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faville
facilitators of virtual learning

IO1 –
Module 2
ICT tools for virtual learning facilitators
Sub module 4 (HOU)
Digital Repositories and digital resources

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1. An introduction to Digital repositories and Digital resources

1.1 Intro to Digital repositories

A **digital repository**, or **digital library**, or **digital collection**, is, according to Wikipedia (https://en.wikipedia.org/wiki/Digital_library), an online database of **digital resources** ("objects"[1]) consisting of **digitized content** such as photos or prints and **digital content** such as word documents, spreadsheets and images. Based on their type (text, image, sound, video etc.), digital resources come in various media formats or combinations of them.

Digital repositories may differ depending on their size or scope and their content can be stored locally or remotely. Besides storing digital resources, they also allow users to organize, search, and retrieve their contents.

The prevailing view today has expanded the concept of digital repositories, from stand-alone software applications with basic storage and retrieval features to integrated software and hardware systems that provide, include, and support policies, processes, services and people, as well as "metadata"[2] besides digital content (resources).

Digital repositories may have a variety of content, for a variety of people (users) and purposes. Repositories use open standards for interoperability, thus ensuring that the content they store is accessible for import, export, search and retrieval by various information management / retrieval systems.

Repositories can be institutional or subject-focused. Storing content into an **institutional repository** enables institutions and their staff to preserve and manage valuable knowledge generated and/or used within the institution itself. For example, a university repository may include journal articles or research data, e-theses, e-learning objects, teaching materials, and administrative data, therefore providing a strong mechanism to support learning, research and administration. **Subject**

[1] see next unit for a definition of the term
[2] see unit after the next unit for a definition of the term

repositories only accept contents within particular subject areas, even if these contents come from multiple sources. For example, E-LIS is a subject repository dedicated to library and information sciences.

One of the most commonly used options for academic, non-profit, and commercial organizations is **DSpace**[3]. DSpace is free and easy to install and completely customizable to fit the needs of any organization in order to create open digital repositories.

The advantages of DSpace are:

- Largest community of users and developers worldwide
- Free open source software
- Completely customizable to fit any needs
- Used by educational, government, private and commercial instutions
- Can be installed easily in any operating system
- Can manage and preserve all types of digital content

Further readings

See the article of Castagné (2013)
(https://open.library.ubc.ca/cIRcle/collections/graduateresearch/42591/items/1.0075768)
for a global view from the comparative presentation of the possibilities and functions offered by the most well-known digital repositories such as:
DSpace (https://duraspace.org/dspace/),
EPrints (https://www.eprints.org/us/),
Digital Commons (https://bepress.com/products/digital-commons/),
Islandora (https://islandora.ca/) and
Hydra (Samvera community nowdays) (https://samvera.org/).

[3] https://duraspace.org/dspace/

1.2 Intro to Digital resources (Learning Objects)

As mentioned above, **Digital Resources** are materials that have been created directly digitally or by converting analogue materials to a **digital** format.

The term "**digital** learning (or educational) resource" is used to refer to materials included in the context of a course that support the learner's achievement of the described learning goals. These materials consist of **resources** of all the above-mentioned technical types**.**

Digital learning (or educational) content plays a significant role in the process of delivering knowledge and takes a wide variety of forms, including tutorials, simulations, scenarios, podcasts, screencasts, videos, slideshows, quizzes and reference materials.

Learning Objects (LOs) constitute a novel approach in the educational content's presentation and organization, which in the literature is missing, a common agreement about the LO's attributes and structure.

According to Wikipedia (https://en.wikipedia.org/wiki/Learning_object), a **learning object** is "*a collection of content items, practice items, and assessment items that are combined based on a single learning objective/outcome*". Similarly, according to the IEEE Learning Technology Standards Committee, a LO is defined as "*any entity digital or non-digital that may be used for learning, education or training*". In relevant literature, a number of other definitions are provided, which prove that there is still a lack of consensus regarding the conceptual definition of a Learning Object in its descriptive, structural and analytical consideration. See below the most important:

- Wiley (2000) describes a LO as "*any digital resource of content that can be reused to support learning*"
- L'Allier (1997) considers a LO as "*the smallest independent structural experience that contains an objective, a learning activity and an assessment*"
- Polsani (2003) defines a LO as "*an independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional contexts*"

Contrary to the lack of consensus regarding the conceptual definition of a LO, there is a broad understanding among the members of the LO community about their

functional requirements. These requirements are presented below, as summarized in Polsani (2003):

- Accessibility: A LO should be tagged with metadata so that it can be stored and referenced in a database
- Reusability: Once created, a LO should function in different instructional contexts
- Interoperability: A LO should be independent of both delivery media and knowledge management systems

Considering the above definitions, we can end up with the following definition: "A Learning Object is a self-contained and independent unit of digital educational content, consisted of content items, practice items, and assessment items, which is tagged with metadata, associated with one or more learning outcomes which it should fulfill, and it has the ability to be reused in different educational contexts".

Alternative terms are: Learning Asset, Digital resource, Digital asset, Digital object, Educational resource, Educational asset and Educational Object.

1.3 Learning Outcomes

A **learning outcome** is a statement of what a learner knows, understands and is able to do on completion of a learning process, which is defined in terms of knowledge, skills and competence (EQF – European Qualifications Framework, 2008).

Brief methodology for writing Learning Outcomes (learning object level)

- Describe in brief the learning object content.
- Underline all concepts (main topics) included.

- For each concept write at least one learning outcome in the desirable Bloom's taxonomy level (https://en.wikipedia.org/wiki/Bloom%27s_taxonomy).

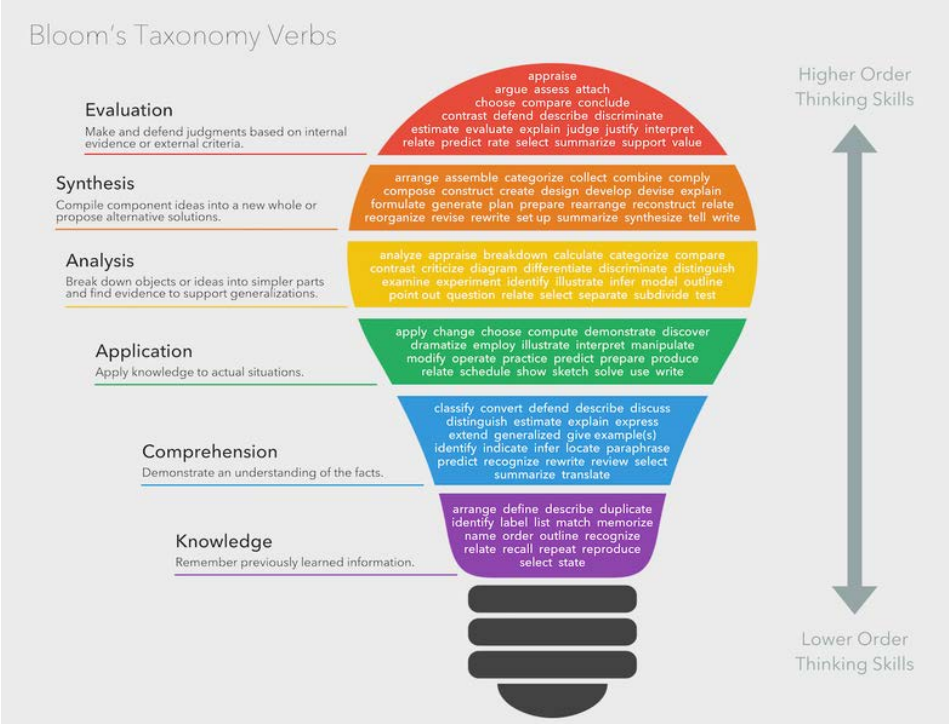

Figure 1: Bloom's Taxonomy Verbs
(retrieved on 1/2/2021
from: https://commons.wikimedia.org/wiki/File:Bloom%E2%80%99s_Taxonomy_Verbs.png)

- Subsequently, write learning outcomes for the Affective and Psychomotor domain.

Guidelines for writing Learning Outcomes (Cognitive domain)

- Each learning outcome should refer to one and only level in Benjamin Bloom's taxonomy
- Each learning outcome should contain one and only one action verb; use the list of verbs associated with each level in the taxonomy
- Each learning outcome should contain one concept of the knowledge domain
- The learning outcomes must be observable, measurable and capable of being assessed

- Avoid complicated sentences. If necessary use more than one sentence to ensure clarity

According to the above points, a learning outcome should be:

(**Active verb** – Bloom's taxonomy level) + (**Criterion**)
+ (**Concept of the knowledge domain**) + (**Condition**)

Examples:

Level 1: Knowledge	**describe** the **7** main phases of an **information system development life cycle** Active verb · Criterion · Concept
Level 3: Application	**construct** the **conceptual model of a database** using the **entity relationship model** Active verb · Concept · Condition

Further readings

Learners are instructed to read more information on how to define, write and apply effective Learning Outcome in the CEDEFOP guidelines document "**Defining, Writing and Applying Learning Outcomes**"
(https://www.cedefop.europa.eu/en/publications-and-resources/publications/4156)
in order to ensure (between others) compliance with **European Qualifications Frameworks (EQF)**
(https://europa.eu/europass/en/european-qualifications-framework-eqf)
according to the **Bologna Process**
(https://ec.europa.eu/education/policies/higher-education/bologna-process-and-european-higher-education-area_en).

1.4 Metadata schemas – profiles

Metadata is data that provides information about other data. In other words, it is "data about data" (https://en.wikipedia.org/wiki/Metadata, https://www.w3.org/WAI/WCAG21/Understanding/understanding-metadata).

Metadata are used to describe the features of a resource (digital or not) using a set of elements (additional data). Thus, metadata makes easier data's management and retrieval. The great importance of metadata lies in the fact that the "meta"-information they convey is machine readable, therefore their utilization for the characterization of resources can lead to improved handling of resources especially the digital ones. A set of metadata elements combined so as to serve a specific purpose, constitute a *metadata schema*.

These elements can be basically categorized as follows:

- **Descriptive elements** provide descriptive information about a resource. It includes elements such as title, abstract, author, and keywords.
- **Structural elements** include information about containers of data. They describe types, versions, relationships and other characteristics of a resource.
- **Administrative elements** are information to help manage a resource, like resource type and dates (creation, publication etc).

Well-known specifications (schemas) for metadata include:

- Metadata Encoding and Transmission Standard (METS) scheme (https://www.loc.gov/standards/mets/)
- Dublin Core Metadata Initiative (DCMI) terms for cross-disciplinary resources (http://dublincore.org/)
- IEEE Standards (https://www.ieee.org/)

Although the adoption of a single metadata standard would assure reusability of resources and interoperability among applications, there exists no metadata schema yet, appropriate to fulfil the requirements and needs of every application. Some schemas focus on technical metadata, other on educational metadata while some other on more specialized elements. When existing approaches are not sufficient enough to cover the special requirements of an institution or organization, the use of **metadata profiles** is suggested. According to Heery & Patel (2000), a metadata profile is a set of metadata elements selected from a number of metadata schemas which constitute a new compound schema.

1.5 Metadata in education

In order to describe learning objects, or any other kind of educational material, it is necessary to exploit an appropriate metadata schema, able to describe the educational characteristics of resources, that goes beyond some simple metadata elements; because of the enormous growth of learning objects requests, this is stated as a necessity (Recker & Wiley, 2001). Therefore, except for some common fields, like *author*, *title*, *language* or the *type of a resource*, an educational metadata schema should include elements which feature the pedagogical characteristics of a resource (e.g. its learning type, learning outcomes that satisfies, intended audience, method of interaction with user, etc.) or other type of information concerning the learning process.

In brief, the educational metadata allow:

- Searching, evaluation, retrieval and use of educational resources from both tutors and learners.
- Sharing and exchange of educational resources among every learning system.
- Consideration of educational resources as units that are possible to be combined composed or decomposed, leading to the creation of new resources.
- The automatic and dynamic creation of individual courses with the aid of intelligent agents.
- Both reading and documentation of existing or new learning outcomes and goals that are related to the educational resources.
- The characterization of the educational content, in a standardized way by the educational organizations.
- The provision of standards to the researchers which support the collection and the exchange of comparative data as regards as the appropriateness and effectiveness of the learning resources.

The most commonly used metadata standard in education is **IEEE LOM**. The IEEE Learning Technology Standards Committee (LTSC) has created a standard for the description of learning material and learning resources, known as IEEE Learning

Object Metadata[4] (IEEE LOM). IEEE LOM is without doubt a widespread standard for educational metadata and focuses mainly on the description of educational resources and especially LOs. It includes more than 60 elements classified into 9 categories (*General, Life Cycle, Meta-Metadata, Technical, Educational, Rights, Relation, Annotation, Classification*), each one of them containing metadata for various aspects of a LO, including its technical characteristics and rights, as well as educational and instructional features.

Further readings

Learners are instructed to read more information on learning object, learning outcomes and educational metadata profile in:

1. Solomou, G., **Pierrakeas, C.,** & Kameas, A. (2015). Characterization of Educational Resources in e-Learning Systems Using an Educational Metadata Profile. *Educational Technology & Society*, 18 (4), 246–260. (which can be retrieved from: https://www.jstor.org/stable/jeductechsoci.18.4.246?seq=1#metadata_info_tab_contents).
2. Nikolopoulos, G., Solomou, G., **Pierrakeas, C.**, & Kameas, A. (2012, September). Modeling the characteristics of a learning object for use within e-learning applications. In *Proceedings of the Fifth Balkan Conference in Informatics (Novi Sad, Serbia: ACM New York, 16-20 September)* (pp. 112-117). ACM. (which can be retrieved from: https://dl.acm.org/doi/10.1145/2371316.2371338).
3. Nikolopoulos, G., Kalou, A., **Pierrakeas, C.**, & Kameas, A. (2012, November). Creating a Learning Object metadata profile for Distance Learning: An ontological approach. *Metadata and Semantics Research* (pp. 37-48). Cádiz, Spain: Springer-Verlag Berlin Heidelberg, 28-30 November. (which can be retrieved from: https://link.springer.com/chapter/10.1007/978-3-642-35233-1_4).

[4] https://standards.ieee.org/standard/1484_12_1-2002.html

1.6 Intro to Open Educational Resources (O.E.R.)

Copyright, according to the Berne Convention for the Protection of Literary and Artistic Works (Paris Text 1971) (https://www.law.cornell.edu/treaties/berne/), is the exclusive, legally secured right to reproduce, distribute, and perform a literary, musical, dramatic, or artistic work) and intellectual property have national legislation, but books, movies and many creative products have always had an international distribution and there's an international convention that offers protection. The Berne convention protects copyright, commercial and moral rights on literacy and artistic works.

For an author to obtain such protection there is no administrative procedure or registration (even though there may be additional legislation or rules according to the country of origin): protection is automatic from the moment his work is published.[5] Therefore, the "author is automatically entitled to all copyrights in the work and to any derivative works, unless and until the author explicitly disclaims them or until the copyright expires" (https://en.wikipedia.org/wiki/Berne_Convention).

Nowadays, the web offers to anyone through easy to use tools and the plethora of available information the opportunity to create their own educational / learning contents among all other types of content. So, individuals can create, modify and disseminate content easily.

However the content that individual can create, modify and disseminate should not be copyrighted already; otherwise they should contact and seek permission from the author or the copyright holder to use the parts of the material they wish.

An exception is the material that exists in the Public domain (CC0 - https://en.wikipedia.org/wiki/Public_domain) concerning content the copyright period of which has expired or the content author of which has decided to make it available

5 Berne Convention for the Protection of Literary and Artistic Works (Paris Text 1971). Article 5/ 2 "The enjoyment and the exercise of these rights shall not be subject to any formality and shall be independent of the existence of protection in the country of origin of the work."

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freely with no rights reservation. Since 2001, authors and copyright holders may also publish their work with some rights reserved using new copyright rules to distribute their work. The most recognized such rules are those created by the **Creative Commons Foundation** (https://creativecommons.org/).

Creative Commons licenses[6] offer different combinations of the author's rights for their work in order to be able to share their works according to the model "**Some rights reserved**".

Each license corresponds to the legal text that the copyright holder signs off by simply adding the respective license name to the work itself. An author can decide to release his work with less restricted copyright regulations.

Therefore, educational resources with no rights reserved (CC0) or with some rights reserved (Creative Commons – CC) can be considered as **Open Educational Resources OER)**.

But again, there is not one single definition of Open Educational Resources, and among researchers there are diverse perspectives concerning OER models of management and pedagogy (e.g. nature of the resource, source of the resource and level of openness of resources).

The table 1 below (Ossiannilsson 2019) represents which are the OER requirements / features for various organizations and quickly shows that the debate on what OERs are is still an issue.

Table 1. Overview of OERs requirements by organization

	Open copyright license required	Right of access, adaptation, and republications.	Non-discriminatory (rights given to everyone, everywhere)	Does not limit use or form (does not include NonCommercial limitations.
Hewlett Foundation	✓	✓	✓	✓
OECD		✓		
UNESCO	✓	✓	✓	✓
Cape Town Declaration	✓	✓	✓	
Wikieducator OER Handbook		✓	✓	✓
OER Commons		✓	✓	✓

[6] see next unit for a definition of the term

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Open educational resources (OER) are free and openly licensed (usually digital) educational material that can be used for teaching, learning, research, and other purposes and can be distributed with licenses (called “open”) that allow them, without cost, to be legally available (with or without restrictions) on the Internet for anyone to:

retain, reuse, revise, remix and redistribute.

Generally, OERs include learning contents (e.g. textbooks, readings), applications (e.g. quizzes, assessment tools) and any other material that can be used for teaching and learning. They usually concern digital resources and each resource is issued under a license which explains how it can be used, usually under a Creative Commons or similar license for open or nearly open use of the content. Some materials can only be used in their original form, in other cases they can me modified or remixed by the resource's creator or its users.

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2. Searching, accessing and selecting OERs

2.1 Searching OERs

As detailed in the document by the Commonwealth of Learning and UNESCO *A Basic Guide to Open Educational Resources (OER)*[7]: "*The scope and availability of OER is ever expanding. [...] A current problem arising out of this growth is that there is no single comprehensive listing of all OER (nor, given the rapid expansion of content online, is there ever likely to be one). This means that, in order to find appropriate OER, the searcher will need to employ a number of search strategies*". The strategies include:

I. The use of a **specialized search engines** that search specifically for OERs, among them:

- Folksemantic: https://www.oerafrica.org/creators/folksemantic
- Open Courseware Consortium: http://www.oeconsortium.org/courses/search/

II. The identification of suitable **OER repositories**. Most of them are institutionally based, focusing on the materials released by the respective organization.

- OpenLearn: http://www.open.edu/openlearn/
- MIT OpenCourseWare: https://ocw.mit.edu/index.htm

III. The use of **OER directory sites**. There are many sites that have a search facility, do not act as a repository, but have identified quality resources and store them in a database of web links:

- OER Commons: https://www.oercommons.org/
- Commonwealth of Learning: https://www.col.org/programmes/open-educational-resources

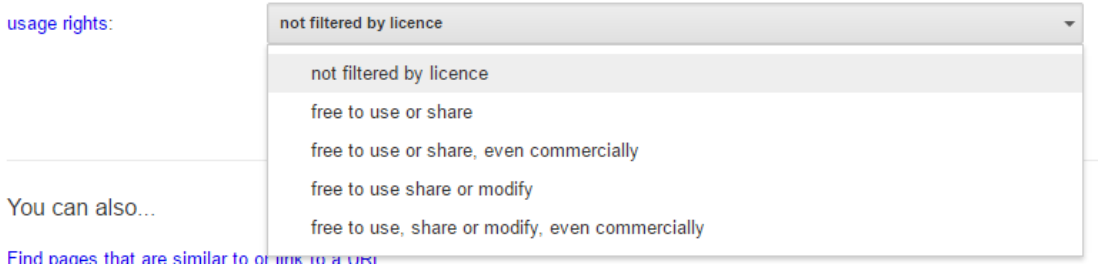
[7] https://unesdoc.unesco.org/ark:/48223/pf0000215804

- The Open Professionals Education Network, which has a guide to finding OERs with a collection of useful links: https://open4us.org/find-oer/

IV. Other resources

- Learning Resource Exchange (LRE) for Schools: http://lreforschools.eun.org/
- Scientix (The Community for Science Education In Europe: http://www.scientix.eu/resources

V. The most common and most widely used search engine the Google where you can modify your search in “Advanced Search” mode giving “usage rights” according to your needs:



VI. The search engine machine provided by the Creative Commons Organization (The Creative Commons Search): https://search.creativecommons.org/ which directs you to this new search portal:

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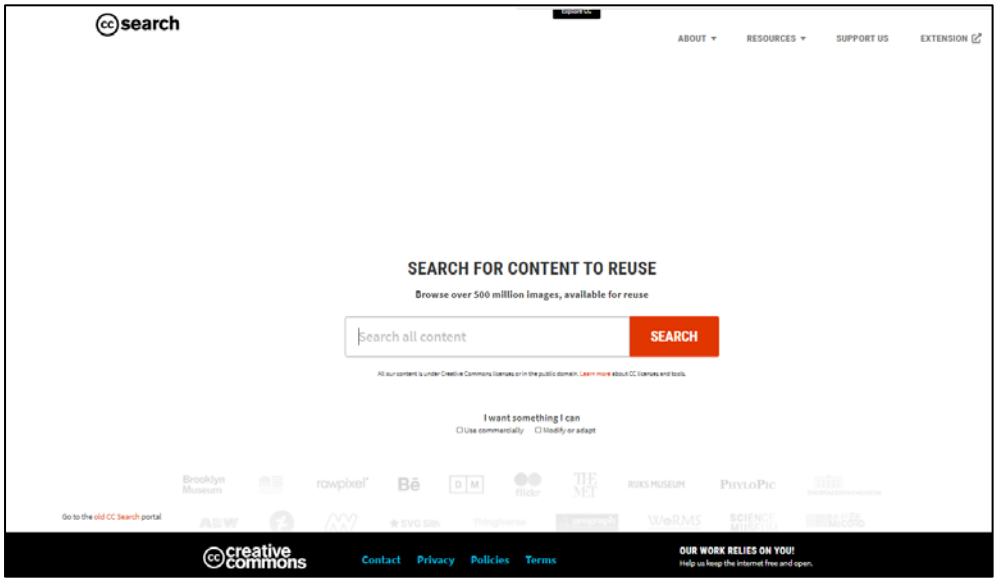
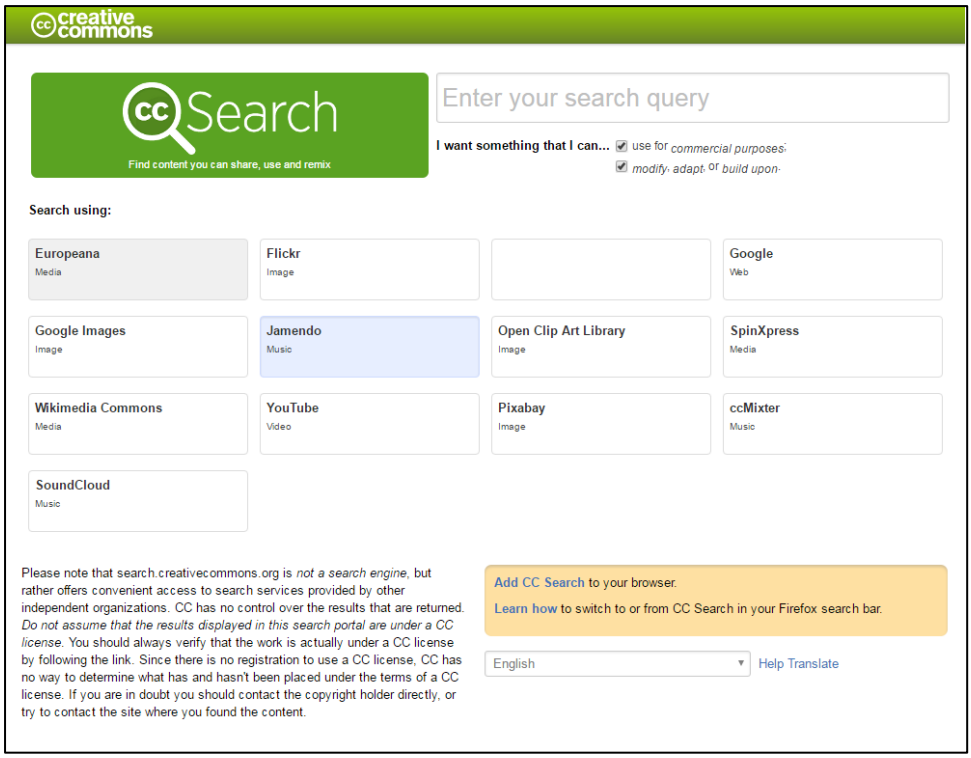


and from where you can go to the old search portal



2.2 Properly select OER

Identification of valuable resources

Another issue linked to the selection of OERs is their **quality**. Since OERs are educational resources, like all learning materials, their quality depends on their sources. In addition, not all OER collections possess an evaluation mechanism to share feedback among the users. Generally, the value of educational resources tends to decrease if not periodically updated. Therefore, it is very important to study and evaluate the digital OER contents before recommending or using them.

Maximizing usefulness of OERs

Furthermore, in order to maximize the usefulness of the selected OERs and depending on each specific case you should either:

a) Select properly licensed OERs which can be used for this specific case;

b) Create your own OERs;

c) Modify OERs if the licensing scheme so permits.

Regarding the last point, since it is more useful for learners to be given suggestions for short and targeted OERs than entire books or lectures, it is better to identify excerpts from large OERs and, if permitted by the licensing scheme, extract them and present them as independent OERs.

3. Licensing OER and Creative Commons (CC) framework

3.1 License and use of resources

Among the main concerns when selecting OERs is the **copyright**, the intellectual property and the possibility (and the ways allowed) to use them. **Licensing** provides the most evident means to check if and how the digital material can be used: it gives an indication of the kind of permissions given by the owner (person, group or organization that created it) to others for the use of such material. It is important to highlight that licensing does not affect intellectual property rights; indeed the necessity of open licenses was born by the desire to protect a copyright holder's rights in environments (e.g. Internet) where digital content can be easily copied and shared without asking permission. A broad spectrum of legal frameworks is emerging to govern how OERs are licensed for use.

The best known such framework is the Creative Commons (CC) licensing framework (see www.creativecommons.org). It provides legal mechanisms to ensure that authors of materials can retain acknowledgement for their work while allowing it to be shared, can seek to restrict commercial activity if they wish, and can aim to prevent people from adapting it if appropriate. As explained on the Creative Commons website, when choosing a resource the user should always verify that the work is actually under a CC license by checking info on licenses in the material. Since there is no registration to use a CC license, CC has no way to determine what has and hasn't been placed under the terms of a CC license. In case of doubt, the user should contact the copyright holder directly, or try to contact the site where he/she found the content.

An outlook on the **license conditions** will guide the partners to identify relevant OERs by (they can choose one or more of the following actions):

a) Selecting properly licensed OERs which can be used for the course;

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b) Creating their own OERs (or suggest resources they have created in other contexts) if properly licensed;

c) Modifying OERs if the licensing scheme so permits.

3.2 The Creative Commons (CC) framework

Creators or copyright holders who wish to apply a Creative Commons license to their work can choose the conditions of re-use and modification by selecting one or more of the restrictions listed below. Every Creative Commons license, except the Public Domain designation, requires users to give attribution to the creator of the work. Other restrictions are optional, and may prevent re-use in unintended ways, so care is suggested in applying the options.

As explained in the webpages of the Creative Commons[8] and Community College Consortium for Open Educational Resources (CCCOER)[9], the following conditions apply for authors (by the mean of licensor) and users:

Attribution (BY) (https://creativecommons.org/licenses/by/4.0/)

AUTHOR: All CC licenses require that others who use this work in any way give to the author credit the way the author requests. If someone wants to use a work without giving credit, he must get permission first.

USER: Users must give appropriate credit, provide a link to the license, and indicate if changes were made. Users may do so in any reasonable manner, but not in any way that suggests the licensor endorses them or their use.

[8] https://creativecommons.org/share-your-work/licensing-types-examples/
[9] https://www.cccoer.org/learn/open-licensing/

ShareAlike (SA) (https://creativecommons.org/licenses/by-sa/4.0/)

AUTHOR: The author lets others copy, distribute, display, perform, and modify his work, as long as they do it under the same terms. If someone wants to distribute modified works under other terms, he must get permission first.

USER: If a user remixes, transforms or builds upon the material, they must distribute the author's contributions under the same license as the original.

NonCommercial (NC) (https://creativecommons.org/licenses/by-nc/4.0/)

AUTHOR: The author lets others copy, distribute, display, perform, and (unless the author has chosen 'NoDerivatives') modify and use his work for any purpose other than commercially.

USER: The material cannot be used for commercial purposes.

NoDerivatives (ND) (https://creativecommons.org/licenses/by-nd/4.0/)

AUTHOR: The author lets others copy, distribute, display and perform only original copies of his work. If someone wants to modify author work, he must get permission first.

USER: If a user remixes, transforms or builds upon the material, he may not distribute the modified material.

Note: works licensed with the ND restriction are not considered OERs (in the strict sense).

The above mentioned conditions are combined into 6 Creative Commons licenses (plus CC0 - public domain waiver) and they apply worldwide. Table 2 below, taken from https://en.wikipedia.org/wiki/Creative_Commons_license summarizes the main features of the CC licenses:

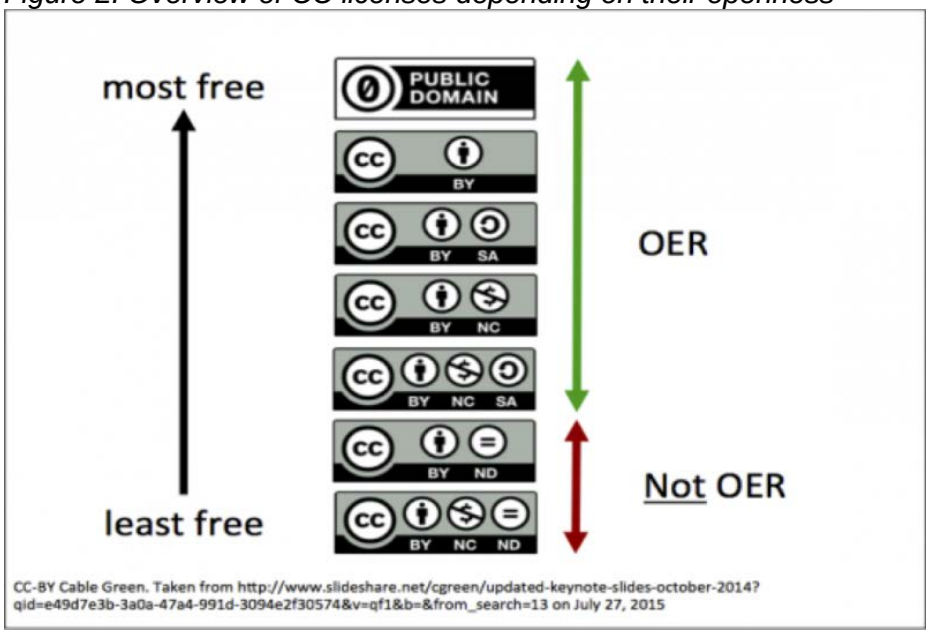
Table 2. Overview of CC licenses (retrived from: [https://en.wikipedia.org/wiki/Creative_Commons_license)](https://en.wikipedia.org/wiki/Creative_Commons_license)

Icon	Description	Acronym	Allows Remix culture	Allows commercial use	Allows Free Cultural Works	Meets 'Open Definition'
PUBLIC DOMAIN	Freeing content globally without restrictions	CC0	Yes	Yes	Yes	Yes
BY	Attribution alone	BY	Yes	Yes	Yes	Yes
BY SA	Attribution + ShareAlike	BY-SA	Yes	Yes	Yes	Yes
BY NC	Attribution + Noncommercial	BY-NC	Yes	No	No	No
BY ND	Attribution + NoDerivatives	BY-ND	No	Yes	No	No
BY NC SA	Attribution + Noncommercial + ShareAlike	BY-NC-SA	Yes	No	No	No
BY NC ND	Attribution + Noncommercial + NoDerivatives	BY-NC-ND	No	No	No	No

As shown in Table 2 "Overview of CC licenses", one main criterion applied to categorize OERs is the right to "adapt" material (not allowed by the 'NoDerivatives – ND' license). Therefore, someone could easily conclude that resources available under the fifth or the last CC licenses do not constitute OERs.

See also Figure 2 below, retrieved from https://www.cccoer.org/learn/open-licensing/

Figure 2. Overview of CC licenses depending on their openness



4. Creating, modifying, management and sharing of digital resources

4.1 Creating and modifying digital resources

The process of creating an OER is basically the same as the process of creating any educational resource: authors should first think about the object for which they will create material (idea); then, they can create content for this object (content) using specific tools (tools). The only difference is the authors' decision to grant some of their rights and characterize the created educational resource as an open source, marking their product with an appropriate CC badge.

Of course, the same should happen if, for the creation of an educational resource, authors use material which is already protected by open licenses like CC. Therefore, when someone creates an adaptation of a CC-licensed work, the simplest scenario is when he takes a single CC-licensed work and adapts it. The table 3 below shows how CC-licensed materials can be adapted to a new work.

Table 3: Adaptation of two CC-licensed materials to one (retrieved from: https://certificates.creativecommons.org/cccertedu/chapter/4-4-remixing-cc-licensed-work/)

Adapter's license chart		Adapter's license						
		BY	BY-NC	BY-NC-ND	BY-NC-SA	BY-ND	BY-SA	PD
Status of original work	PD	■	■	■	■	■	■	■
	BY	■	■	■	■	■	■	■
	BY-NC	■	■	■	■	■	■	■
	BY-NC-ND	■	■	■	■	■	■	■
	BY-NC-SA	■	■	■	■	■	■	■
	BY-ND	■	■	■	■	■	■	■
	BY-SA	■	■	■	■	■	■	■

The more complicated scenario is when an author adapts or remixes pre-existing resources with different CC licenses to a new educational resource. The following table 4 is a useful guide for these cases. So, if you want to use two resources for

adaptation or remix, then find the license for the first work in the rows and the license for the second work in the columns. If there is an "X" in the intersection cell, then the works probably cannot be adapted or remixed, unless there are some exceptions; otherwise, if there is a check mark, then the two works may be adapted or remixed without problems.

Table 4: Ability to remix two resources with different CC licenses (retrieved from: https://certificates.creativecommons.org/cccertedu/chapter/4-4-remixing-cc-licensed-work/)

	PUBLIC DOMAIN	PUBLIC DOMAIN	BY	BY SA	BY NC	BY ND	BY NC SA	BY NC ND
PUBLIC DOMAIN	✓	✓	✓	✓	✓	✗	✓	✗
PUBLIC DOMAIN	✓	✓	✓	✓	✓	✗	✓	✗
BY	✓	✓	✓	✓	✓	✗	✓	✗
BY SA	✓	✓	✓	✓	✗	✗	✗	✗
BY NC	✓	✓	✓	✗	✓	✗	✓	✗
BY ND	✗	✗	✗	✗	✗	✗	✗	✗
BY NC SA	✓	✓	✓	✗	✓	✗	✓	✗
BY NC ND	✗	✗	✗	✗	✗	✗	✗	✗

4.2 Tools for Creating OERs

It is appropriate for creating OERs to use open and free tools. Below is a list of various such tools that could be used to create OERs.

- LibreOffice - Office suite with the same basic functions as Microsoft Office. It is compatible with MS Office and is open source and free.
- OpenOffice - Office suite with the same basic functions as Microsoft Office. It is compatible with MS Office and is open source and free.
- Google Drive – Suite which offers word processing, spreadsheets and a presentation tool as well as a tool for creating forms, all online. It also offers file sharing and storage capabilities. It is not open source but it is free (free of charge).

- SlideShare – It allows the upload of presentations and their embedding in pages, blogs, and more.
- Pixlr - It allows online image conversion but also offers design possibilities. It is not open source, but it is free.
- Dia - Free, open source tool for creating charts and saving them in various formats.
- GIMP - Free open source tool that allows image editing, similar to Photoshop.
- GreenShot - Free open source tool that allows you to create screenshots of a selected region, window or fullscreen, resize images and add markers on them.
- Flickr - Platform that allows the upload and sharing of images, as well as content search to build your OER (they use Creative Commons).
- Audacity - Free open source tool that allows you to record and edit audio.

4.3 Mark your digital resource with an open-license badge

Finally, you can mark your work by inserting the appropriate CC badge in it. You can download your desired badge from https://creativecommons.org/about/downloads, where all badges are given in a number of different formats in order to suit your needs.

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