or re-skill at a lower or nearly no cost, and in a flexible way¹
- promotes openness in both formal and non-formal education sectors, representing a new set of educational routes that a learner can follow, thus allowing more freedom and opportunities⁶
- supports the modernisation of education in Europe, since contemporary open education is largely carried out via digital technologies¹
- increases the variety of educational resources available to teachers and students, thus improving the quality of teaching and learning
- can reduce the costs associated to proprietary educational resources thus increasing the budget for other needs of the learners
- encourages educational institutions to be more transparent (e.g., through open data about schools) and make themselves more accountable to society with regard to how they deliver their public mission, thus further enabling equal opportunities and inclusion⁶
- prompts a change of mindset, further helping education systems to become

6 Inamorato dos Santos, A. (2017) Going Open – Policy Recommendations on Open Education in Europe (OpenEdu Policies). Ed: Punie, Y., Scheller, K.D.A., EUR 28777 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73496-0, doi:10.2760/111707, JRC107708, retrieved from: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC107708/jrc107708_jrc_107708_final__going_open_-_policy_recommendations_on_open_education_in_europe.pdf

more open and transparent at all levels in education systems and towards society: educational policies, teaching and learning processes, educational resources, technologies, leadership, research, professional and career development⁶

In 2002, the term 'Open Educational Resources' (OER) was adopted at UNESCO's Global Forum on Open Courseware to describe the phenomenon of sharing educational resources under open licences. At its core, OER is a simple legal concept: it describes educational resources that: 1) are offered freely; 2), are openly available to anyone, and, under some licences: 3) allow others to reuse, adapt, and redistribute the resources with few or no restrictions. The best known of these are the Creative Commons (CC) licences⁷, which provide legal mechanisms to ensure that people retain acknowledgement for their work while allowing it to be shared and which enable copyright holders, if they so wish, to restrict commercial activity or prevent people from adapting the work. OER can include lecture notes, slides, lesson plans, textbooks, student handouts, videos, online tutorials, podcasts, diagrams, entire courses, and any other material designed for use in teaching and learning.

In 2007, the Cape Town Open Education Declaration⁸ stressed that open education is not limited to "just open educational resources. It also draws upon open technologies that facilitate collaborative, flexible learning and the open sharing of teaching practices that empower educators to benefit from the best ideas of their colleagues. It may also grow to include new approaches to assessment, accreditation and collaborative learning".

In 2012, at the World OER Congress in Paris, France, OER was emphasized as a means of providing equal access to knowledge. The Congress also showcased innovative policies and initiatives that demonstrate the potential of OER to improve communities. Importantly, it led to the adoption of the Paris OER Declaration⁹, which calls on governments worldwide to license publicly funded educational materials openly for public use.

In 2015 the United Nations adopted the 2030 Sustainable Development Agenda with 17 goals¹⁰, where Goal 4 is about quality in education, and calls on the international community to "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all". To further disseminate open education as a valuable support mechanism to achieve SGD4, UNESCO in 2017 organised the 2nd World OER Congress, in Ljubljana, Slovenia, which led to the adoption of the Ljubljana OER Action Plan¹¹, and subsequent drafting of an OER Recommendation, which was approved at the 2019 UNESCO General Conference.

Concretely, the UNESCO OER Recommendation has five objectives¹²: (i) Building capacity of stakeholders to create access, use, adapt and redistribute OER; (ii) Developing supportive policy; (iii) Encouraging inclusive and equitable quality OER; (iv) Nurturing the creation of sustainability models for OER; and (v) Facilitating international cooperation.

7 <https://creativecommons.org/>

8 Cape Town Open Education Declaration: <https://www.capetowndeclaration.org/read-the-declaration>

9 Paris OER Declaration: http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/CI/pdf/Events/English_Paris_OER_Declaration.pdf

10 UN Sustainable Development Goals: <https://sustainabledevelopment.un.org/>

11 Ljubljana OER Action Plan: https://en.unesco.org/sites/default/files/ljubljana_oer_action_plan_2017.pdf

12 <https://en.unesco.org/news/unesco-recommendation-open-educational-resources-oer>

For the European Commission (EC), opening up education is also a pivotal item on the policy agenda, and open education is part of two complementary agendas: the modernisation of education and the future of learning in the digital age. Most particularly, open education has featured in two EC Communications¹³ for the higher education (HE) and school sectors, where it was mentioned:

- HE Communication: *The Commission will: [...] 4. Develop and roll out a digital readiness model to help HEIs [Higher Education Institutions], their staff and students implement digital learning strategies and exploit the potential of state-of-the-art technology, including learning analytics. This will be accompanied by guidance on open education initiatives.*
- Schools' Communication: *[...] Collaborative environments and digital technologies can enhance teacher learning. Traditional workshops and training courses away from school still prevail. Educational innovations such as collaborative peer networks, massive open online courses (MOOCs), and the sharing of open educational resources can complement these methods and help overcome barriers to participation.*

The EC working definition of open education is “a way of carrying out education, often using digital technologies. Its aim is to widen access and participation to everyone by removing barriers and making learning accessible, abundant, and customisable for all. It offers multiple ways of teaching and learning, building and sharing knowledge. It also provides a variety of access routes to formal and non-formal education, and connects the two.”¹

This intergovernmental policy support has been further reinforced by the growing number of national OER policy initiatives and by rapid growth in access to openly licensed content online (reported by Creative Commons to be nearly 1.5 billion openly licensed resources in 2017 compared to 140 million in 2006¹⁴).

2.2 Opening-up Education: challenges

However, the process of opening up education does not come without its challenges.

13 HE: https://ec.europa.eu/education/sites/education/files/he-com-2017-247_en.pdf and Schools: https://ec.europa.eu/education/sites/education/files/school-com-2017-248_en.pdf

14 Creative Commons). State of the Commons, retrieved from <https://stateof.creativecommons.org/>

Although OER are high on the policy agenda and supported by many education and training stakeholders, their use at schools, universities and adult education institutions are from being mainstream or part of the daily life and institutional culture of these institutions.

Some of the bottlenecks and barriers to mainstreaming the use of OER in education and training might be related with the following¹⁵:

2.2.1 Content aspect: Foster adequate, easy to find and high quality resources

National and regional policies have focused on the production of educational contents and the creation of repositories to facilitate access, which has led to a number of educational resources and OER platforms on the Internet.

The demand, however, is still lacking due to the following factors:

- Discoverability of quality resources appropriate to user user's teaching and learning needs (and lack of systematic organization across repositories);
- Lack of quality assurance mechanisms across repositories;
- Reduced language diversity (and consequent cultural richness and biasing of target audience) in many OER initiatives (english is the predominant language; also, many resources have been developed in the United States and are not readily adapted to be used in European schools);
- Lack of adoption of agreed open standards¹⁵.

2.2.2 Societal aspect: Foster learners' and teachers' skills for using OER

The use of OER is also hindered by access constraints and lack of skills, including:

- Uneven availability of information and communication technology (ICT) infrastructure across Europe;
- Different levels of digital skills across Europe and regarding age, education level and gender.
- Teacher's training needs regarding digital pedagogic skills;

15 Alquézar Sabadie, J.M., Castaño Muñoz, J., Redecker, C., Vuorikari, R. (2014) OER: A European policy perspective, Journal of Interactive Media in Education p. 1-12, Institute of Educational Technology (IET), The Open University, UK, retrieved from: https://www.researchgate.net/publication/261516344_OER_A_European_policy_perspective

- Difficulty in implementing innovative teaching practices integrated with the use of OER resources¹⁵.

2.3 Opening-up Education: policy approaches across the European Union

On top of the challenges described above, in 2017, the report “Policy Approaches to Open Education – Case Studies from 28 EU Member States (OpenEdu Policies)”¹⁶, highlighted the existing diversity regarding open education policy approaches in the European Union (EU), where each Member State (MS) has specific goals for education and priority areas to address when formulating its policies.

However, this research also showed that MS are aware of open education issues and that, in one way or another, most MS have implemented some kind of initiative with regard to open education (even though that goal is not explicit in some cases). Nevertheless, the report also emphasized that there is still a long way to go: in most MS the vision of open education is rather broad, going beyond OER and open content – even if in a number of MS, when this vision is applied to actual policy, the approach is still limited to OER. Importantly, one of the relevant points of this study was the identification of the main barriers that can prevent open education policies from fully succeeding, as well as the potential enablers for open education.

The main barriers identified were: low ICT-readiness, low policy priority assigned to open education, fragmentation of initiatives, lack of institutional support, resistance to cultural change, lack of awareness about open education, low open education capacity within the teaching population, and the absence of an open licenses national recognition scheme.

The main enablers identified for open education to thrive were: a clear policy priority assigned to open education, both at MS and EU level; awareness-raising on open education, targeting leaders and educators; capacity-building on open education for educators and other stakeholders; measures to empower educators; and online platforms and advocacy communities.

From the purpose of this deliverable, this report exposed two important conclusions:

- if MS and the EU wish for greater progress – and in a more uniform way – in the open education field, steps will have to be taken by the EU to both increase awareness of open education and increase the frequency of studies and peer-learning activities among MS.
- due to the vagaries of project-based funding, rather a large number of MS had not looked at open education issues for many years. As such, a more systematic approach, such as a kind of regular “open education census”, would be needed, preferably carried out in some kind of MS-EU partnership.

In Annex 1 we present an overview of the identified policies across the different MS (from¹⁶).

16 Inamorato dos Santos, A., Nascimbeni, F., Bacsich, P., Atenas, J., Aceto, S. Burgos, D., Punie, Y. (2017) Policy Approaches to Open Education – Case Studies from 28 EU Member States (OpenEdu Policies). EUR 28776 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73495-3, doi:10.2760/283135, JRC107713, https://publications.jrc.ec.europa.eu/repository/bitstream/JRC107713/jrc107713_jrc107713_policy_approaches_to_open_education.pdf

2.4 Opening-up Education: Open Licences

A license is a document that specifies what can and cannot be done with a given product. It grants permissions and states restrictions. Broadly speaking, an open license is one that grants permission to access, re-use and redistribute a work with few or no restrictions.

As an illustration:

— **All rights reserved Copyright state:**

It is mine. I do NOT allow you to take this material and repurpose it. You need to ask for my permission to use this.

— **Whereas, Open Licence state:**

Is it mine. But I DO allow you to take my material. Just remember to make a proper attribution to me. It is free, and you do not need to ask for my permission to use it.

There are many open licenses developed for different areas of knowledge (please see below some examples), however, when it comes to OER the most typical and common open licenses used are CC Licenses (please see 2.4.1. Creative Commons Licences):

- Open Source Hardware Licences:
 - Open Source Hardware Association Certification¹⁷
 - CERN Open Hardware Licence¹⁸
- Open Source Software Licences:
 - GNU Public Licence¹⁹
 - Mozilla Public Licence²⁰

17 <https://certification.oshwa.org/>

18 <https://kt.cern/open>

19 <https://www.gnu.org/licenses/licenses.en.html>

20 <https://www.mozilla.org/en-US/MPL/>

— BSD Licence²¹

The website <https://choosealicense.com/> provides a useful guide for creators to choose the licence that is the most appropriate for their product.

2.4.1 Creative Commons Licences⁷

In 2001, inspired by the open source license movement (launched in 1983), a group of experts comprised of educators, technologists, legal scholars, investors, entrepreneurs and philanthropists, namely from Stanford University, developed a set of copyright licenses that would allow creators to easily share materials that were not software code, such as blogs, photos, films, books, etc. They ended-up founding the nonprofit organization “Creative Commons” and developed the first set of open licenses in 2002.

The popularity of CC licences has grown incrementally since its launch in 2002, and by 2006 it was estimated that 45 million web pages had been licensed with a CC licence²².

The philosophy of CC has been described as follows²³:

Inspired by the free software movement, the Creative Commons believes that a large vibrant public domain of information and content is a prerequisite to sustained creativity, and there is a need to proactively enrich this public domain by creating a positive rights discourse. It does this by creating a set of licenses to enable open content and collaboration, as well as acting as a database of open content. Creative Commons also serves to educate the public about issues of copyright, freedom of speech and expression and the public domain.

The CC licences take account of different copyright laws in different countries or jurisdictions and also allow for different language versions. To make the licensing process as simple as possible for users the CC site makes use of a licence generator that suggests the most appropriate licence based on a user’s response to specific questions regarding how their work can be used. In order to facilitate searching for resources licences in a particular way, the CC licence is expressed in three versions:

- Commons deed (also known as “human readable” version of the licence): this is a plain language version of the licence, with supporting icons (Figure 1);
- Legal code: the legal fine print that ensure the licence is recognised in a court of law;
- Digital code: a machine readable translation that allows search engines to identify work by its terms of use (‘About–Creative Commons’; ²³).

21 <https://spdx.org/licenses/BSD-3-Clause>

22 Smith, M. S., & Casserly, C. (2006). The Promise of Open Educational Resources. Change, Fall, retrieved from <http://learn.creativecommons.org/wp-content/uploads/2008/03/changearticle.pdf>

23 Liang, L. (2004). Guide to Open Content Licenses. Piet Zwart Institute, Willem dr Kooning Academy Hogeschool Rotterdam. Moller, E. (2005). Creative Commons – NC Licenses Considered Harmful, retrieved from www.kuro5hin.org/story/2005/9/11/16331/0655

All CC licences include 'Baseline Rights': the rights to copy, distribute, display, perform publicly or by digital performance, and to the change the format of the material as a verbatim copy²⁴. In addition, all CC licences assert the author's right over copyright and the granting of copyright freedoms and require licensees to:

- Obtain permission should they wish to use the resource in a manner that has been restricted;
- Keep the copyright notice intact on all copies of the work;
- Publish the licence with the work or include a link to the licence from any copies of the work;
- Not change the licence terms in anyway;
- Not use technology or other means to restrict other licences' lawful use of the work²³.

Detailed Information about the CC licences can be found on the CC website²⁵.



You allow others to copy, distribute, display, and perform your copyrighted work – and derivative works based upon it – but only if they give credit the way you request.



You allow others to copy, distribute, display, and perform your copyrighted work – and derivative works based upon it – but for non-commercial purposes only.



You allow others to copy, distribute derivative works only under a license identical to the license that governs your work.



You allow others to copy, distribute, display, and perform only verbatim copies of your work, not derivative works based upon it.

24 Hofman, J., & West, P. (2008). Chapter 6: Open Licences. In Copyright for authors, educators and librarians, retrieved from www.col.org/resources/knowServices/copyright/Pages/openLicense.aspx

25 <https://creativecommons.org/licenses/>

2.5 Opening-up Education: where does one find OER?

The scope and availability of OER is ever expanding. Every week, new resources are being added to the global body of resources. A current problem arising out of this growth is that there is no single comprehensive listing of all OER (nor, given the rapid expansion of content online, is there ever likely to be one). This means that, there can be several approaches to find appropriate OER.

2.5.1 OER initiatives

The project POERUP²⁶, partly funded by the EC's Lifelong Learning Programme (November 2011-June 2014) created an inventory of more than 500 OER worldwide initiatives which are documented on the POERUP wikpage²⁷.

This inventory was then refined into a list of 120 notable initiatives²⁸ (see Appendix), by applying a number of criteria:

- To qualify as notable, the OER initiative should focus on producing content, material or resource for teaching and learning.
- To be categorised as a notable initiative, CC licence or other types of open licence must be used for at least a significant amount of content. For this reason, some initiatives which were usually considered as OER initiatives, such as TED Ed²⁹, were excluded, as their content was not openly licensed.
- All initiatives whose focus was on producing e-textbooks and making them freely available or at a low cost to students (even the textbooks not openly licensed) were included as notable initiatives in order to highlight the significance of open textbooks in terms of removing financial barriers to access to educational content.
- MOOCs were considered as notable initiatives, even those which were not licensed under CC. As the number of MOOCs is increasing rapidly, it was not possible to include in this inventory every single MOOC that was being offered worldwide (for a complete and up-to date list of MOOCs the authors suggest visiting³⁰).
- Because the United States dominated the list of worldwide OER initiatives, this report has only included a representative selection, whereas countries with less visible OER were more broadly represented

The list of notable initiatives created by the POERUP can be found in the POERUP project Deliverable 2.3 – Report on Comparative Analysis of Transversal OER Initiatives²⁸ (p. 31-44).

26 POERUP project: <http://www.poerup.info/>

27 POERUP wikpage: http://poerup.referata.com/wiki/Open_Education_Initiatives_-_by_country

28 POERUP project, Deliverable 2.3 – Report on Comparative Analysis of Transversal OER Initiatives: http://poerup.referata.com/w/images/POERUP_D2.3_Comparative_Analysis_of_Transversal_OER_Initiatives_v1.0.pdf

29 <https://ed.ted.com/>

30 <http://www.mooc-list.com/>

2.5.2 Repositories, Portals and Directory Sites

The OER landscape at compulsory school level is very different to that at HE level. In HE there has been a concerted effort to centrally fund OER production and development by partnerships and networks of universities or at single institutions, however, this has been less common at school level (primary to secondary). Nonetheless, this does not mean that OERs do not exist at school level and that are not shared, and many OER resources can actually be found in Educational Repositories, Portals and Directory Sites.

There are many examples of these repositories and portals in Europe, and a large proportion has been part, or fully, funded by the EU and/or national governments. To attempt to quantify the number of active repositories in Europe would be extremely difficult since there are so many and they are so diverse. In addition to the large national school repositories (e.g. in Greece, Norway and Latvia) there are countless single subject repositories (often regarding science-based subjects e.g. Cosmos or Mathematics e.g. Intergeo) and numerous “cultural sector” repositories provided by museums, galleries and archives (Pathe, BFI, Openarchives, the Swedish Digital Museum) or sometimes national broadcasters (BBC, YLE, NBC). EdReNe (Educational Repositories Network) is an attempt to bring some order to this often previously fragmented landscape.

Below we highlight some STEM-based resources key initiatives.

1. Learning Resource Exchange (LRE) for Schools³¹

LRE was established by the European Schoolnet partnership. Whilst the LRE was initially created to meet national Ministries desire to make “open content” more widely and easily accessible, it also offered the potential to support commercial content. The LRE has resources on virtually every curriculum subject and includes resources developed by teachers themselves.

The LRE is part of 120 notable OER initiatives.

2. Open Discovery Space (ODS)³²

ODS represents a collaboration of repositories, federations, portals and tools to provide a single point of access to an estimated 1.5 million resources, providing a multilingual open learning infrastructure to boost the adoption of eLearning resources from dispersed educational repositories in Europe.

3. Scientix

Scientix promotes and supports a Europe-wide collaboration among STEM teachers, education researchers, policymakers and other STEM education professionals. In its first stage (2009-2012), Scientix built an online portal to collect and present European STEM education projects and their results, and organised several teacher workshops. The goal of the second and

31 <http://lre.eun.org/index.html>

32 <https://portal.opendiscovery.space.eu/en>

third phases of the Scientix project (2013-2019) was to expand this community to the national level. Through a network of National Contact Points, Scientix reached out to national teacher communities, and contributed to the development of national strategies for wider uptake of inquiry-based and other innovative approaches to science and maths education.

4. OERCommons³³

In 2007, the Institute for the Study of Knowledge Management in Education launched OER Commons, its digital public library and collaboration platform (with 120 major content partners) to provide a single point of access through which educators and learners can search across collections. OER Commons offers a comprehensive infrastructure for curriculum experts and instructors at all levels to identify high-quality OER and collaborate around their adaptation, evaluation, and use to address the needs of teachers and learners.

The OERCommons is part of 120 notable OER initiatives.

5. OER World Map³⁴

The OER World Map is a portal where anyone involved in Open Education can share information, experiences and ideas related to their work. Anyone can contribute to the information on the World Map and anyone can access the information on the World Map.

Since the OER World Map's beginnings, in 2014, the team and the partners of the OER World Map are striving to make OER, related projects, actors, data and events visible on a global scale. The World Map is being built by hbz and graphthinking GmbH in association with The Open University (UK) funded by The William and Flora Hewlett Foundation.

6. astroEDU³⁵

astroEDU is an open-access platform that uses the familiar peer-review workflow of scientific publications, to improve the standards of quality, visibility and accessibility of educational activities. This online platform, which was selected by HundrED as top 100 education innovation in 2018, is a project from the International Astronomical Union. It was founded by the Sterrewacht at Leiden University, which still is one of the official supporters of the platform. astroEDU is a place where educators can discover, review, change, and share astronomy – and space-related activities for primary and secondary education, and also have their activities peer-reviewed by professionals in education and science.

33 <https://www.oercommons.org/>

34 <https://oerworldmap.org/>

35 <https://astroedu.iau.org/en/>

7. STEMYouth³⁶

The STEMYouth portal contains comprehensive presentations of selected topics and challenges from major STEM disciplines: Mathematics, Physics, Chemistry, Astronomy, Engineering, Medicine and Citizen Science, a concept developed within the EU Horizon 2020 STEM4youth project. Each discipline involves a series of challenges (lessons) which, in the authors' opinions, are essential to better understand a given scientific area, its impact on our lives and on the current and future labour market and economy. The portal's materials are primarily dedicated to secondary and high-school teachers as sources of ideas for their extra-curricular lessons, as well as to those students wishing to expand their knowledge, have a more holistic view on STEM and get more information about which career opportunities are accessible thanks to a STEM education. The portal is open so everyone can upload their own materials, which are made publicly accessible after a technical verification by the system administrator.

8. Global Learning and Observations to Benefit the Environment (GLOBE)³⁷

The GLOBE Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process, and contribute to our understanding of the Earth system and global environment. GLOBE provides grade level-appropriate, interdisciplinary activities and investigations about the atmosphere, biosphere, hydrosphere, and soil/pedosphere, which have been developed by the scientific community and validated by teachers. GLOBE is sponsored by the U.S. National Aeronautics and Space Administration (NASA) with support from the National Science Foundation (NSF), National Oceanic and Atmospheric Administration (NOAA) and Department of State. Internationally, GLOBE is implemented through government-to-government agreements with each country partner responsible for in-country activities.

36 www.stem4youth.eu

37 <https://www.globe.gov/>

3. OPENING-UP EDUCATION: THE ROLE OF OSHUBS

This document prepares the ground to devise the strategy on how OSHubs can support schools opening-up education, namely through the use of OER in school's daily life and institutional culture.

As such, based on the findings, recommendations and trends exposed throughout this document, the OSHub.Network set four objectives and corresponding actions, which will be developed throughout the time course of the project:

1. Assessment of national OER initiatives

Given the diverse realities in terms of OER across the MS and the existing scattered information, the OSHub.Network will conduct national surveys in each of the partner countries to map existing OER initiatives.

2. Creation of the OSHub.Network Library based on open standards

Taking as a base the hundreds of OER worldwide initiatives mapped by the POERUP project and the repositories/portals highlighted above, we started creating the OSHub.Network Library which includes OER initiatives targeted at schools. This library is also being updated with more recent initiatives that have been emerging in the last years, and it will also include the results of the national landscape surveys.

Currently, the list of these resources is being compiled in the document that can be found in the footnote of this deliverable³⁸. The OSHub.Network Library will also be available on the website of the project, which will be launched in March 2020 (D6.2 OSHub.Network Digital Platform).

Importantly, since OSHubs will be fully based on Open Standards, including technology, design, architecture, the OSHub.Network Library also includes information about open resources regarding hardware, software and furniture design.

The OSHub.Network Library will be part of the OSHub.Network Blueprint (D4.2 OSHub.Network BluePrint).

3. Development of Open Schooling projects based on OER

The Open Schooling projects that will be developed at schools will be fully based on OER. In addition, all new products, documents, tools and other elements developed during the project duration will be licenced under Creative Commons Licences.

Most specifically, the OSHub.Network will have a dedicated section to "Open Schooling projects". These projects will include the local challenges that are being tackled, together with the OER resources that are being implemented and the respective methodology.

For example, the OSHub-Portugal, together with the school of Figueira de Castelo Rodrigo, is currently investigating the impact of tourism river cruises traffic on the water quality of the Douro River. For that, they partnered with the project Drinkable Rivers³⁹ (CC-BY-NC-SA Creative Commons licence), and have been performing monthly analysis of the Douro river, and evaluating several parameters associated with water quality, such as pH, temperature, level of phosphates, nitrates, E. coli.

The documentation associated with each Open Schooling project will make available all the necessary information so that any school in any point of the globe is able to implement a similar kind of project.

The Open Schooling projects will be part of the OSHub.Network Blueprint.

4. Implementation of training sessions for teachers and school heads on OER resources

As mentioned earlier, the lack of teacher experience, knowledge and confidence regarding digital pedagogic skills and the difficulty in implementing innovative teaching practices integrated with the use of OER are two of the barriers for implementing OER initiatives at school level. As such, this will be part of the continuing professional development program for teachers and school heads.

38 OSHub.Network Library: https://docs.google.com/spreadsheets/d/1zc82uSdLOBcrCoNc_IRSgxov6d1b1H_wMT7__lwCruw/edit?usp=sharing

39 <https://drinkablerivers.org/>

4. CONCLUSION

This document focuses on the state-of-the-art regarding Open Education and OER, including its relevance and challenges for its effective implementation, the policy approaches across the European Union, and a (living) compilation of OER initiatives. In addition, it prepares the ground to devise the strategy on how OSHubs can support schools opening-up education, namely through the use of OER and other open standard resources in school's daily life and institutional culture.

Based on the findings, recommendations and trends exposed throughout this document, the OSHub.Network set four objectives and corresponding actions, which will be developed throughout the time course of the project: assessment of national OER initiatives; creation of the OSHub.Network Library based on open standards; development of Open Schooling projects based on OER; and implementation of training sessions for teachers and school heads on OER resources.

ANNEX 1

Table 1: Overview of the identified policies across the EU MS (from 2017¹⁶)

COUNTRY	NAME OF POLICY	TYPE OF POLICY	SECTOR	LEVEL	STATUS
Croatia	Strategy of Education, Science and Technology	General education policy	All sectors	National	Ongoing
Cyprus	Digital Strategy for Cyprus	Policy for ICT in education	School education	National	Ongoing
Czech Republic	Strategy for Education Policy until 2020	General education policy	School and Adult Ed	National	Ongoing
Estonia	Estonian Lifelong Learning Strategy 2020	General education policy	School and Adult Ed	National	Ongoing
France	FUN MOOC	Specific open education policy	Higher education	National	Ongoing
France	PIX	Policy for ICT in Education	All sectors	National	Ongoing
Germany	Advancement through Education: Open Universities 2011-2020	Specific open education policy	Higher Ed and Adult Ed	National	Ongoing
Germany	OER Info	Specific open education policy	School and Higher Ed	National & Regional	Ongoing
Greece	3rd National Action Plan on Open Government 2016 – 2018	Open Government Action Plan	All sectors	National	Ongoing
Ireland	National Forum for the Advancement of Teaching and Learning in Higher Education	General education policy	Higher Education	National	Ongoing

Italy	National Plan for Digital School	Policy for ICT in Education	School Education	National	Ongoing
Lithuania	Activity Plan for ICT Implementation in General and Vocational Education 2014–2016	Policy for ICT in Education	School Education and VET	National	Closed
Malta	National Lifelong Learning Strategy 2014-2020	General education policy	Post-secondary education	National	Ongoing
Netherlands	HO2025, de waarde(n) van weten – The value of knowing	General education policy	Higher education	National	Ongoing
Poland	OP KED – Operational Programme for Knowledge Education Development	General education policy	All sectors	National	Ongoing
Portugal	Tell us a story	Policy for ICT in Education	School education	National	Ongoing
Romania	National Open Government Plan (Virtual School Library and OER)	Open Government Action Plan	School Education	National	Ongoing
Slovakia	Open Government Partnership Action Plan 2015	Open Government Action Plan	School Education	National	Ongoing
Slovenia	Opening Up Slovenia	Specific open education policy	All sectors	National	Ongoing
Spain	Plan de Cultura Digital en la Escuela	Policy for ICT in Education	School Education	National	Ongoing
UK (England)	Higher Education Funding Council national OER programmes 2009-15	Specific open education policy	Higher Education	Regional	Closed
UK (Scotland)	Open Educational Practices in Scotland (OEPS)	Specific open education policy	Higher Education	Regional	Ongoing





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