OER Innovation Briefing n.6

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An introduction to Open Educational Resources and Innovation

encore+
European Network for Catalysing Open Resources in Education

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Welcome to the sixth ENCORE+ Innovation Briefing!

The purpose of this stakeholder report is to provide an accessible introduction to the innovation potential of Open Educational Resources (OER) in Europe. This report is compiled from a series of briefings aimed at professionals and leaders from higher education and business.

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Table of Contents

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What are Open Educational Resources (OER)?

OER 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” (UNESCO).

This technical description conveys a simple concept: when the resources used are “open” people are empowered because they can do things that copyright would otherwise prevent them from doing. These are sometimes called the ‘5 Rs’ of OER, and can come in different combinations depending on the licence.

Image by BCOER Librarians CC BY 4.0. Taken from https://nsufl.libguides.com/oer/5rs

What do these mean in practice? The right to…

- *Retain* means that the resource can be freely copied, downloaded and stored;
- *Reuse* allows resources to be used in different contexts (classroom; home; online, &c.) in an unaltered format;
- *Revise* conveys that the content can be altered, edited, revised or otherwise changed (e.g. to update or translate a resource);
- *Remix* permits a resource to be combined with other resources to create something new (e.g. an anthology, remix or ‘mash-up’);
- *Redistribute* enables the republishing and sharing of a resource (in original or altered forms).

The most common way to apply an open licence is to use one of those provided by Creative Commons, a non-profit organisation which works with governments and institutions to provide a legal infrastructure and support for open approaches to licensing creative works. (You can read an overview of the CC licences at https://creativecommons.org/licenses/.)

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By adding these freedoms to educational (and training) resources new things become possible. Take the example of textbooks. Textbooks on open licences can be freely shared among learners, so no-one has to go without. But the same textbooks can be updated by the educator, or be rewritten for some new purpose. Of course, an open textbook is just one kind of OER - just as a textbook is only one form of educational resource!

OER have great potential to transform the way that materials for education and training are produce and used:

- Reducing the cost of education
- Making it easier for more people to participate
- Empowering educators and learners
- Encouraging reflection and innovation
- Contributing to sustainability

OER and Copyright

Most OER have one of the following copyright statuses:

- Public domain
- Creative Commons (CC) license
- Free software / open source licence

Open licences present an alternative to traditional copyright, but they do not invalidate copyright. Instead, open licences use existing copyright as a foundation for additional permissions. The copyright system developed alongside the printing press as a way to incentivize and reward artistic and creative production. Rights holders control what can happen with these works (and any derivatives). In most countries copyright is automatically applied to creative works. Only a copyright holder has the legal right to add an open licence to a copyrighted resource. However, the rights holder may not be the same person as a creator since copyright can be bought & sold.

If this system works, why do we need open licensing?

Copyright enables some things, but at the cost of restricting certain freedoms. Openly licensed works are instead free to be shared, improved and built upon! This leads to economic gains through lowered costs of production and consumption for educational and creative works, making these things accessible to more people. But it also

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facilitates experimentation which can drive innovation in teaching, learning and training.

How are OER used?

It's hard to give a definite answer to this as there are so many possibilities - in essence OER have all the affordances of proprietary materials plus whatever is added through their specific licence!

It's really the flexibility of OER that allows them to be used in all types of ways by all kinds of people. OER are widely used online in the form of resources like Wikipedia. They are used in all levels of classroom teaching. They are used in professional training. They are used for art and creativity. Because of their less restrictive licences, OER can be used well beyond their originally intended use.

Common examples of OER include full courses, course materials, modules, textbooks, images, streaming videos, assessments, databases, software, and any other tools, materials, or techniques used to support access to knowledge (such as curricula or lesson plans). Full courses are sometimes organised as 'Massive Open Online Courses' or MOOCs, and it's possible to complete an entire degree using only OER (see https://www.veletsianos.com/2019/02/05/a-list-of-z-degrees-and-zed-creds/ for a list of courses). But this is still just 'the tip of the iceberg'...

What are the benefits of OER?

Openly licensed works lead to economic gains through lowered costs of production and consumption for educational and creative works, making these things accessible to more people. But OER also facilitates experimentation which can drive innovation in teaching, learning and training. There is evidence that OER use can lead to improved educational outcomes while lowering the costs and barriers to entry for learners.

The Open Education Research Hub investigated a range of claims about OER, and found evidence that learners believe that OER use improves their learning performance through factors such as improved enthusiasm for study, confidence and overall interest. They also found strong evidence that OER use and exposure leads to reflection on practice by educators, causing them to incorporate a wider range of content, and to consider different teaching approaches and to reflect upon their role. The accessible

report is available in full from https://oerresearchhub.files.wordpress.com/2014/11/oerrh-evidence-report-2014.pdf.

More generally, the affordances of OER are associated with:

- Cost savings
- More opportunities for translating, adapting or improving works
- Rapid response implementation of new learning materials and perspectives
- Greater creativity and responsiveness in the learning process
- Building communities through collaboration and co-creation
- Enhanced freedom and agency
- Enabling diversity in curriculum and lesson design

Are OER of lesser quality?

In the early days of OER a consistent criticism made was that they could never match the quality of traditional resources. This view has been comprehensively debunked!

A good starting point for understanding this is the following paper, which combined the results of 16 separate studies and found that "students generally achieve the same learning outcomes when OER are utilized and simultaneously save significant amounts of money". You can also watch a video presentation about this research at https://www.youtube.com/watch?v=SX0K0hb_xKE&ab.

"In total 46,149 students have participated in studies relating to the influence of OER on learning outcomes. Only one of the nine studies on OER efficacy showed that the use of OER was connected with lower learning outcomes in more instances than it was with positive outcomes, and even this study showed that the majority of the classes were non-significant differences. Three had results that significantly favored OER, three showed no significant difference and two did not discuss the statistical significance of their results. In synthesizing these nine OER efficacy studies, an emerging finding is that utilizing OER does not appear to decrease student learning."
Hilton, J. (2016) Open educational resources and college textbook choices: a review of research on efficacy and perceptions. *Educational Technology Research and Development* 64, 573–590. https://doi.org/10.1007/s11423-016-9434-9

A useful place to find out more about OER and evidence of their quality and benefits is the *OER Knowledge Cloud* - a repository of OER research with nearly 5,000 contributors. https://www.oerknowledgecloud.org/.

Where can I find OER?

Many open resources can be found online! Some of the major repositories and search engines for OER are listed below. (There are also many dedicated national repositories in languages other than English.)

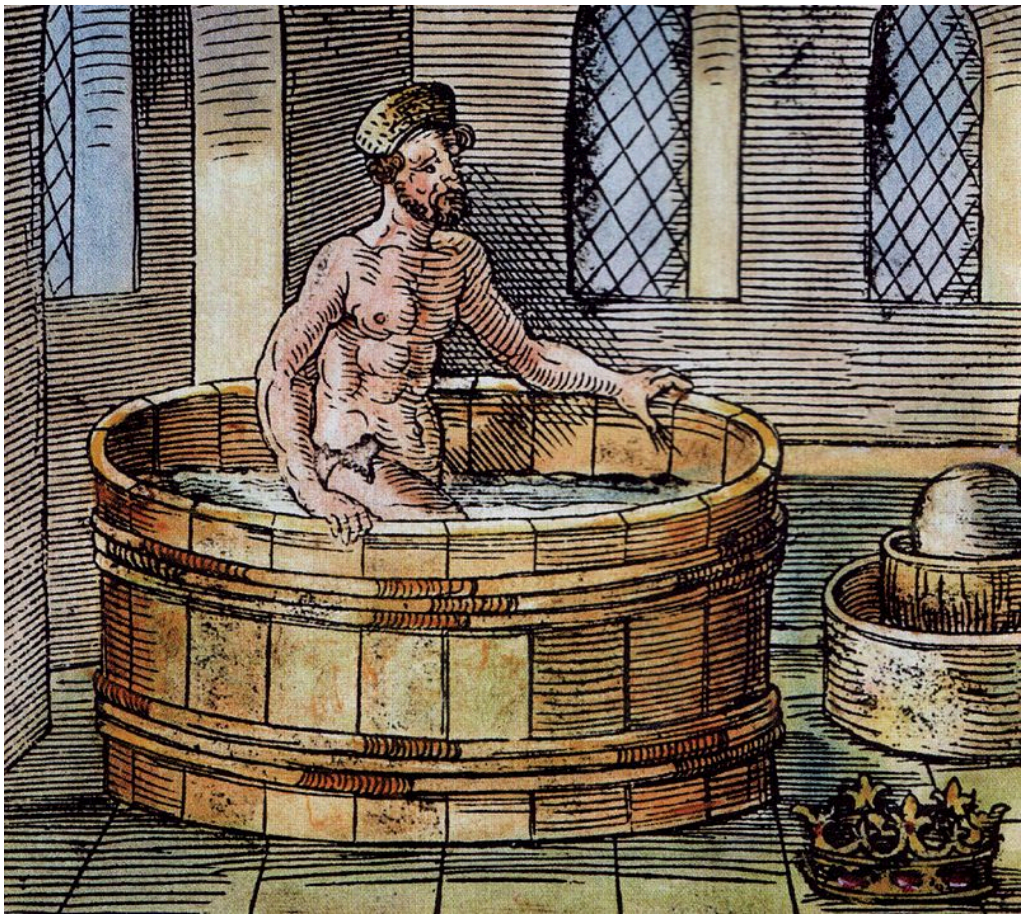
- BC Campus Open Textbook Collection https://open.bccampus.ca/
- Commonwealth of Learning Directory of OER http://doer.col.org
- Creative Commons Search https://search.creativecommons.org/
- Curriki https://www.curriki.org/
- Directory of Open Access Books (DOAB) http://www.doabooks.org/
- FutureLearn https://www.futurelearn.com/
- Houston Community College Libraries https://library.hccs.edu/c.php?g=228229&p=1514373
- iTunesU https://www.open.edu/itunes/
- Libre Texts https://libretexts.org/
- Lumen Learning https://lumenlearning.com/
- Mason OER Metafinder https://mom.gmu.edu/
- MERLOT https://www.merlot.org/merlot/
- MIT Open Courseware https://ocw.mit.edu/
- MOOC List https://www.mooc-list.com/
- NSU OER Search Engines/Repositories List https://libguides.nsu.edu/c.php?g=292834&p=2281470
- OER Africa https://www.oerafrica.org/
- OER Commons https://www.oercommons.org/
- OERu https://oeru.org/
- Open Culture http://www.openculture.com/
- Open Textbook Library https://open.umn.edu/opentextbooks/
- Openly Available Sources Integrated Search (OASIS) https://oasis.geneseo.edu/about.php
- OpenLearn https://www.open.edu/openlearn/
- OpenStax https://openstax.org/
- Saylor Academy https://www.saylor.org/
- Skills Commons https://www.skillscommons.org/

Understanding Innovation

A key focus for this series is the relationship between OER and innovation. People innovate to overcome challenges, as we see in the original introduction of copyright to regulate the reproduction of intellectual property. Open licencing builds on this to provide new opportunities.

How does Innovation happen?

Innovation requires change in perspectives and practices. It's common to think of innovation in terms of the 'Eureka!' moment where an individual has a moment of inspiration or invention. The canonical version of this is the Ancient Greek polymath Archimedes sitting in the bathtub, discovering that the displacement of water can be used to measure the volume of irregular shapes.



Archimedes exclaiming Eureka (Public Domain)

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Eureka indeed! But although Archimedes' idea is now synonymous with the moment of inspiration, innovation doesn't really happen in the thoughts and actions of individuals. This is because innovations require popular awareness and uptake by a user base if they are to become established. A more modern definition of innovation - based on a review of more than 25 years of data - emphasises this.

> *Innovation is production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and the establishment of new management systems. It is both a process and an outcome.*
>
> Crossan, M.M. and Apaydin, M. (2010), A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Literature. Journal of Management Studies, 47: 1154-1191. https://doi.org/10.1111/j.1467-6486.2009.00880.

OER are particularly suited to supporting innovation because they can be more easily adapted to new requirements; lower costs; facilitate the involvement of larger and more diverse groups; shorten feedback loops; and may be brought to relevant markets more quickly and efficiently.

We'll take a look below at some of the main theories of innovation and see how they can apply to the proliferation and use of OER below.

Theorizing Innovation

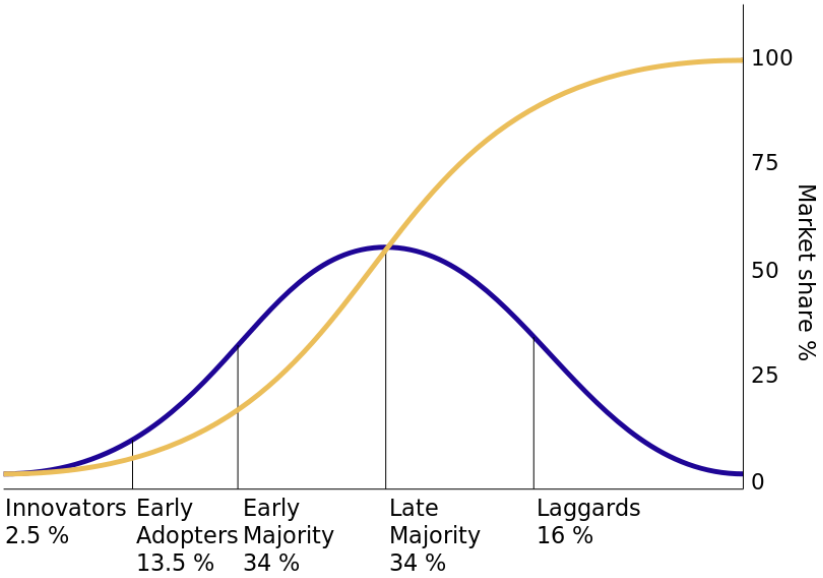
Here we highlight some of the main theories of innovation and their potential relationship to open educational resources (OER).

Diffusion of Innovations

The 'Diffusion of Innovations' (Rogers, E. (2003). *Diffusion of Innovations*. Simon and Schuster) is a long standing theory first published in 1962. It attempts to describe the way that innovations become incorporated into everyday practices and spread through social systems. Rogers emphasizes the importance of human capital, communication channels and social systems for adoption to reach a critical mass of users so that an innovation becomes self-sustaining.

Adopters are characterised by the point at which they enter the process: innovators, early adopters, early majority, late majority, and 'laggards'. Most adopt somewhere

around the middle of the process when a critical mass is reached, but there are those who are earlier or later to get on board. The image below summarises this process. The blue line represents the rate of adoption, while the yellow line represents overall market share. The process is spearheaded by the 'innovators' and 'early adopters' who are the first to embrace an idea and bring it to market.



Rogers (2003). Diffusion of Innovations (Public Domain)

So, what does the adoption of OER into educational markets look like at present? Perhaps the most mature market is found in the USA where many institutions have adopted OER as their main provision. However, OER market share in the USA is still only around 5% (though rising rapidly). In Europe the rate of adoption is lower, indicating even more potential for impact.

For more detail on the USA adoption of OER, see the report by Seaman & Seaman (2020) at https://www.onlinelearningsurvey.com/reports/k-12_whatweteach.pdf.

Task-Artifact Cycle

The Task-Artifact Cycle conceives of an ongoing dynamic relationship between tasks and artifacts that co-evolve and influence each other. The requirements of tasks inspires the development of tools ('artifacts'), while the tools available to us determine the kinds of tasks we can engage with. Thus, new tasks and artifacts contribute iteratively to an ongoing emergence of understanding and possibility.

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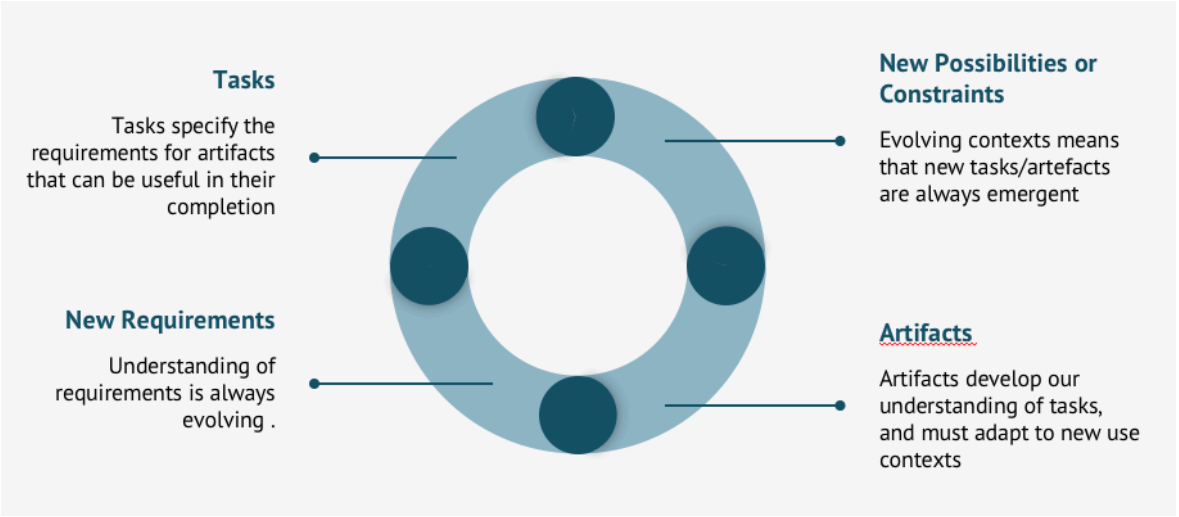

Task-Artifact Cycle (redrawn from Carroll, J. M., Kellogg, W. A., & Rosson, M. B. (1991). The Task-Artifact Cycle. In J. M. Carroll (Ed.), *Designing Interaction: Psychology at the Human-ComputerInterface* (pp. 74–102). New York, NY: Cambridge University Press.)

The context of use for artifacts is always changing, and there is an ongoing process of rethinking and reframing what we need tools to do, and what kind of tasks we can engage with. This model captures the ever evolving nature of work practices, and recognises the many dependencies involved in innovation while offering a useful reduction into a simple set of concepts. This has made it a popular approach to design and software development.

The relevance of this approach to OER is twofold. Firstly, this model articulates the interdependency of tasks and the tools used to address them. The freedoms enabled by OER enable this feedback loop to be shortened dramatically as artifacts can be created and built upon with fewer restrictions. Secondly, an artifact generated in response to a particular task can become part of the Task-Artefact Cycle for a completely unrelated context very easily. This facilitates the spread and adoption of effective tools and approaches.

Substitution, Augmentation, Modification, Redefinition

The SAMR model was formalized by education researcher Ruben Puentedura to explain how technology is incorporated into everyday learning (http://www.hippasus.com/rrpweblog/archives/2014/11/28/SAMRLearningAssessment.pdf). The model proposes a cognitive hierarchy for the uses of new technologies. First comes the enhancement of existing practices, through 'substitution' (using a new tool for an existing task) and 'augmentation' (improving performance with an existing task).

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At the top of the hierarchy are more transformative changes: through significant reform of the task itself ('modification') and the identification/creation of new tasks that are enabled by the innovation ('redefinition').

This progression maps onto the OER experience of many educators and learners. Typically open resources are first substituted in for proprietary resources. Then, as practitioners become more familiar, confident and ambitious with using OER they use it to support experimentation and new practices. The SAMR model also has the benefit of being focused specifically on educational technology.

We can see the relevance of this typology if we apply these categories to an example of OER, such as openly licensed textbooks. Here we observe a potential progression of OER use aligned with varying levels of pedagogical and organisational innovation.

Substitution	Augmentation	Modification	Redefinition
Use Open Textbooks in place of proprietary versions Enhances access, reduces financial dependency on grants and loans	Freely shared and accessible online Digitalization Supports pedagogical innovation and experimentation	Integration into Learning Management Systems Regular updates to material Producing revised/remixed versions of lessons, textbooks and supplementary resources Collaboration across institutions	Rethinking the textbook as the standard organisation of curricula New communities of practice Novel pedagogies (e.g. co-creation)
SAMR Framework applied to Open Textbooks			

As this series (and as ENCORE+ project progresses) we will draw on theories of innovation to develop and share a tool for evaluating instances of innovation with and through OER. We will also be highlighting real-life examples of innovation with OER and raising the profile of successful initiatives.

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State of OER

Open Education Week 2022 at the OE Global Conference included 321 papers in 233 sessions. There were 88 resources listed, of which we present a selection here. Vectors of innovation represented here include linguistic and technical translations; tools for finding and working with OER; open textbooks; and a range of projects contributing in diverse ways to the open education ecosystem.

Resources posted on the OE Week 2022 websites vary widely in format. There are some offerings from international OER reports, numerous information materials on OER itself, some of which are aimed primarily at teachers and creators of OER. To meet the main need for OER or other learning resources, this list unsurprisingly includes numerous textbooks, video materials, and interactive content on specific topics (to name a few: Medicine, Neurology, Mathematics, Machine Learning, Law, etc.) for learners. This group also includes a large number of open textbooks for elementary school students. In these books, the design is tailored to target learners in their interactive approach. Technological innovations revolve around issues of interoperability, multilingualism, interactivity, and discoverability of OER. The cohort offers some reports describing the issues of multilingualism, as well as a number of repositories offering toolkits in numerous formats to facilitate access to interactive content for creators of OER.

This list of resources, projects, and tools indicates the wide range of innovation possibilities that are unlocked with open educational resources and open educational practice. For further inspiration, check out Education For All: Ten Years of Open Education Luminaries from Around the World (https://awards.oeglobal.org/book/) which summarises ten years worth of award winning open education activities.

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Open Educational Resources (OER)

Service / Resource	Description
Adição https://proyectodescartes.org/iCartesiLibri/materiales_didacticos/Livro_A_Soma_br/index.html	This interactive book is aimed at second-year elementary school students. It can also serve as a review for third-year elementary school students.
Alquimétricos LAB - Open STEAM toys https://lab.alquimetricos.cc/	A collection of projects in STEAM education (Science, Technology, Engineering Arts, Mathematics)
CDC Museum Public Health Academy STEM Lessons https://www.cdc.gov/museum/education/lessons/	The CDC Museum Public Health Academy STEM Lessons aim to educate students about public health issues through the integration of science, technology, engineering, and mathematics (STEM).
CREA: El nuevo portal de educación abierta para América Latina de la Fundación Siemens Stiftung https://crea-portaldemedios.siemens-stiftung.org	CREA is the Spanish-language media portal of the Siemens Stiftung International Foundation. In it, teachers will find more than a thousand free and freely accessible resources for teaching STEM subjects.
e·Chinese Tools https://dtieao.uab.cat/txicc/echinese/?lang=en	One thousand and one (openly licensed) tools to learn Chinese
Greek Open Library https://www.openbook.gr/	The (Greek) Open Library was created in 2010 and is a repository of thousands of Greek digital and audio books that are freely and legally distributed on the internet. It includes works of Classical Literature and Ancient Writing that are free of copyright (Public domain), but also modern works that have chosen to be made freely available by their authors or publishing houses. At the same time, it promotes digital literature by publishing innovative e-books with free distribution.
Kit de REA REBIUN https://rebiun.libguides.com/GuiaREA/KitREA	Translation and adaptation of the OER Tookit (University of Ontario) by the Repositories Working Group of REBIUN (Spanish Network of University Libraries)
Módulo de Sensibilización medioambiental https://sites.google.com/view/	This environmental awareness module aims to respond to the need to address the environmental problems promoted by Public Administrations both at a state, European and

grupo1sensibilizacionambiental/p%C3%A1gina-principal	global level, improving the environmental awareness of the population, as well as the acquisition of habits and good practices in the workplace and personally.
Global Citizenship https://sites.google.com/view/understandgc/home	Three modules of learning where the different dimensions of global citizenship, human rights, and gender equity are addressed. This course content is offered under a CC Attribution Non-Commercial Share Alike license.
Open Risk Academy course: "An introduction to Environmentally Extended Input-Output Economic Models using Python" https://github.com/open-risk/Academy-Course-SFI32064	Supporting material for the Open Risk Academy course: An introduction to Input-Output Economic Models using Python
Salón de clase, Intermediate Spanish for Education Professionals https://salondeclase.sites.uiowa.edu/	Salón de clase, Intermediate Spanish for Education Professionals is a comprehensive intermediate Spanish open access textbook with reading, listening, speaking, and writing practice for students who have an interest and/or intend to pursue a career in the field of education
Video Series: Exploring the Medieval Manuscript Book https://www.europeana.eu/en/blog/video-series-exploring-the-medieval-manuscript-book	Unique artefacts in the reading room of the Leiden University Library are given life through interactivity
Wiki Resources related to outreach in poorly connected areas of the world - English, French, Spanish https://meta.wikimedia.org/wiki/WikiAfrica_Offline_Resources/en	These pages serve as a central repository for documents and material related to outreach in poorly connected areas of the world. Those resources are made available on wikifundi, the offline solution to edit Wikipedia articles without a reliable internet connection.

Finding and Working with OER

Service / Resource	Description
Alan's Box of Image Search Tricks https://connect.oeglobal.org/t/alans-box-of-image-search-tricks/3540	Alan Levine's insider guide to finding openly licensed images.
Commons In A Box OpenLab https://cboxopenlab.org/	Commons In A Box OpenLab (CBOX OpenLab) is free, open source software that enables anyone to launch a commons for open learning. It was created in partnership with Commons In A Box (CBOX) and is modeled on The OpenLab at City Tech, an open digital platform for teaching, learning, and collaboration originally built by and for New York City College of Technology, CUNY.
Curationist https://www.curationist.org/	MHz Curationist is an ecosystem for collecting and sharing cultural materials from the Creative Commons and public domain.
Exploring reuse of audiovisual content for education https://pro.europeana.eu/post/exploring-reuse-of-audiovisual-content-for-education	The Europeana Task Force on Audiovisual Material in Europeana Classroom developed a case study on Copyright in Education to help teachers across the EU use audiovisual content lawfully and safely.
H5P Kitchen http://kitchen.opened.ca/	This is the hub for projects awarded BCCampus H5P OER Development Grants. These projects are augmenting open textbooks with open-licensed interactive learning activities authored in H5P.
Inclusivity, collaboration and student co-creation: Open textbook production models for social justice https://docs.google.com/presentation/d/1_dSl8md517hWdmJuK9fZzB_RqBisJxdsk-WUaY9jhug/edit?usp=sharing	Slides and recordings from a conversation event focused on the relation between open textbooks and social justice.
L'Open Education, quelques clés pour s'en emparer https://uclouvain.be/fr/etudier/lll/cahier-open-education.html	This notebook is intended to be a guide to accompany you in Open Education. It opens the doors to certain notions such as Massive Open Online Courses (MOOCs), Open Educational Resources (OER), OpenCourseWare (OCW) or even Creative Commons (CC) licences.

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LOERA (Learning OER Anytime) https://michaellporter.me/learning_OER	LOERA is a series of self-paced, interactive, on-demand, responsive learning modules. LOERA contains 15 learning modules that can be used to provide a structured learning path to the introduction of Open Education Resources (OER,) as well as an opportunity for additional exploration and discovery of OER.
Madison College Open Educational Resources Guide https://libguides.madisoncollege.edu/OER	An overview and introduction for those new to OER
Metadata Learning & Unlearning (Medium Publication for OpenGLAM OER) https://medium.com/metadata-learning-unlearning	This series raises questions and makes proposals for what metadata can do to advance a broader dialogue about diverse worldviews within open education and openGLAM realms (GLAM = Galleries, Libraries, Archives & Museums)
MoodleNet https://moodle.net/	Find, share and curate open educational resources
Open Content Toolkit https://paper.dropbox.com/doc/WELCOME--Bbz343~XTvh51cBDT1A1farRAQ-qjldBSZoWBnvyx3E7GQtE	The Open Content Toolkit provides links to millions of items of contemporary and historical open-content items from around the world. Open content offers enormous benefits for education. Students and teachers can use open media archives and web portals to find resources for their work, safely, creatively, without fear of infringing copyright.
Open Education Benefits: an ENOEL Toolkit https://zenodo.org/record/5906818	A set of tools (slides, leaflets, and Twitter cards) prepared by the European Network of Open Education Librarians (ENOEL). The toolkit aims to help raise awareness of the importance of Open Education, and describe benefits for students, teachers, institutions, and society.
Texas Learn OER https://sites.google.com/austincc.edu/texaslearnoer/module-1-introduction-to-this-course	Texas Learn OER serves as an introduction to open educational resources (OER) and as an opportunity for further exploration and discovery of open education practices.
Wikilivre : Ressources pédagogiques relatives au droit d'auteur https://fr.wikibooks.org/wiki/Ressources_p%C3%A9dagogiques_relatives_au_droit_d%27auteur	This wikibook offers a set of resources intended for teaching staff in order to raise awareness of the notions of intellectual work, copyright, Creative Commons Licenses and good attribution practices when reusing works produced by others. It comes in the form of 3 modules, of increasing difficulty, the first module being more intended for children

	aged 9-13 while the following modules are more intended for an 11-14 year old class.

Reports

Service / Resource	Description
Advancing an Ecosystem for Open Educational Resources OER in Texas Higher Education Biennial Report 2021 https://reportcenter.highered.texas.gov/reports/reports-and-studies-non-fiscal/advancing-an-ecosystem-for-open-educational-resources-oer-in-texas-higher-education-2021/	This report presents the results of a biennial independent survey commissioned by the Digital Higher Education Consortium of Texas (DigiTex), in collaboration with the Texas Higher Education Coordinating Board (THECB), to examine the landscape of Open Educational Resources (OER) programs, policies, and practices at higher education institutions in Texas.
Transformation numérique : plan stratégique pour un déploiement de l'Open Education, l'Open Science et la formation à distance https://hdl.handle.net/20.500.12279/819	After a first Digital Strategic Plan, rolled out from 2015 to 2020, UCLouvain is adopting a new digital transformation project in 2021 on the horizon of the institution's 600th anniversary. It contributes to the implementation of objectives of openness (Open Science, Open Education, international dynamics via Circle U.) and innovation (transformation of the educational environment).

Projects and Initiatives

Service / Resource	Description
Beyond the Screen! https://www.hoou.de/projects/beyond-the-screen/preview	Hamburg Open Online University (HOOU) education platform which brings eight universities together to provide open learning which facilitates educational transitions and enables learners to follow their individual learning path.
Commonwealth Digital Education Leadership Training in Action (C-DELTA) https://cdeltaousl.wordpress.com/	Commonwealth Digital Education Leadership Training in Action (C-DELTA) is a programme of the Commonwealth of Learning (COL) to promote digital education environments in Commonwealth nations by assessing digital education competencies, developing learning materials around digital education skills, providing training opportunities for teachers, and monitoring student achievement and its relationship to

	livelihood.
DigiCulture Courses online https://digiculture.eu/en/courses/	This project aims to create a sustainable and efficient education program dedicated to adult learners with low digital skills and low-qualified adults involved in the creative industries sector from Romania, Italy, Austria, Denmark, Lithuania, UK and Ireland.
Frontiers for Young Minds: kids' science journal https://kids.frontiersin.org/about/journal/	Frontiers for Young Minds provides a collection of freely available scientific articles by distinguished scientists that are shaped for younger audiences by the input of their own young peers.
GO-GN Collega mentoring program https://go-gn.net/gogn/go-gn-collega-program/	A project from the Global OER Graduate Network, GO-GN Collega was established to address the recommendations above by pairing experts in OE from the Global North and South as mentors and mentees.
Guida Italiana all'Open Education - Italian guide to Open Education https://educazioneaperta.eu/openeducation_unaguida/	Open Education Italia is a community of experts, teachers and other stakeholders aimed at promoting Open Education in Italy
How to set up a Subtitle-a-thon - a guide for educators https://pro.europeana.eu/post/engaging-students-with-audiovisual-heritage-through-subtitle-a-thons	A Subtitle-a-thon is a crowdsourcing initiative which invites the public to create and add subtitles to archival audiovisual clips from European heritage collections available on the Europeana website.
LibreTexts https://libretexts.org/	The LibreTexts mission is to unite students, faculty and scholars in a cooperative effort to develop an easy-to-use online platform for the construction, customization, and dissemination of open educational resources (OER) to reduce the burdens of unreasonable textbook costs to our students and society.
Open Education Champions https://openscholarchampi	SPARC shares information about influential European academics and information professionals invested in

ons.eu/openeducation	the mission of open education.
OER & CC Training Arena https://oerarena.open.uaf.edu/about/	The OER & CC Training Arena is a virtual space where CC & OER Superhero faculty can learn more about topics to help in the fight for open education to ultimately banish high-cost materials from higher education.
School Counsel(l)ors From Across The World https://www.oercommons.org/groups/school-counsel-l-ors-from-across-the-world/5177/	This is a space and a place for School Counsel(l)ors, School Counsel(l)or Educators, School Counselling interns and School Counsel(l)ing students to create and share A global School Counsel(l)or hub and network.

Open Textbooks

Service / Resource	Description
Decolonization and Justice: An Introductory Overview https://opentextbooks.uregina.ca/decolonizingjustice/	'Decolonization and Justice: An Introductory Overview' emerged from the undergraduate students' final assignment in JS-419 on Advanced Seminar in Criminal Justice at the University of Regina's Department of Justice Studies, Canada.
Designing Quality Tech-Enabled Learning Experiences https://ecampusontario.pressbooks.pub/creatingqualityteleexperiencesselfstudy/	Collaboration between Lakehead University and Nipissing University designed to facilitate the development of any person who seeks to create quality, technology-enhanced (digital) learner experiences.
Digital learning in the pandemic - cultural heritage resources by and for educators https://pro.europeana.eu/post/digital-learning-in-the-pandemic-cultural-heritage-resources-by-and-for-educators	This handbook from Europeana Education and European Schoolnet showcases best practices and examples of digital learning during the pandemic. It provides a resource to help educators throughout Europe find innovative, ready-to-use educational material.

Global Femicide Subtitle: Indigenous Women and Girls Torn from Our Midst (2nd Ed.) https://opentextbooks.uregina.ca/femicide/	This book underscores the common, interlocking effects of racism and sexism on Indigenous women. Family members, scholars and researchers, artists, activists and policy-makers provide their decade-long perspectives, providing testimony and evidence that sexualized and racialized violence is not only a product of historic colonization but continues to manifest in entrenched systems of colonization and global femicide.
Liberated Learners: How to Learn With Style https://ecampusontario.pressbooks.pub/learner/	Following in the footsteps of the Ontario Extend: Empowered Educator program is its predecessor, Ontario Extend: Liberated Learners. The original program worked to prepare educators to be better able to teach in a digital realm. The Liberated Learner seeks to do the same for the learners themselves.
Open Neuroscience Initiative https://www.austinlim.com/download	The Open Neuroscience Initiative is a free-to-use textbook by August Lim.
Real-World Applications for Analytics Teaching and Learning https://doi.org/10.13023/msc.textbook.01	This document provides learning-by-doing materials for Analytics software skill development using SAS JMP. It integrates Analytics concepts and techniques with real-world scenarios based on the COVID-19 pandemic to illustrate how real-world data can be transformed into actionable insights to offer decision support for COVID-19 related issues.

OER in Europe

What does the European use of OER look like?

There are perhaps a surprisingly high number of European projects focused on OER. The image below - taken from the OER World Map (see below) - shows clusters of OER initiatives and projects that are taking place right now. These are a mix of more than 6,000 higher education institutions, companies, repositories, government agencies, services, events and individuals represented.

European entries on the OER World Map

How does Europe compare to other regions?

Open Educational Resources are a phenomenon all over the world! Perhaps the most mature markets are in countries like the USA where OER has approximately 5% share of the provision for primary and secondary education (https://www.bayviewanalytics.com/reports/k-12_whatweteach.pdf). OER has saved learners vastly more than $1 billion (https://sparcopen.org/news/2018/1-billion-in-savings-through-open-educational-resources/).

This scale of innovation and efficiency has been made possible through coordination of effort across state and national boundaries. There is massive potential in Europe to harmonise the use and development of OER at scale, and this would benefit a wide range of stakeholders.

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The OER World Map

You can review what's happening in your locale or anywhere else via the OER World Map. The OER World Map facilitates the exchange of data, experiences and ideas between different people and communities with an interest in open education. It's a place where you can share your perspective and see what the OER landscape as a whole looks like. Learn more, join the community and explore the map at https://oerworldmap.org/.

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Technologies Supporting Open Education

We begin this issue of the Innovation Briefing with an overview of tools & technologies commonly used in the production and use of open educational resources (OER). (For more background on OER and innovation, see Innovation Briefing 1.)

Our goal here is not to provide an exhaustive account but rather to reflect the range, diversity and sophistication of offerings. This section is organised into the following categories: search & discovery; repositories; creation & remix; teaching & learning. This corresponds to the stages of a typical journey into OER from discovery to application of the concept.

Search & Discovery

The process often begins with finding OER that is suitable for the learning or teaching task at hand. Traditional web searches are often used for this but there are also dedicated search engines and online collections which add functionality like searching by licence.

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CC Search

Provided by Creative Commons, CC Search indexes more than 300 million images across multiple repositories into a single catalogue, searchable by licence. https://search.creativecommons.org/

Google Search

Google search remains a common way to find a range of open resources, though it is not possible to specifically search only OER. (Images can be filtered by licence, however.) Finding relevant materials can be made more efficient through Boolean searches.

Mason OER Metafinder

Based at George Mason University in Virginia, USA, the OER Metafinder offers a simultaneous, real time search across 22 databases of OER content. https://mom.gmu.edu/

OASIS

Openly Available Sources Integrated Search (OASIS) indexes open content from 114 different sources and contains 440,269 records. https://oasis.geneseo.edu/index.php

OER Commons

OER Commons was created by ISKME to provide links between content providers and users of OER. Their advanced search engine for OER allows resources to to be searched and filtered by subject area, use context, media types, accessibility options and licence (among others). https://www.oercommons.org/advanced-search

OERSI

The Open Educational Resources Search Index (OERSI) indexes more than 30,000 resources and supports filtering by subject, types, licence, author, language, organisation and provider. https://oersi.de/resources/

OER World Map

The OER World Map is a socio-technical network that records information about the world of open education, including repositories and OER themselves alongside persons, projects, organisations, tools and services. OER can be filtered by language, educational level, licence, country and region. https://oerworldmap.org/

Repositories

Another route to obtaining relevant OER is to access one of the many dedicated repositories which also act as places to share back materials that have been developed so that others can benefit. Popular repositories of audiovisual content often act as unofficial repositories of OER, including YouTube, Flickr and Slideshare. However, they typically lack advanced features that support OER creation, remixing and reuse. In Europe and elsewhere, many higher education institutions also host their own repositories of open access content. We focus here on more general services.

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Directory of OER Repositories (DOER)

Provided by the Commonwealth of Learning, the Directory of Open Educational Resources (DOER) comprises more than 7,000 OER collections organized into communities for higher education, open schooling, teacher education and technical skills development. http://doer.col.org/

Edinburgh OER

Provided by the University of Edinburgh, this repository draws together open outputs from across the different faculties and was recognized with an Open Education Global award this year. https://open.ed.ac.uk/

Khan Academy

Khan Academy offers a range of learning activities and instructional videos organised by a personalized dashboard. Materials are offered in 36 languages and there are also dedicated resources for educators wishing to use the materials.
https://www.khanacademy.org/

MERLOT

MERLOT (Multimedia Education Resource for Learning and Teaching) provides almost 100,000 learning resources and is supported by a community of more than 188,000 across more than 4,00 institutions. Resources are organised by categories including assignments, courses, presentations, textbooks, tutorials and audiovisual assets.
http://www.merlot.org/merlot/index.htm

MIT OpenCourseWare

One of the first providers of an OER repository, MIT OpenCourseWare (OCW) was founded on the idea that educational opportunity should be extended to all. Millions have taken OCW courses or accessed their content, with visits doubling during the COVID-19 pandemic. https://ocw.mit.edu/index.htm

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National Digital Science Library

Based in the USA, the NDSL provides a range of OER with a focus on sciences, technology, engineering, and mathematics (STEM) disciplines. While the library is open access, not all materials indexed are openly licenced. https://nsdl.oercommons.org/

OER Knowledge Cloud

OER Knowledge Cloud is a collection of research into OER which aggregates materials from almost 5,000 authors to make research more accessible and remove barriers to knowledge. https://oerknowledgecloud.org/

Open Textbook Library

A wide range of subjects are included in this library of textbooks that are free to use and distribute, and are licensed to be freely adapted or changed with proper attribution. A record of the metadata about the contents of the library can be downloaded as a CSV file. https://open.umn.edu/opentextbooks/

OpenStax

OpenStax provides high-quality, peer-reviewed, openly licenced college textbooks that are free online and can also be printed at low cost. Established in 2012, their 42 textbooks are being used by 60% of college and universities in the U.S.A. and over 100 countries. Their offer is supported by low-cost online course ware including assessment and feedback systems. https://openstax.org/

Plataforma Integrada do MEC

Since 2015 the MEC platform has consolidated open resources from Brazil. The initiative was developed by the Federal University of Paraná (UFPR), Federal University of Santa Catarina (UFSC) and contributed to by educators from all over Brazil. https://plataformaintegrada.mec.gov.br/

SUNY Digital Repository (SDR)

Centrally managed by the State University of New York, SDR brings together thousands of OER in collections from almost 50 campuses and community colleges using the Dspace infrastructure.. https://dspace.sunyconnect.suny.edu/

WOU Weko Repository

Provided by Wawasan Open University in Malaysia, the Weko repository contains OER as well as metadata about learning objects and other media. https://weko.wou.edu.my/

Creation & Remix

Creating and modifying OER is where the magic happens! Some of these tools have other (or general) uses and some are designed specifically for working with OER.

CC Chooser

helps people choose the right Creative Commons license for their worK
https://chooser-beta.creativecommons.org/

Gitbook

Gitbook is an open source program which allows books to be created and shared on GitHub https://www.gitbook.com/

Google Docs

Google offers several free services which can be used to collaboratively create and share materials, including Google Drive, Docs, Sheets & Slides.

Jupyter Notebook

Jupyter Notebook is a web-based interactive platform that supports using live code, equations, visualizations and narrative text in documents. https://jupyter.org/

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Libre Office

Libre Office offers a full suite of free and open-source office productivity software including programs for word processing, spreadsheet calculation, database creation, writing and delivering presentations and creating diagrams and visual aids. https://www.libreoffice.org/

Open Author

Provided by OER Commons, the Open Author tool combines an intuitive visual editor to design resources that differentiate the teacher and student facing parts of an OER. Integration with Google drive and accessibility features are also offered. https://www.oercommons.org/authoring-overview

Pressbooks

Pressbooks is a platform that supports open publishing by emphasizing accessibility, customisation, interoperability and open values. Their publishing platform supports downloading OER in different formats, social annotations, assessments and embedded multimedia. More than 2,000 books can be searched in their directory and there are services for LMS integration. https://pressbooks.com/

Tutory

Tutory supports the creation of lesson plans and worksheets by remixing openly licensed content. https://www.tutory.de/funktionen

WikiEducator

WikiEducator is a community based tool for planning educational projects linked with the development of free and open content. https://wikieducator.org/

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Teaching and Learning

Learning management systems (LMS) bring together different digital tools into a single environment, but this is just one example of how technologies support open pedagogy.

Canvas

Produced by Instructure, Canvas is a leading LMS with more than 30 million global users. You can read case studies of Canvas implementation at https://www.instructure.com/canvas/resources/case-studies.

FLOE

FLOE (Flexible Learning for Open Education) supports the individualisation and personalisation of learning by leveraging the affordances of OER. This enables inclusive learning design and improved accessibility. https://floeproject.org/

Moodle

Moodle is a free and open-source learning management system first released in 2002. Moodle supports a range of learning scenarios incorporating distance and blended learning. It has been widely employed across education and the workplace, and is designed to support collaborative learning activities. Moodle is attractive to many because it provides a set of professional services without licence fees. Many features of elearning systems were first developed through Moodle, and hundreds of available plugins now extend the features of Moodle's core functionality. Moodle is often run and managed by educational institutions but can also be run on an enterprise basis. Partnering with specialists to run the installation can support optimisation and service provision, allowing educators to focus on pedagogy. https://moodle.org/

Mahara

Mahara ePortfolio system is an open source, learner centred learning management system that can be integrated into other systems. https://mahara.org/

Saylor Academy

A non-profit established in 2008, Saylor offers around 100 full college and professional level courses for flexible self-study. They offer certification and college credit opportunities. https://www.saylor.org/

SPLOT

SPLOT (or) was designed to simplify open web authoring while respecting student privacy and autonomy. SPLOT acts as an interface for Wordpress to make dedicated online learning tools. The code can be accessed at https://github.com/cogdog/splotbox and a showcase of possibilities at https://splot.ca/.

In addition to these specialised tools and technologies, there are many other software programs released on open source licences which are used extensively in education.

H5P: Interactive OER

H5P stands for 'HTML5 Package' and has been developed by Joubel to facilitate the production and use of interactive OER. The key concept for H5P is that authors should be enabled to create interactive learning content without having to learn how to code or write scripts. H5P comprises a web based content editor; a site for sharing content; plugins for content management / learning management systems; and a protocol for bundling HTML5 resources.

Much of the interactive OER that exists can be found in centralised repositories. These often don't allow users to edit the content, which is designed to be reused and shared in specific contexts - such as to accompany an open textbook or open course. H5P uses a decentralised approach based around a network of websites which facilitate reuse, sharing and interaction. This decentralisation provides enhanced possibilities for content customisation and design. Security and privacy are also enhanced since installations are self hosted and not reliant on a third party provider. Yet collaboration is enabled at a global level through the sharing of HTML based content, technologies and OER. H5P is already being used on 200,000 websites reaching over 200 million users.

H5P's approach confers several advantages. Modernisation of workflow improves efficiency and facilitates pedagogical innovation. Improving the interactivity of OER content enables educators and content creators to design learning experiences rather than just resources for learning. The application interface is designed to be user-friendly for those without programming experience and supports many types of interactivity including interactive video, quizzes, presentations, games, virtual tours and narrative experiences. Some of the diverse activities enabled by H5P can be explored in this periodic table of content types. Learners can be provided with instant feedback and support.

Joubel also offer hosting services for those who don't want to maintain their own website or hosting solution through H5P.com. This allows technical management to be performed offsite so that OER creators and users can focus on teaching and learning. Using H5P in this way still supports LMS integration and learning analytics.

The forthcoming H5P Content Hub will provide a library of free and open content which is searchable and ready to be repurposed.

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Useful H5P links:

- Test the H5P authoring tool https://h5p.org/testdrive-h5p
- Finding H5P examples https://kitchen.opened.ca/2020/10/22/how-to-scout/
- New on H5P https://h5p.org/oer-hub-coming
- Developer Guide https://h5p.org/developers#new-plugin
- H5P Roadmap https://h5p.org/roadmap

Innovative OER Projects

Here we highlight current or recent projects of interest from the perspective of innovation and OER. If you have a project you'd like to share in a future edition, get in touch using the contact details on the final page.

North Rhine-Westphalia's Open Pivot

During the Corona crisis, the universities in North Rhine-Westphalia set up an online summer semester with a comprehensive range of digital courses in a very short time. In order to support the universities in this, the Ministry of Culture and Science is funding together with the Digital University of North Rhine-Westphalia (DH.NRW) in the funding line "OERContent.nrw" (Open Education Resources) 18 concepts for digital teaching and learning formats with a total of €10.5 million euros.
https://www.dh.nrw/kooperationen/OER-Content.nrw-42

DIGITASK4IC

Like ENCORE+, DIGITASK4IC is an Erasmus+ funded project. They have developed a free/open web app for pedagogical task design that transforms openly licensed OERs into task materials by design. The beta version of the app can be accessed at https://www.digitask.app/open. The project is a collaboration between Hacettepe University, Turkey; University of Innsbruck, Germany; Universitat Autònoma de Barcelona, Spain; and Muğla Sıtkı Koçman University, Turkey. https://digitask4ic.com/

Institute for the Future of Education (IFE): Observatory

Provided by Tecnológico de Monterrey (Mexico), the IFE observatory has been providing OER since 2014 alongside news updates, in-depth reports, interviews, webinars and podcasts about open education. The Observatory has many hundreds of thousands of subscribers and was recognized this year with an Open Education Global award for excellence. https://observatory.tec.mx/

OpenLearn

Another winner at the Open Education Global awards this year, OpenLearn was highlighted for its response to the Covid-19 pandemic. OpenLearn is a free repository of OER provided by The Open University in the UK. Established in 2006, it has provided more than 95 million visitors with access to open learning content.
https://www.open.ac.uk/about/open-educational-resources/openlearn

Open for Anti-Racism (OFAR)

A programme co-led by the Community College Consortium for OER (CCCOER) and College of the Canyons (California, USA) which just received additional funding through to 2023, OFAR demonstrates how faculty can use Open Educational Resources and open pedagogy to make instructional materials and their teaching more anti-racist.
https://www.cccoer.org/ofar/

OpenLang Network

Another example of an Erasmus+ project supporting OER, OpenLang addresses language competences across Europe - still a significant barrier to participation in education and employment. The Network brings together educators and learners in higher education and beyond with volunteer language teachers who receive specialised training on the creation, sharing and use of language OER.
https://www.openlangnet.eu/

ConvOERter

A new tool named convOERter aims to facilitate the production of OER from other online resources. The prototype tool works with Microsoft Word documents and Microsoft PowerPoint presentations, replacing non-OER images with open equivalents taken from image portals like Flickr and CC Image Search. Metadata and licence information are also retrieved and integrated into the new product when it is published. This functionality is complemented by web analytics which can be used to reconstruct and build on the operation. (Ali & Shroeder, 2021).

Open Game

The OPEN GAME project (Promoting Open Education through Gamification) aims to contribute to the popularisation and uptake of OER in higher education through situated learning experiences. The project has already produced a Handbook of Successful Teaching Practices and a toolkit for applying the 'open game' approach in other contexts. You can play the game (and learn more about OER) at https://opengame-project.eu/game/.

ENCORE+ Thematic Focus

This section presents some innovation aspects arising from different areas of focus within ENCORE+.

Quality

A list of approaches is also being collected within the ENCORE+ consortia to map different approaches to quality. The Quality Working Group, with the intention of exploring and later creating a quality framework for OER, invited 8 representatives of different quality approaches to join a working group.

As the position paper (link) published prior to the second Quality Circle event states, "Quality for OER or respectively quality for open education is viewed as the single most important factor determining the uptake of OER in institutions and training contexts."

Analysing Quality Metrics for OER Repositories

The aim of this part of the work, carried out in the framework of the ENCORE + project, is not to compare different quality approaches, but to describe quality concepts in order to make transparent how quality is ensured in the different European OER repositories. Since the OER quality framework needs to be able to describe the large number and diversity of quality concepts in the European OER repositories, it is necessary to move from a "one size fits all" approach to a community-oriented and community-developed model. During the lifetime of the ENCORE + project, a community will be built to jointly develop a quality framework for European OER repositories that can continue to grow and adapt after the project through a functioning and continuous community. To this end, experts from across Europe have been brought together to work on the quality framework in thematic peer groups that meet in peer workshops.

In Table 1 you can find all 8 different quality approaches and some of the innovative aspects in the quality approaches identified:

Name	Description	Quality approach	Innovation
Future Learn https://www.futurelearn.com	Earn CV-ready certificates, learn at your own pace and get long-term access to thousands of high-quality short courses.	● Mission driven and fit-for-purpose ● Institutions are central to QA processes ● Contextual in choosing appropriate QA approaches ● Owned, shared, and distributed across the institution ● Is representative of all stakeholders, especially students ● Intentional and integrated into mainstream QA processes ● Conversational, shares experiences and involves feedback loops ● Evidence driven, transparent, action-focused, and impactful ● Dynamic as part of a living and thriving quality culture	For some courses, users are peer-reviewers.
TU Graz OER Repository https://telucation.tugraz.at/en/oer-tc-en/	Open Educational Resources in the TU Graz TeachCenter & beyond	Content quality insurance through qualification: A process to qualify TU Graz teachers to authorise OER plug-in activation and to publish OER is established.	Required metadata is assessed by AI.
WLO https://wirlernenonline.de/	WirLernenOnline is both a search engine and a community for free educational materials (OER)	● Editorial statute ● Transparency page on ● quality process & criteria ● Overview on source ● Development ● Implementation of quality criteria in ● metadata and test machine vs. editorial ● curation	Human and computer oversight on quality. Part of the quality evaluation is done by AI.

DABAR https://dabar.srce.hr/en	Digital academic archives and repositories	Collaboratively authoring, managing, discovering, and stewarding digital collections across data types and knowledge domains. Quality is ensured also through author validation (only content from official national education institutions and repositories)	Working groups assess different quality aspects based on different content of the material.
ORCA https://www.orca.nrw/	ORCA is a free online portal for digitally supported teaching and learning at universities.	There is a sub-project (QualOER) which aims to develop a quality assurance concept for the OER content on this state-wide platform.	Find out more about QualOER at https://imt.uni-paderborn.de/en/projects/qualoer.
HOOU https://www.hoou.de/	The HOOU sees access to high-quality and open academic education as an elementary building block for a free, democratic and diversity-sensitive society.	Faculty developed OER's and offering of training, which includes the application of explicitly defined quality criteria on created OER.	Peer-support quality approach: authors of OER receive training for creating OER.
ZOERR https://www.oerbw.de/	The central OER repository of the universities in Baden-Württemberg	Implement quality assurance measures before production begins. After publication: a checklist for proper licensing, metadata, technical review, and didactic design is implemented. No quality standard for content. Provenance control instead.	Identification of authors and validation through their affiliation to a higher education institution.
Twillo https://www.twillo.de/oer/web/	Transform your teaching-learning units into OER even easier with our templates and guides.	Twillo Quality Promotion Instrument • OER Quality Check • Peer review process • Community assessment • Automated quality assurance	The self-check instrument which is available for the OER creators.

Table 1. Quality Processes used by OER Repositories

Outcomes of the 2nd Thematic ENCORE+ Peer Group Workshop

Five points became clear during the analysis of the good practices in the ENCORE+ workshop.

- Users have a high expectation regarding quality assurance of OER repositories.
- Users take increasingly important roles in quality.
- From peer review to peer support.
- A future European OER repository Ecosystem is demanding for greater transparency of underlying quality philosophies and practices in order to enable trust from users' perspectives.
- A "quality passport" as a transparency tool can help to make quality practices in OER repositories understandable and visible to users and stakeholders.

The piloting of the Quality Transparency Framework is planned from October 2022 until March 2023. At least six repositories will be invited to test the first version. Subsequently, a refined version will be released with a set of recommendations for further developing it.

Foresight on the European OER Ecosystem 2030

The ENCORE+ report, Foresight on the European OER Ecosystem 2030, is based on the results of a Delphi study conducted with European expert stakeholders. You can access the report directly for the full picture, but here are some brief highlights:

- There was broad agreement with the proposition that “the majority of higher education institutions and the corporate sector of education and training will have adopted policies which include regulations on OER repositories”
- Experts expressed support for the idea that in the future OER repositories will serve as community hubs facilitating collaboration around quality development, development of 'open educator skills' and exchange training and learning experiences
- A majority anticipate that “OER uptake in Europe will be strongly led on by a start-up scene which will provide companies with OER-related services”

Technology

Reviewing success drivers for OER repositories

Here we compare the highlights of the selected cohorts of resources published at OE Global Week 2022 and the list of repositories examined from a quality perspective with the results of the literature review to examine the requirements of users, creators, and developers of OER from a technological perspective.

In order to contribute to the design of the next generation of Learning Objects Repositories (LOR), it is undoubtedly necessary to analyze what has happened in recent years with LOR, with the user experience in LOR and with the impact of this type of tools on the educational landscape. An in-depth analysis of the current state of the art can provide us with valuable information to design new strategies that meet users'

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needs and develop a new ecosystem compatible with the fourth industrial revolution (4.0). Such an analysis was performed in ENCORE+ by selecting 20 scientific papers from the Web of Science repository published in relevant journals.

Figure 1. Word cloud in the selected literature

The analysis of scientific papers published between 2016 and 2021 provides a good overview of the most frequently cited topics related to success criteria for OER repositories. Among the most frequently cited topics, interoperability and the quality of the content and technical solution top the list. The paper, titled Why Open Educational Resources Repositories Fail, notes that “lack of quality seems to be a critical barrier in LOR use and high quality content has been identified as a key characteristic of a successful LORs." According to the same paper, from the users' perspective, LOR must address the following quality aspects: LOR must contain high quality OER, LOR must be technically state-of-the-art, working and easy to use, LOR must contain a critical mass of OER. From the developers' point of view, it should act as a test lab or showcase, it should change the didactic culture in the community of teachers and allow active participation of users.

The quality and innovation of the technical solutions are related to the success criteria found in the literature review: Ease of use, ease of access, and a user-friendly interface. If users do not have a satisfactory experience, the availability of OER will add limited value. On the one hand, some users may have limited practical search skills; on the other hand, search engines sometimes provide very limited options: OER is difficult to find, metadata is manually selected, relevance of the resource does not always meet users' expectations, algorithms are not as effective, and the ability to choose between detailed annotations and full text is not guaranteed.

Some papers relate these problems to another issue, or we could say to a possible approach for new solutions: new ways of dialog between developers and users (more often teachers) could do much to improve current repositories. Improved dialog between developers and teachers could have a positive impact on another problem: The process of submitting learning resources needs more effective classification capabilities and should be easier. Peer reviewing of resources is also a process that can take a lot of time.

The list is concluded with another caveat, which may be related to all the others: The amount of resources available may not be sufficient to meet the diverse needs of users. The need for larger repositories brings us to the next step: interoperability. The primary need of users to find what they are looking for leads to the consideration that search engines should be able to find resources hosted outside the repository. To achieve satisfactory results, metadata plays a fundamental role. The presence of different relational databases leads to heterogeneity. There is a lack of standardization of metadata in repositories, which leads to lower interoperability. Several resources seem to lack important descriptive metadata: They are not always used by content experts when they upload new resources, and search engines often do not use content to filter results, which would be a possible alternative solution. If, on the one hand, there is a data entry problem that affects the end user, on the other hand, there seems to be a lack of a standardized reference system to which the teacher can refer. The quality of the metadata seems to be as important as its correct use.

More Information about the literature review is Available In the Proof of Concept document here: https://encoreproject.eu/wp-content/uploads/2022/07/PoC-key-features-of-OER-infrastructure_published.pdf.

X5Learn - Artificial Intelligence and OER

X5Learn (available at https://x5learn.org) is a human-centered AI- powered platform for supporting access to free online educational resources. X5Learn provides users with a number of educational tools for interacting with open educational videos, and a set of tools adapted to suit the pedagogical preferences of users, becoming part of the solution to the acknowledged technology-related limitations in OERs (see: ENCORE-OER-Technology-Position-paper-No.1.pdf (encoreproject.eu). It is intended to

support both teachers and students, alike. For teachers, it provides a powerful platform to reuse, revise, remix, and redistribute open courseware produced by others. These can be videos, pdfs, exercises and other online material. For students, it provides a scaffolded and informative interface to select content to watch, read, make notes and write reviews, as well as a powerful personalised recommendation system that can optimise learning paths and adjust to the user's learning preferences. What makes X5Learn stand out from other educational platforms, is how it combines human-centered design with AI algorithms and software tools with the goal of making it intuitive and easy to use, as well as making the AI transparent to the user. We present the core search tool of X5Learn, intended to support exploring open educational materials.

X5LEARN is part of the X5GON product family. It helps OER publishers get the most out of their content sites. The recommendation engine is designed to increase content engagement, quality assurance, audience engagement and traffic, directly improving site metrics. X5LEARN's core product is an AI engine that aggregates millions of pieces of content from OER across sites, cultures, and languages into one interface based on relevance and personal learning needs. OER publishers are using X5LEARN's tools to redistribute their content to other websites, making it the first AI-powered open learning environment. The technological innovation of this solution is based on the use of AI to enable multilingual, cross-domain and cross-site discoverability of OER. In developing this solution as part of the X5Gon project, quality models were investigated and developed to automatically assess the content quality of OER at scale. A number of regression and classification-based models were developed to automatically assess the quality of educational content.

Supporting engagement with H5P technology

Joubel is the parent organisation responsible for designing and launching the H5P plugin (in August 2018) to provide technological solutions for content creation, primarily for Teaching and Learning practices within higher education institutions worldwide. The purpose of the H5P plugin (and associated support services) is to facilitate the creation, use and reuse of html-based content across multiple sites and to encourage the exchange of resources and expertise created by the worldwide community of H5P users. Html content can be shared and published across different sites (e.g., WordPress, Canvas etc) which can help disseminate high quality educational

resources to multiple users, for example academic staff and students. The various offerings to customers, either H5P plugin as a stand-alone product or additional technological and customer support (Software as a Service) is a key aspect of the H5P business model. H5P support staff can offer different levels of expertise and assistance to users (in Higher Education Institutions) to promote the development and use of interactive and online teaching and learning materials to enhance the student experience and learning outcomes. The H5P plugin is used by customers (200 million users on 200,000 websites) to create, share and reuse over 40 types of interactive content (e.g., quizzes, memory games, flashcards, videos etc).

In summary, a key aspect of the H5P business model, products and associated services is the acknowledgement of different levels of expertise and confidence of various users and organisations to engage with technology to create educational materials. The ease of use of the H5P plugin means that individuals who are not technological experts can develop educational content, which can help to upskill academic staff and lecturers and potentially increase their confidence in developing and sharing resources. Users who are proficient in developing online learning resources may be willing to share their expertise and academic content, which in turn may potentially promote a culture of sharing, using and reusing educational materials which may impact positively on increased access to high quality OER (Open Educational Resources) for students.

Proof on Concept (PoC) of key features of OER Infrastructure

Version 2.0 of the PoC (not yet including the mockups) is ready, and the LMS Demonstrator environment is 50% complete. You can access the proof of concept at https://encoreproject.eu/2022/07/05/poc-of-key-features-of-oer-infrastructure/.

Cutting Edge Technology Showcase for European OER

There's now a Canvas demo environment as part of the technology showcase to provide a reference point for current and potential user experiences using OER resources and repositories. This will include a number of OER LTIs + H5P integration on the system to highlight current practices. The environment is live at https://encoreplus.instructure.com/ and ENCORE+ team members are in the process of developing content. API documentation can be found at https://canvas.instructure.com/doc/api/file.tools_intro.html.

Policy

The ENCORE+ work package on policy is seeing great results, with concrete recommendations and models emerging from core activities.

Policy Recommendations

A provisional set of recommendations for policies and strategies supporting OER

1. Greater collaboration and strategic partnerships are required to minimise duplication and enhance the quality of OER offerings.
2. Institutional policy and strategic planning are required for OER to increase commitment and stakeholder engagement.
3. Need for a sustainable financial structure.
4. Commitment to OERs beyond project dates/creation.
5. Opportunity to enhance value propositions through promotion of unique selling points such as: easy to use, accessible 24/7, free, social equality, environmental benefits in a world moving toward net zero emissions.
6. OERs should promote themselves and operate as OERs, thus being free and Open.
7. Business Models and OER strategy must be evaluated to see if optimal approach has been adopted.
8. Encourage and incentivise more OERs producers to exploit the value of publishing under the Creative Common Licence framework.
9. Encourage and incentivise more businesses to embrace innovation and technological advances in machine learning, recommender systems and data analytics.

Visit the ENCORE+ website for an update on the policy recommendations of the project!

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OER Sustainability and Future Proofing

Another output from ENCORE+ policy focus is the following checklist for planning for OER sustainability.

OER Sustainability and Future Proofing Checklist	
Available Skilled Staff	✓ Learning Experience Designer/ Instructional Designers/Learning Technologists: Design, develop and Look after the flow and touchpoints of a course, consult with SME's on performance & showcase the impact of the learning. ✓ Community Manager: Create Social Media Content, Create Engagement, respond to VLE community needs, solve learner/user issues, analyse trends & Moderate Forum Discussions. ✓ Subject Matter Experts (SME) ✓ Graphic and Multimedia Designers ✓ LMS/VLE Administrator: To manage the learning environment ✓ Data Analyst: Collect and monitor data for key insights ✓ Project Manager: Manage stakeholders, timelines, budgets & deliverability of the course to the required standard/quality ✓ Trainer/Academic Developer: To Provide training & support
Financial Ability	✓ Environmental Impact: Potential restrictions increased carbon taxes- could this impact ability to provide open; potential reduction in number on education/business campuses- less travel, heat, energy emissions or is it? Environmental targets towards climate neutrality- friend/foe? Costs associated. ✓ Global reach: Who pays? Potential loss of business to global entities ✓ Access to more global learners. Developing nations versus EU. ✓ Managing a global workforce: Increasing labour costs, ✓ Current economic status: economic growth in EU, employment rates, inflation rates, monetary policy, user/business/higher ed confidence and commitment to open education.
Technical Ability	✓ IT skills ✓ Infrastructure available ✓ Accessibility from a learner/user perspective. ✓ Environmental Impact: potential restrictions regarding emissions, data centre planning process, data centre energy usage, could this impact ability to provide OER. ✓ Ability to provide service required ✓ Cybersecurity ✓ Data protection
Social, Environmental and Political Environment	✓ Trends emerging from pandemic. ✓ Learnings from failed past models, how to avoid repetition; evaluation and reflection for learning and future planning. ✓ Social environment and appetite for OER. ✓ Political environment and appetite for OER: global influences, EU influences, current or proposed relevant legislation, stability of EU and member state governments. ✓ Legal: GDPR, Creative Commons Licensing, Copyright, Intellectual Property, Environmental legislation.

Figure 2. OER Sustainability and future proofing checklist

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Innovation

Activities in the ENCORE+ Innovation work package include these briefings as well as original research and synthesis around OER Innovation and business models using OER. Some of the conceptual work we have done in the earlier phases of the project will inform our upcoming survey activity in the final quarter of 2022. Through this survey we will create a collection of cases of OER innovation and the results will also inform our OER Innovation Evaluation Toolkit. Here we present some of the emergent concepts.

OER Edupreneurship & Educational Innovation

Hamda Darwish's paper (2019) remains an important resource for those interested in differing stakeholder perspectives on OER innovation in higher education. Darwish presents four business models for different environments and educational objectives. In the ENCORE+ Innovation survey these are cross-referenced with the SAMR model (Puentedura, 2013) for understanding the integration of technology into education.

Understanding Strategic Approach

Understanding strategy is a key part of the Innovation and Business Models work package. In the survey we propose to use a classic schemata from business studies sometimes referred to as the aggressiveness strategy. Miles et al. (1978) describe four types of approach - prospector, defender, analyzer and reactor - based on the 'aggressiveness' of their strategy. In our survey these will be simplified to defender and prospector, similarly to the methodology of Orr et al. (2019)].

Open Education for Social Enterprise

Open educational resources (OER) can play a pivotal role in supporting social enterprise initiatives by providing accessible, adaptable, and cost-effective educational materials that can empower individuals and communities to address social and environmental challenges. OER are often freely available online, breaking down financial barriers to education. This accessibility ensures that individuals from diverse socio-economic backgrounds can access high-quality educational resources, empowering them to engage in social enterprise initiatives regardless of their financial means.

OER can be customised and adapted to meet the specific needs of social enterprises and their target communities. This flexibility allows organisations to tailor educational materials to local contexts, languages, and cultural sensitivities, ensuring relevance and effectiveness in addressing social challenges. OER serve as valuable tools for capacity building within social enterprises and their partner organisations.

By providing training materials, curricula, and learning resources, OER enable individuals to develop the skills, knowledge, and competencies necessary to drive social innovation and entrepreneurship. OER promote collaboration and knowledge sharing among social enterprises, practitioners, researchers, and educators. Through open licensing models, OER facilitate the sharing of educational resources, best practices, and lessons learned, fostering a vibrant community of practice focused on advancing social impact initiatives. OER contribute to the scalability and sustainability of social enterprise initiatives by reducing the costs associated with educational content development and distribution.

By leveraging existing OER repositories and platforms, social enterprises can reach broader audiences and extend the impact of their educational programs cost-effectively. OER empower individuals and communities to actively participate in the design, development, and implementation of social enterprise solutions. By democratising access to knowledge and education, OER promote inclusivity and empower marginalised populations to drive positive social change from within their communities. OER support monitoring and evaluation efforts within social enterprises by providing access to resources and tools for assessing the effectiveness and impact of educational interventions.

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Through open access to evaluation frameworks, assessment tools, and data analytics resources, organisations can measure outcomes, track progress, and refine their strategies for greater social impact. Open educational resources serve as catalysts for innovation, collaboration, and empowerment within the social enterprise sector, enabling individuals and communities to address pressing social and environmental challenges through accessible, customizable, and sustainable educational initiatives.

African Health OER Network

The African Health OER Network is a collaborative initiative focused on improving healthcare education and training across the African continent through the use of OER. Through partnerships with universities, medical schools, and healthcare organisations, the network develops and disseminates freely accessible educational materials, including textbooks, lectures, and interactive simulations, covering a wide range of healthcare topics.

Code.org

Code.org is a nonprofit organisation that leverages OER to promote computer science education globally. Their platform offers free coding tutorials, curriculum resources, and interactive activities designed to make computer science accessible to students of all

ages and backgrounds, fostering digital literacy and equipping learners with valuable skills for the future.

Commonwealth of Learning (CoL)

The Commonwealth of Learning is an intergovernmental organisation that promotes open and distance learning across the Commonwealth countries. COL utilises OER to develop and disseminate educational materials in areas such as teacher training, vocational education, and lifelong learning, helping to expand access to quality education and skills development opportunities.

Digital Public Library of America (DPLA)

The Digital Public Library of America aggregates OER from various sources, making them accessible to users across the globe and supporting educational initiatives focused on promoting digital literacy, cultural heritage preservation, and civic engagement.

Edraak

Empowering individuals to actively shape social solutions, OER promote inclusivity and empower marginalised groups to drive positive change from within their communities. The Edraak platform, for instance, offers free, high-quality educational content in Arabic, enabling learners in the MENA region to access educational opportunities and contribute to social and economic development.

GENIE

GENIE is a large-scale, long-term national policy and initiative developed and implemented by the Ministry of National Education and Vocational Training, Higher Education and Scientific Research of Morocco. The GENIE programme is based at the National Laboratory of Digital Resources of the Ministry of Education, Morocco. The GENIE programme was awarded the 2017 UNESCO King Hamad Bin Isa Al-Khalifa Prize for its work in making innovative use of Information and Communication Technologies (ICTs) in education.

Global Voices

Global Voices is an international community of bloggers, journalists, and activists dedicated to amplifying underrepresented voices from around the world. They use OER to provide training and resources to citizen journalists, enabling them to produce accurate, independent, and culturally relevant news coverage that highlights local perspectives and promotes global understanding.

Khan Academy

OER offer flexibility in tailoring materials to local languages, cultures, and contexts, amplifying their relevance and impact. One notable example is the Khan Academy, which offers a wide range of educational resources in multiple languages, allowing learners worldwide to access high-quality content tailored to their needs.

MOONLITE

An Erasmus+ funded project, MOONLITE aims to develop cross-national cooperation services to explore larger-scale uptake of MOOCs in Europe as well as creating learning and collaboration opportunities for refugees, stakeholders and MOOC providers in member states. In general MOONLITE contributes to the further improvement of educational offerings to refugees both by HEI and in cross-regional collaboration.

OER Africa (OERA)

OER Africa is a pioneering initiative dedicated to advancing education and knowledge-sharing across the African continent through the use of open educational resources (OER). Collaborating with educators, institutions, and policymakers, OER Africa works to develop, adapt, and disseminate high-quality OER to address local educational challenges and promote sustainable development.

Open IDEO

OER foster collaboration and knowledge exchange among practitioners, researchers, and educators, fueling a dynamic community dedicated to advancing social impact initiatives. The OpenIDEO platform is a prime example, where individuals worldwide

collaborate to tackle social and environmental challenges by sharing ideas, resources, and expertise freely.

Public Lab

Public Lab is a community-driven research organization that uses OER to democratize science and environmental monitoring. Through their platform, they provide access to open-source tools, DIY kits, and educational resources that enable citizens to conduct their own environmental investigations and advocate for positive change in their communities.

Restart Project

The Restart Project is a social enterprise focused on promoting repair and reuse as alternatives to electronic waste. They use OER to develop educational materials and workshops that teach people how to repair electronic devices themselves, reducing waste and empowering individuals to take control of their electronics consumption habits.

SABIER

SABIER (South African Biology In-Service Education and Resource) is a notable initiative focused on enhancing biology education in South Africa through the use of OER. Developed in collaboration with educators and experts, SABIER offers a wealth of freely accessible teaching materials, including lesson plans, multimedia resources, and assessment tools, designed to support both pre-service and in-service biology teachers. Through its innovative approach and commitment to open access, SABIER is making significant strides in improving the quality and accessibility of biology education in South Africa, ultimately empowering teachers and students alike to excel in the field of biology.

Saide's African Storybook Initiative

Saide's African Storybook Initiative is a pioneering effort aimed at promoting literacy and language development across Africa through the creation and distribution of openly licensed children's storybooks. Developed in collaboration with educators,

writers, and illustrators from diverse African communities, the African Storybook Initiative provides a rich collection of culturally relevant, multilingual storybooks that reflect the linguistic diversity of the continent. These storybooks cover a wide range of themes and genres, catering to the interests and experiences of children from different backgrounds.

Social Enterprise Institute

The Social Enterprise Institute, which offers free online courses and resources to help aspiring social entrepreneurs develop their ideas, build sustainable business models, and make a positive impact in their communities.

SolarSPELL

SolarSPELL, a social enterprise project, utilizes OER to provide educational content in off-grid, low-resource areas, enabling communities to access vital knowledge on topics like health, agriculture, and entrepreneurship.

TESSA (Teacher Education in Sub-Saharan Africa)

TESSA (Teacher Education in Sub-Saharan Africa) is a groundbreaking initiative aimed at improving the quality of teacher education across the Sub-Saharan African region. Developed collaboratively by educators and experts from various African countries, TESSA provides OER designed specifically for pre-service and in-service teacher training programs. These resources cover a wide range of subjects and teaching methodologies, catering to the diverse needs and contexts of African classrooms. By promoting interactive, learner-centred approaches to teaching and learning, TESSA equips teachers with the knowledge, skills, and confidence needed to deliver effective instruction and support student success.

Wikimedia Foundation

The Wikimedia Foundation is the nonprofit organization behind Wikipedia and other Wikimedia projects. They leverage OER to support the creation, curation, and dissemination of free knowledge resources in multiple languages and subject areas,

empowering people around the world to access and contribute to the world's largest open educational resource.

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OER Business Models

OER can be a powerful strategic approach for meeting business and social enterprise goals, but it's important to emphasise the need for sustainable approaches.

ENCORE+ activity has audited innovation related behaviours for a range of organisations that use OER. More than OER innovation 40 case studies have been prepared and a selection of these are presented with a critical commentary among the deliverables for work package 6. Alongside this, the related evaluation framework is being shared on an open licence for others to use and better understand the role of innovation in their own OER practice.

In this section we introduce the ENCORE+ OER Business Model Typology. The ENCORE+ OER Business Model Typology is part of the evaluation frameworks and data is being collected to map real life examples of each business model type.

The Typology rationalises the current range of frameworks and models into one framework. The possible range of descriptions are rationalised into four basic revenue models: externally funded; internally funded; community funded; and service models. From these, fourteen business model types are identified.

The categories used in the Typology have been validated through interactions with the ENCORE+ network through integration and network events. This makes it a good starting point for thinking about the sustainability of OER implementations, though it should be noted that there is always the potential for new and innovative approaches!

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ENCORE+ OER Business Model Typology

Category	Business Model	Description
Externally funded	Donations Model	Funding from donations or grants, e.g., foundations, society, industry, non-governmental agencies
	Governmental Model	National and international governmental agencies providing funding for OER
	Sponsorship / Advertising Model	Generating revenue by exposing learners to commercial messages
Internally funded	Institutional Model	Higher education providers setting aside some part of their budget for OER programmes
	Substitutions Model	Cost savings from redundant services (e.g. obsolete systems) are redirected towards OER programmes
	Author pays Model	Publishers generate revenue by charging content creators
Community funded	Community based	Members of a community or network collaboratively create and use OER, generating revenue through services and/or infrastructure
	Membership Model	The Membership model relies on organizations contributing to the OER provider with money, services and/or goods
	Platformization	Organises stakeholders around a digital ecosystem, facilitating interaction and generating insights
Higher Education Service Models	Data Exploitation Model	Generates revenue by selling analytic data about the activities of those using a learning environment
	Dual-Mode University	Use of OER in an online course (e.g. Massive Open Online Course) to develop a distance learning or virtual university operation
	Freemium	Educational materials are offered for free and sustainability is derived from subsequent income streams offered alongside this (e.g. assessment or access to a larger curriculum)

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	Online Programme	Extending presence-based education to online or blended courses
	Segmentation Model	Commercializing a service relating to OER (such as printing open textbooks; providing assessment or certification of learning)

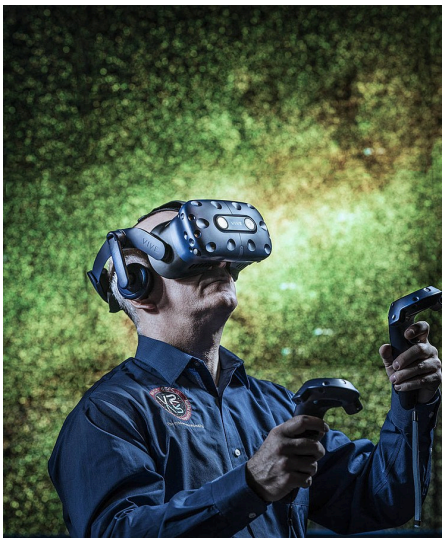
The ENCORE+ OER Business Model Typology has been developed as part of a wider effort to understand and evaluate economically sustainable approaches to OER as well as to formulate OER value propositions for different stakeholders.

For a fuller account of the development of this typology of OER business models, see:

Farrow, R. (2023). A Typology of OER Business Models. In: EDEN 2023 Annual Conference "Yes we can!" – Digital Education for Better Futures, 18-20 June 2023, Dublin, Ireland. *Ubiquity Proceedings*, 3(1): 394-401 https://doi.org/10.5334/uproc.114

What Does the Future Hold?

Virtual Realities



New wearable technologies for more immersive synchronous learning made possible by developments in Augmented Reality (AR), Extended Reality (XR) and Mixed Reality (MR) are rapidly emerging such as the new ECIU XR Campus, a virtual environment which provides collaborative learning opportunities across Europe. Such developments challenge the conceptual definition of what constitutes a learning environment (Hamilton, et al., 2021) and offer '...the possibility for learners to have first-hand experiences that would not be possible in the real world' (Natale, et al., 2020). Accordingly, these technologies are likely to be one of the most exciting new trends in online learning over the next 1-5 years. (Image credit: NASA https://go.nasa.gov/2RFSOLw)

OER and Accessibility

A recent article (Moon & Park, 2021) reviews trends in OER used to support disabled learners and highlights the flexibility of open resources which can be used in a variety of learning scenarios. Thirty papers were included in the review. It was found that OER contribute to learner equity in various ways. Through universal learning design, educational materials deployed digitally online or through an LMS can be tailored to specific accessibility needs, and open materials are well suited to these kinds of flexible uses. OER themselves are often employed in accessibility testing, and many projects have focused on improving the accessibility of OER. Disabled learners benefit from many varieties of OER, including open sources programs, toolkits and games; MOOCs

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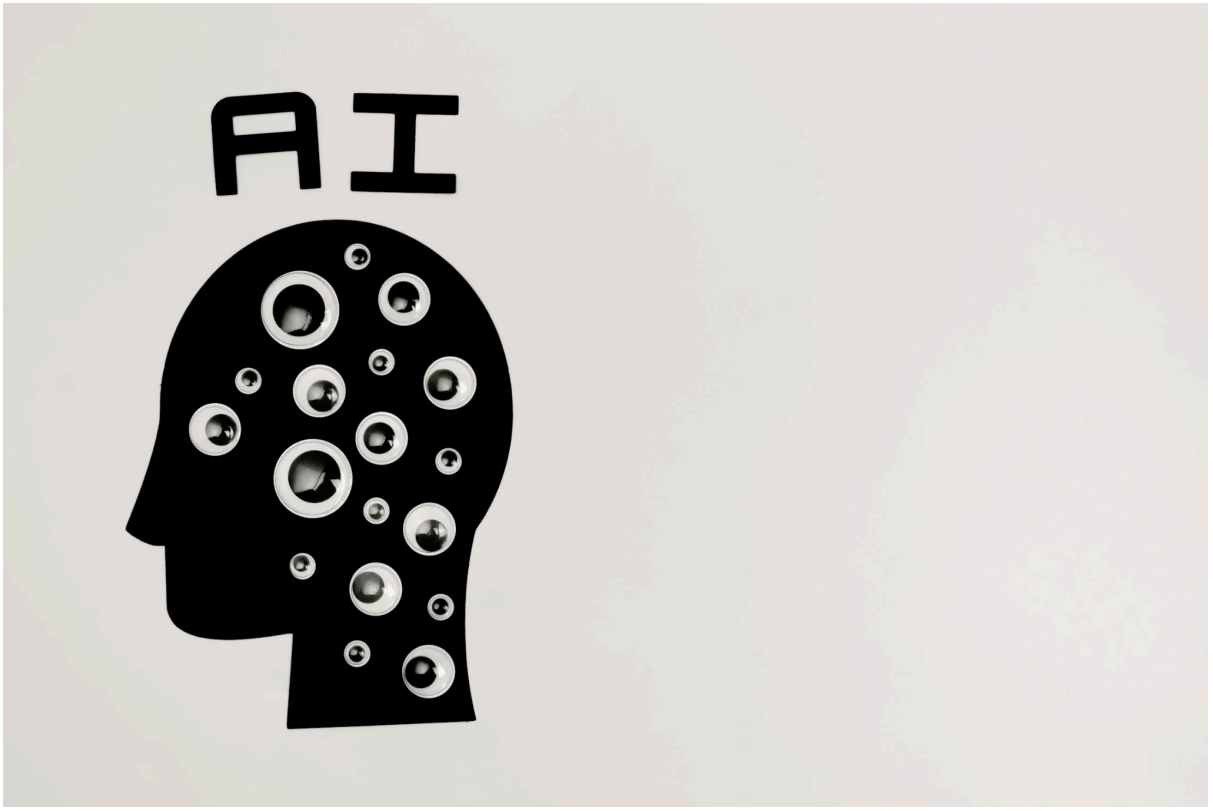
and other full study programmes; audiovisual content; and materials in institutional repositories.

The review concludes with three recommendations for the design of learning resources. Firstly, that during collaborative learning activities disabled learners may require additional informal support which can be provided by facilitating learner-learner and learner-educator interactions. Secondly, that educators receive more training in the use of assistive technologies to support disabled learners so that OER can be used effectively. Thirdly, that future research should integrate diffuse practices of instructional design practice into learning supports for learners with disabilities across various OER cases.

The Potential for AI in Open Education

Artificial Intelligence (AI) presents a plethora of opportunities for open educators, revolutionising various aspects of teaching, learning, and educational resource development. One significant application lies in adaptive learning systems powered by AI algorithms. These systems can analyse vast amounts of data on student performance, preferences, and learning styles to deliver personalised learning experiences. By tailoring content, pace, and instructional strategies to individual needs, adaptive learning systems enhance engagement, retention, and mastery of educational material, ultimately improving learning outcomes.



Moreover, AI-driven content creation tools empower open educators to develop high-quality educational resources more efficiently and effectively. Natural Language Processing (NLP) algorithms can assist in content curation, synthesis, and generation, automating tasks such as summarization, translation, and even the creation of interactive learning materials. By harnessing AI, educators can augment their creativity, productivity, and scalability in developing diverse and engaging educational content.

Furthermore, AI-enabled analytics platforms provide valuable insights into student learning and performance, facilitating data-driven decision-making in education. These

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platforms can track student progress, identify learning trends, and predict areas of difficulty, enabling educators to intervene early, customise instruction, and optimise learning pathways. Through continuous monitoring and assessment, AI analytics promote adaptive teaching practices and support the ongoing improvement of educational interventions and resources.

Additionally, AI chatbots and virtual assistants offer innovative solutions for student support services in open education. These intelligent agents can provide immediate assistance, answer queries, and offer personalised guidance to learners, enhancing accessibility and responsiveness in online learning environments. By leveraging Natural Language Understanding (NLU) and machine learning algorithms, AI chatbots can engage in meaningful interactions with students, addressing their diverse needs and fostering a supportive learning community.

In essence, AI technologies hold immense promise for open education, offering opportunities to enhance access, quality, and effectiveness in teaching and learning. By leveraging AI-driven adaptive learning systems, content creation tools, analytics platforms, and student support services, open educators can harness the power of technology to meet the diverse needs of learners, promote inclusive education, and foster lifelong learning in the digital age.

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The explosion of interest in AI technologies following the release of ChatGPT in 2023 reflected the breakthrough of usable interfaces into large language models (LLM). The rush to market and optimistic exploration of the uses of such technologies in teaching, learning and training is ongoing. The hype surrounding Artificial Intelligence (AI) in education reflects both the excitement and the scepticism surrounding the potential of AI to transform teaching and learning. Proponents argue that AI has the power to revolutionise education by personalising learning experiences, automating administrative tasks, and providing valuable insights through data analytics. AI-driven adaptive learning systems, content recommendation engines, and intelligent tutoring systems hold promise for improving student engagement, retention, and academic outcomes. However, amidst the hype, there are concerns about equity, privacy, and the ethical implications of AI in education. Sceptics caution against overreliance on AI algorithms, highlighting the importance of human teachers and the need for critical evaluation of AI-powered tools and interventions. While AI has the potential to enhance education, it is essential to approach its implementation thoughtfully, ensuring that it serves the best interests of learners and educators while addressing the broader societal challenges facing education systems worldwide.

AI for OER Workflows

OER Production, Search and Discovery

Integrating AI into the workflow of OER producers presents a multitude of possibilities for transforming content creation, curation, and dissemination in education. Firstly, AI-driven content creation tools offer significant advantages in terms of efficiency, scalability, and customization. Natural Language Processing (NLP) algorithms can assist in generating, editing, and optimising text-based content, enabling OER producers to automate tasks such as writing summaries, explanations, and assessments. Machine learning models can analyse vast datasets to create interactive multimedia resources, simulations, and adaptive learning experiences tailored to the unique needs and preferences of individual learners. These AI-powered content creation tools not only streamline the resource development process but also enhance the accessibility and effectiveness of educational materials across diverse learning contexts.

Furthermore, AI-powered content recommendation engines play a pivotal role in improving discoverability and engagement on OER platforms. By leveraging machine learning algorithms and user data, recommendation systems can provide personalised suggestions for relevant educational materials, courses, and resources based on learners' interests, learning objectives, and past interactions. Collaborative filtering techniques can identify similar users and recommend resources based on their preferences and behaviour, fostering a sense of community and collaboration among learners. Additionally, AI-driven recommendation engines can continuously refine their recommendations over time, adapting to changes in user preferences and content availability to promote a dynamic and responsive learning experience.

Moreover, AI-driven analytics platforms offer valuable insights into user behaviour, learning outcomes, and content effectiveness. By analysing data on how learners interact with educational resources, OER producers can gain actionable insights into usage patterns, engagement levels, and learning trajectories. Predictive analytics algorithms can anticipate user needs and preferences, enabling OER producers to proactively identify emerging trends, gaps in content coverage, and opportunities for improvement. These insights inform data-driven decision-making processes, allowing OER producers to optimise resource allocation, prioritise content development efforts, and tailor educational interventions to better meet the evolving needs of learners and educators.

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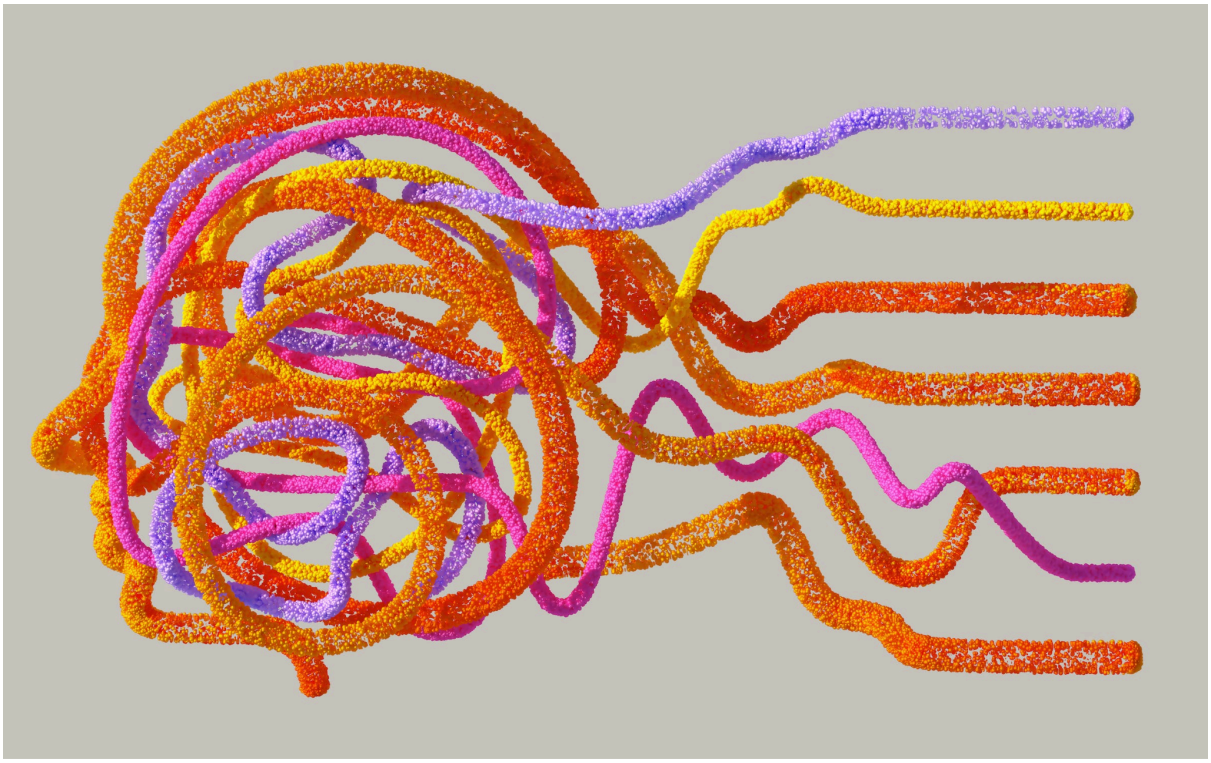
Additionally, AI chatbots and virtual assistants enhance user support services on OER platforms by providing personalised assistance, answering queries, and facilitating communication between learners and educators. Through Natural Language Understanding (NLU) and machine learning algorithms, chatbots can engage in conversational interactions with users, offering timely feedback, recommendations, and guidance. These AI-driven support services improve accessibility, responsiveness, and user satisfaction, enhancing the overall learning experience on OER platforms.

In summary, incorporating AI into the workflow of OER producers enables them to harness the power of technology to create, curate, and disseminate educational resources that are more accessible, engaging, and effective. By leveraging AI-driven tools and technologies, OER producers can advance the mission of open education to provide inclusive, personalised, and high-quality learning opportunities for learners worldwide.

How can Open Educators make use of AI?

Educators who incorporate OER into their teaching can leverageAI to enhance various aspects of their educational practices. One significant application lies in AI-powered adaptive learning systems, which analyse student data to provide personalised learning experiences. These systems can assess students' strengths, weaknesses, and learning styles, offering tailored content, resources, and assessments to meet their individual needs. For instance, AI algorithms can recommend specific OER modules or learning pathways based on a student's performance and preferences, enabling educators to provide targeted support and enrichment opportunities. Additionally, AI-driven content creation tools can assist educators in developing and customising OER materials to suit diverse learning objectives and contexts.



Some of the most tangible potential gains are to do with increasing efficiencies. Natural Language Processing (NLP) algorithms can automate tasks such as summarising, translating, and adapting OER content, saving educators time and effort in content development and localization. Moreover, AI analytics platforms enable educators to gain insights into student engagement and progress, facilitating data-driven decision-making in instructional design and intervention strategies. By analysing data on student interactions with OER, educators can identify areas of difficulty, monitor learning trajectories, and assess the effectiveness of instructional interventions. Furthermore, AI chatbots and virtual assistants can provide personalised support to

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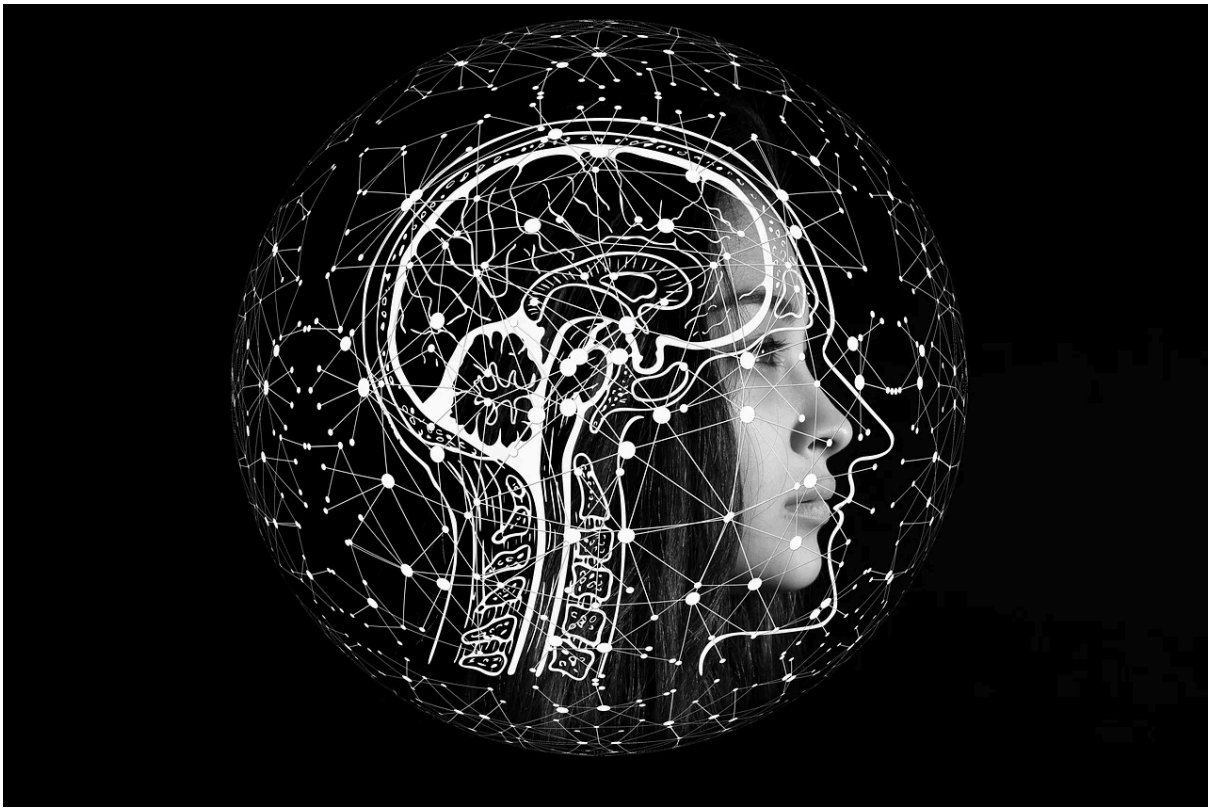
students, offering real-time assistance, feedback, and guidance on their learning journey. These intelligent agents can answer questions, provide explanations, and facilitate peer collaboration, enhancing the accessibility and effectiveness of OER-based learning environments. Overall, AI offers educators using OER a potential wealth of opportunities to personalise learning experiences, optimise instructional practices, and support student success in diverse educational settings.

Open Education Tools Using AI



The integration of emerging technologies such as Artificial Intelligence (AI) and educational data mining algorithms could help to increase and enhance the use of OER for learning and teaching. In presenting a future vision. Tlili et al. (2020) discuss the potential of these solutions in addressing the problem of locating and selecting the most appropriate OERs among the many thousands, if not millions, that are published and that are available online, and trusting them.

In recent years, Recommender Systems that help to discover patterns in large datasets have been used to learn the preferences of different users and predict items that correlate to their needs (Khalid, Lundqvist & Yates, 2020). Some of the larger platforms for MOOCs (Massive Open Online Courses) already deploy such systems. The vision articulated by Tlili et al. (2020) anticipates placing OER at the centre of technology-enhanced learning processes, using advanced algorithms to analyse "big learning data" and refine the offer made to learners.

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Critical Perspectives on AI in Education

It's important to temper the excitement about the potential for AI to support open education by acknowledging the many concerns and criticisms that have been expressed. Critical perspectives on the use of AI in education encompass a range of considerations that highlight both the potential benefits and drawbacks of integrating AI technologies into educational settings. One significant critique revolves around issues of equity and access, as AI-driven educational tools may exacerbate existing inequalities by favouring students with access to advanced technology and resources. This digital divide can widen disparities in educational outcomes, particularly for marginalised and underserved communities who may lack access to reliable internet connectivity, devices, or technical support. Moreover, there are concerns about the potential for AI algorithms to reinforce bias and discrimination, particularly in areas such as grading, admissions, and recommendation systems. Without careful design and oversight, AI systems may inadvertently perpetuate or amplify existing societal biases, leading to unfair outcomes and exacerbating inequities in education.

Additionally, critics raise questions about the depersonalization of education that may result from overreliance on AI-driven technologies. While AI can provide personalised learning experiences and support, there is a risk of reducing education to a transactional process focused solely on achieving predefined learning outcomes. This mechanistic approach may neglect the holistic development of students, including the cultivation of critical thinking, creativity, and social-emotional skills that are essential for success in the 21st century. Moreover, the increasing reliance on AI for tasks such as grading and assessment raises concerns about the devaluation of teachers' professional judgement and expertise, as well as the erosion of trust between educators and students.

Furthermore, there are ethical concerns surrounding data privacy, surveillance, and algorithmic transparency in the use of AI in education. The collection and analysis of vast amounts of student data raise questions about informed consent, data ownership, and the potential misuse of sensitive information. Educators, policymakers, and technology developers must address issues of data security, confidentiality, and transparency to safeguard student privacy and ensure ethical use of AI technologies. Additionally, there is a need for greater transparency and accountability in the design, development, and implementation of AI algorithms used in educational contexts. Algorithmic decision-making processes should be subject to scrutiny and oversight to

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prevent unintended consequences and ensure fairness, accountability, and transparency in educational practices.

Finally, some critics argue that the rapid integration of AI into education may outpace research and evidence-based practices, leading to the adoption of technologies that are not adequately validated or understood. There is a need for rigorous research, evaluation, and ongoing assessment of AI-driven educational interventions to determine their effectiveness, impact, and ethical implications. Educators and policymakers must engage in critical reflection, ethical deliberation, and evidence-based decision-making to ensure that AI technologies serve the best interests of learners and educators while addressing broader societal challenges in education.

Just as we see that GPTs are beginning to become a primary interface for inquiry, replacing search engines that have become bloated and provide highly commercialised results - so the rise of GPTs could be seen to undermine the need for OER. After all, why create educational materials in advance when GPTs can (in theory) answer any question or design pedagogical activities on the fly? The answer to this is still in the process of becoming, but it is important to note that there are ongoing legal disputes regarding the legality of using copyrighted materials to train GPTs. It is quite feasible that copyrighted materials may be excluded from training sets in the future. This may provide an opportunity for public domain materials to be used instead, but openly licensed content would still require adequate attribution, which many GPTs cannot provide. Further case law in this area is needed, though it is noteworthy that the EU AI Act (2023) makes specific provision for open approaches as these issues move towards resolution.

Overall, critical perspectives on the use of AI in education underscore the importance of thoughtful consideration, ethical reflection, and responsible innovation to harness the potential of AI while acknowledging and attempting to mitigate risks and limitations. For open educators, who are more likely to have a nuanced appreciation of copyright issues, the future developments in this area of innovation will be of great interest.

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About the ENCORE+ Project

ENCORE+ is the *European Network for Catalysing Open Resources in Education*.

ENCORE+ builds the foundation for the European OER Ecosystem which can best support innovation and inclusion in education and training; improve digital skills; improve employability; and share the benefits of open online learning with as many Europeans as possible.

- Developing a validated, shared vision and roadmap for OER in Europe
- Providing a sustainable European collaboration model responding to authentic needs
- Working with diverse stakeholders to create the ENCORE+ OER Quality Framework
- Establishing European OER Strategy Guidelines for higher education & businesses
- Establishing a well connected European OER Ecosystem of technologies & communities

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Consortium Members

ENCORE+ brings together expertise from across academia, business and technology.

Baden-Wuerttemberg Cooperative State University (DHBW)

DHBW is the largest university in Germany. It is a dual mode university in which students alternate between study and work partnerships from industry and public sector. It is the first university in Europe integrating academic studies and work experience systematically institution-wide on a large scale, working with 9000 private and public organisations.

Dublin City University

Dublin City University is a world leader in designing, implementing and researching new blended, online and digital (BOLD) models of education. DCU is committed to providing strategic leadership, building strong communities of innovation, and contributing to world-class research.

Fondazione Politecnico di Milano (FPM)

FPM is a foundation and research institute strictly connected to the Politecnico di Milano University, aimed at building a bridge between the teaching and research activities in the university and the corporate sectors. In particular, the Digital Learning Area of FPM investigates innovative didactical solutions (MOOCs, gamification, OER development and use) that support learning at scale. FPM supports SMEs in programmes of business growth centered on multidisciplinary training to prepare companies for future trends.

Instructure Global Ltd.

Known for making teaching and learning easier through open, usable, cloud-based technologies, Instructure has connected millions of instructors and learners at more than 3,000 higher education, further education, secondary education, and corporate institutions throughout the world. Through Canvas VLE, Instructure supports the development of OER resources, repositories and research. Instructure believes it critical

that educators have the ability to effectively find, utilize, and assess high-quality OERs in any learning environment.

International Council for Distance Education

The International Council for Open and Distance Education (ICDE) is the leading global membership organization for open, distance, flexible and online education (including e-learning). ICDE draws its membership from institutions, educational authorities, commercial actors, and individuals in more than 70 countries. ICDE organize events, conduct studies, projects and comprehensive information and communication activities to promote high quality educational opportunity for all.

Joubel

Since 2014 Joubel has been working on improving the world of Interactive content by establishing and leading the H5P project. H5P is a plugin for existing publishing systems that empowers users to create interactive content like Interactive Videos, Presentations, Games, Quizzes and more. Joubel has collaborated with the open source community to create more than 40 H5P content types. Joubel works towards the vision of empowering everyone to create, share and reuse interactive OER content.

Knowledge 4 All Foundation Ltd (K4A)

K4A is a distributed institute based in London (UK) with 2 main streams of activities (pioneering Machine Learning methods of pattern analysis, statistical modeling and computational learning; and transforming these into technologies for large scale applications in Open Education). It advocates AI & big data in Open Education. K4A supports its 1000+ researchers and 62 member institutions by co-funding more than 260 events, 60+ machine learning challenges, 20.000 academic video lectures and creating machine learning tools and software.

The Open University (UK)

The Open University (UK) is a world leader in increasing access to education which, alongside its core provision in distance learning, has provided many innovative OER repositories (including OpenLearn, Open Research Online, FutureLearn) and leadership

in OER research (OER Research Hub; Global OER Graduate Network). The Open University is the largest UK university and one of the largest universities in the world.

UNIR | La Universidad en Internet

UNIR is an online university from Spain with a strong commitment to its growing open education network. UNIR recently adopted an internal open education policy and is active in projects such as Open Educators Factory and OpenMed. The Research Institute for Innovation & Technology in Education (UNIR iTED) holds a UNESCO Chair on eLearning, an ICDE Chair in OER, and Delegation IITE for Southern Europe and Latin America (UNESCO Institute for Information and Technology in Education).

Associated Partners

In addition to the core consortium, ENCORE+ comprises many associated partners from manifold sectors. In the private sector these include technology, communication and resourcing businesses such as IBM, Adecco, Bayer, and Telefónica.

ENCORE+ is also supported by sectoral and international organisations including: UNESCO; Open Educational Global; European Association of Distance Teaching Universities (EADTU); European Association of Institutions in Higher Education (EURASHE); and Open Iceseo. This international network is further supported by dozens of higher education institutions, associations, networks, NGOs, businesses and projects in European and non-European countries.

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www.encoreproject.eu

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