Learning Object Metadata and discoverability of STEM educational resources

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Introduction

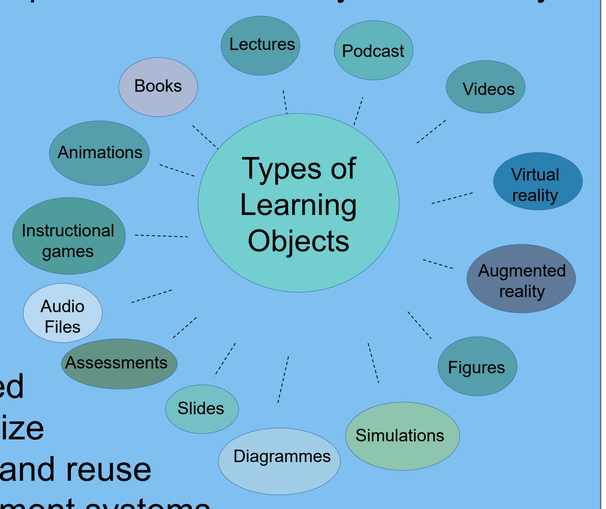
It is crucial for teachers to use appropriate learning resources to support student learning. Learning Object Repositories (LORs) provide a set of learning resources that can be used to implement lesson plans.

The content of the LORs is indexed so that interested parties can search and retrieve learning objects. Learning Object Metadata (LOM) is a metadata standard that can be used to describe learning resources in a typical way by providing discoverability.

Since STEM is a broad-spectrum field of science, in order for relevant educational resources to be labeled, well-defined STEM subject classifications should be used. Using taxonomies, learning resources can be categorized at different levels and topics and more easily identified by stakeholders.

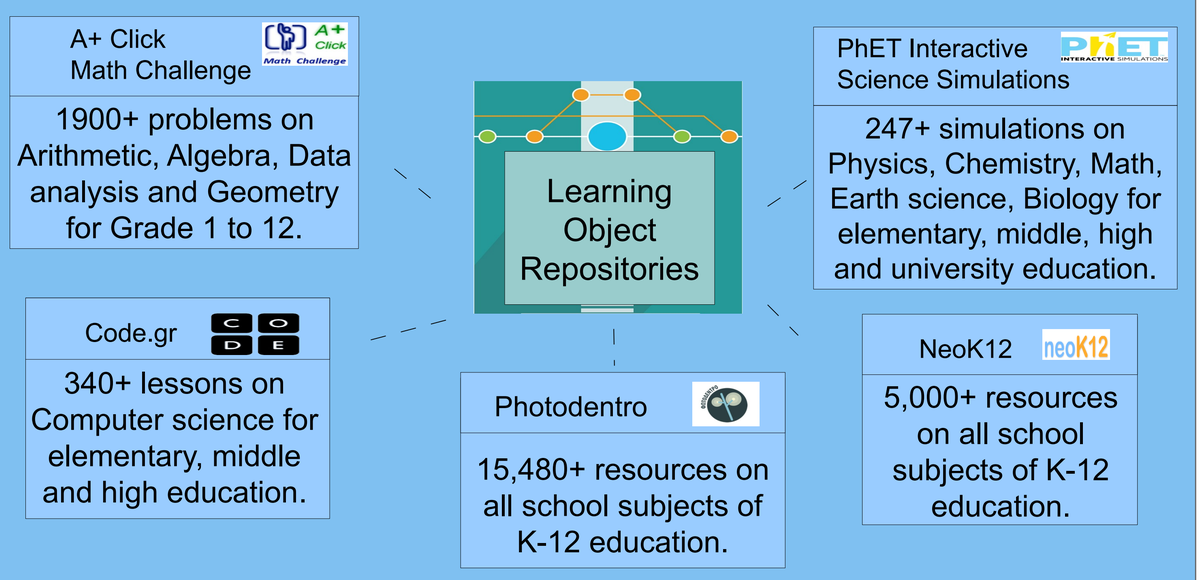
Learning Objects

A wide definition of the term Learning Object, as provided by IEEE working group, is that a Learning Object could be "*any entity digital or non digital that may be used for learning, education or Training".* Learning Objects are designed to reduce the cost of learning, standardize learning content and to enable the use and reuse of learning content by learning management systems.



Learning Object Repositories

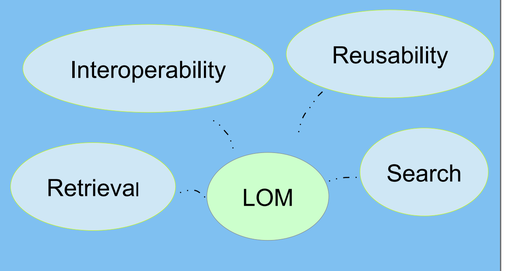
Learning Objects repositories (LORs) make learning resources more accessible through the creation and availability of shared information resources. They provide teachers and other stakeholders a plethora of learning objects that could use to support their lesson plans.



IEEE LOM

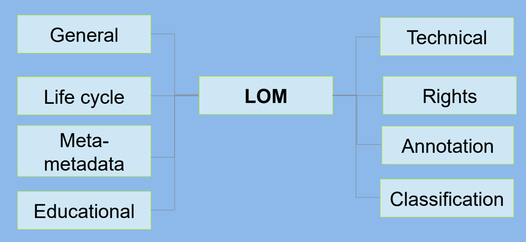
Discovering and filtering suitable LOs from a wide collection, which may be included in different educational repositories, is not an easy task. To make the search easier and to enhance interoperability and reusability of LOs there is a need of tagging their content description with metadata.

The Learning Object Metadata (LOM) standard, published by the IEEE Learning Technology Standards Committee (LTSC), specifies a conceptual data schema that defines the structure of metadata instance for a LO.



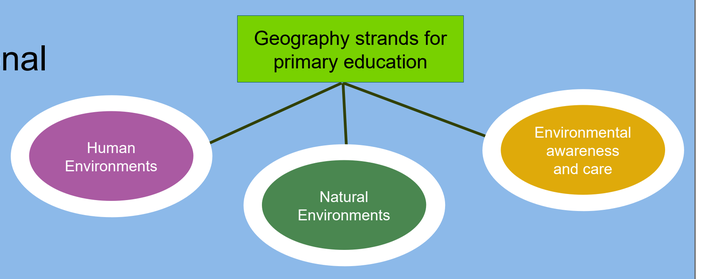
LOM fields can be used for tagging LOs, thus helping stakeholders to chose a LO based on the desired subject domain they aim to teach including filtering options on resources based on their format, technical requirements and others.

It supports discoverability by describing characteristics of LOs based on the categories: **General, Life cycle, Meta-metadata, Educational, Technical, Rights, Annotation, and Classification**.



LOM and STEM

In LOM that concern STEM educational resources, different taxonomies and vocabularies can be used, to guide metadata creators and retrievers of LOs to classify and detect the relevant resources.



For example, when the 1999 Irish 1st and 2nd Class Geography curriculum is used as a vocabulary for tagging geography LOs, the strands "Human environments", "Natural environments" and "Environmental awareness and care" can be used for describing a geography LO.

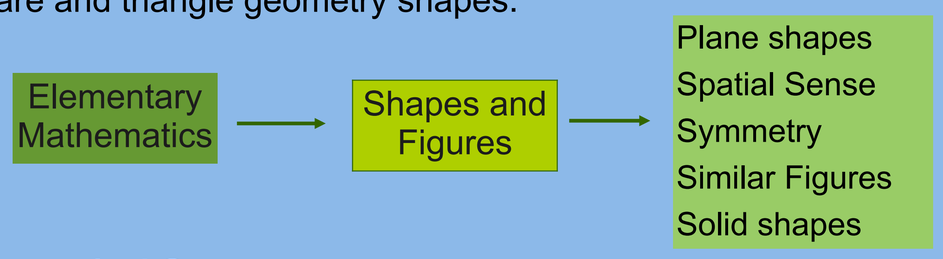
The ARETE STEM LOs

The ARETE H2020 project uses Augmented Reality (AR) immersive technology applications in primary school context to understand the contribution of AR technology in education. It enables disruptive innovation of AR for interactions, access and distribution of AR content to be fully realised through three different pilots. Pilot 2 concerns the STEM subject domain and supports the project by developing geometry and geography applications and by distributing the LOs included in the apps. For the ARETE project needs, so far have been defined 21 LOs for pilot 2's applications.

The taxonomies that were used to classify the LOs identified for pilot 2 focus on the subjects of mathematics and geography education. These taxonomies include different unit levels by providing the different areas of the fields that someone would like to target on.

7 geometry LOs:

- A geometry workbook along with an included collection of geometric building blocks (tangibles LOs).
- 5 collections of AR assets corresponding to the circle, hexagon, rectangle, square and triangle geometry shapes.



14 geography LOs:

- A geography map of the world along with its workbook (tangibles Los).
- 7 collections of AR assets corresponding to the animals, plants, volcanoes, bases and heritage per continent including: Africa, Antarctica, Australia, Eurasia, Europe, North America and South America.
- 5 collections of animals, plants, volcanoes, bases and heritage of the world in-depended of the continents mentioned earlier.

The STEM learning objects which were defined for pilot 2, as well as the non STEM learning objects of the other pilots, will be accommodated in the ARETE Moodle learning repository accompanied by LOM metadata facilitating their discoverability.

References

Primary School curriculum, Geography. Social, Environmental and Scientific Education, Teacher guidelines, 1999, reviewed on 17 May 2021, https://www.curriculumonline.ie/getmedia/86f7ee50-2437-4327-a7c9-4a03ce7565a1/PSEC03b_Geography_Guidelines.pdf

Core Subject Taxonomy for Mathematical Sciences Education, "Final" Draft Proposed by the Mathematical Sciences Conference Group on Digital Educational Resources, 2002, reviewed on 17 May 2021, https://services.math.duke.edu/education/mathnsdl02/math-taxonomy-0202-1web.htm

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