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A federate reference structure in an open informational ecosystem

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Abstract

The paper will describe a federate ecosystem for OER using the example of the German educational system ,where a variety of ROERs (Muuß-Merholz & Schaumburg, 2014) and reference platforms have been established over the past years. In order to develop this ecosystem not only metadata standards are necessary, but also open APIs to exchange information. In conclusion, it is essential that all relevant stakeholders agree on one transparent policy that they develop collaboratively. A metadata exchange service can act as the connector of all partners.

Introduction

Digital Media are not a value or target in learning processes as such. They need to be adjusted to overall targets of teaching and learning in general. Surely digital literacy, computer and information literacy can be such targets. But also learning in different subjects can be supported or enhanced by the use of digital media. Krischner (2015) has recently pointed out, that digital media are not to be regarded as something special, as something to add to normal teaching and learning. In general they should be part of day-by-day teaching. Fullan (2012) argues that pedagogy, technology and the management of change processes in School must be seen as a unit. To do so a variety of be conditions must be met. One is that teachers need educational resources to be used in their teaching.

These digital resources can bring some added value to teaching and learning. Digital media can bring together text, audio, video and animations. They can easily be adapted to a certain learning group and it is easy to distribute them to many learners. Another set of advantages is the possibility to rearrange materials, to combine them and to put them into another context. These new materials can be republished and shared with others. The advantages of digital media are accompanied by risks and uncertainties. The questions educators ask are about the right to put contents in a LMS, the right to copy files for learners. But also the question: Do I have the right to remix, share and republish materialis? In other words: To benefit from digital possibilities some legal issues have to be solved. The answer to most of these questions seem to be the use of open educational resources (OER). Materials are publised under an open licence that makes it easy to benefit from what Wiley (2014) call the 5R of OER: retain, reuse, revise, remix and redistribute.

Initiatives around the world have adapted the idea of OER and we can find many repositories of OER (ROER) (Atenas & Havemann, 2014). They fulfill some tasks to bring the idea of OER to users and in some cases users (teacher or learner) will be satisfied with the material they can find in one or some ROERs. Yet unsolved and underestimated is the question how to enhance transparency between different ROERs (Conole & Alevizou, 2010) Only a variety of ROERs does not seem to fit all needs of users. It is inconvenient to search many ROERs to find appropriate material (Allan, Seaman 2014). In ROERs recommendations of other teachers or from teacher training institutions may be missing, for a single ROER it might by possible to get sufficient users using the OERs, but only a small part of them will leave comments. To close this gap it seems to be helpful, to use referatories or reference systems or platforms. Here users can find references to OERs in many ROERs and the metadata in a referatory can come from different independent actors: editorial staff can give recommendations, they can put materials in the context of a topic, age group etc. Users themself can do the same. They can rate, tag and describe materials and they can add their view on a material; they can report how the materials actually have been used in teaching and learning. Finally crawler can automatically aggregate metadata (Heinen, Blees, Kerres, & Rittberger, 2014). Another advantage of referatories: They can include references that haven't been published as learning materials in first place, but have been used by teachers or students in learning processes (Kerres, 2013).

Open informational ecosystems

So far we described a system of repositories and referatories of OER that can be called an informational open ecosystem. An ecosystem like this allows for any provider of contents to "plug into" the ecosystem by providing meta-data and retrieve them from a referatory. Contents and meta-data can be used in different places and metadata from different sources can be combined to enrich the set of metadata that describes a resource.

It is not only possible to arrange the flow of contents, resources and metadata in an open system. Users can benefit from closed systems, too. The find everything in one place and have a smooth user experience. But they find themselves locked into the boundaries of such a system. From an educational point of few there are reasons to arrange teaching and learning materials in an open ecosystem (Kerres & Heinen, 2015). But this doesn't necessary means that all aspects of a system have to be open. For various reason the right to change, remix, share and republish some resources might be restricted. Access to collections of resources can allowed only for specific target groups and maybe a closed learning management system can be the best place to use open resources. Finally open educational processes can be build completely on closed resources. Fig. 1 shows the complexity, we just described.

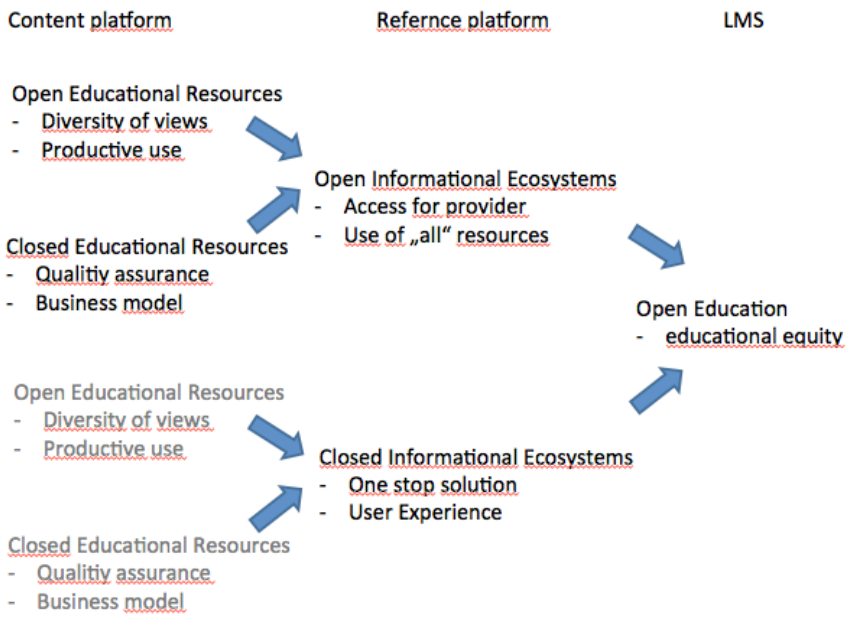

Figure 1: Aspects of openness and closeness in informational ecosystems

To fulfill the idea of an informational open ecosystem a decentralized and federated system of interconnected services needs to be designed. To reduce the complexity of an ecosystem and to make it easy for different players to contribute to and benefit from it, a centralized metadata exchange service is proposed. This service can manage the exchange of metadata and translate different metadata standard. The service has to offer a variety of APIs. Different player than only have connect to this service to be connect with all services within the ecosystem. A crucial point is the indecency of the centralized service as is has to guarantee the free and open access for all participants (provider and user). Building federated or decentralized systems of interconnected services seems to be a difficult task as there are not only questions of exchange formats and APIs to be answered but also complex practices – often invisible for users and / or authors – need to be aligned to attract different players to take part. Although the intermediation of the reference infrastructures is challenging, it offers a great chance at the same time; each player benefits from each other by enriching the choices of users and the diversity of OERs (Figure 2) .

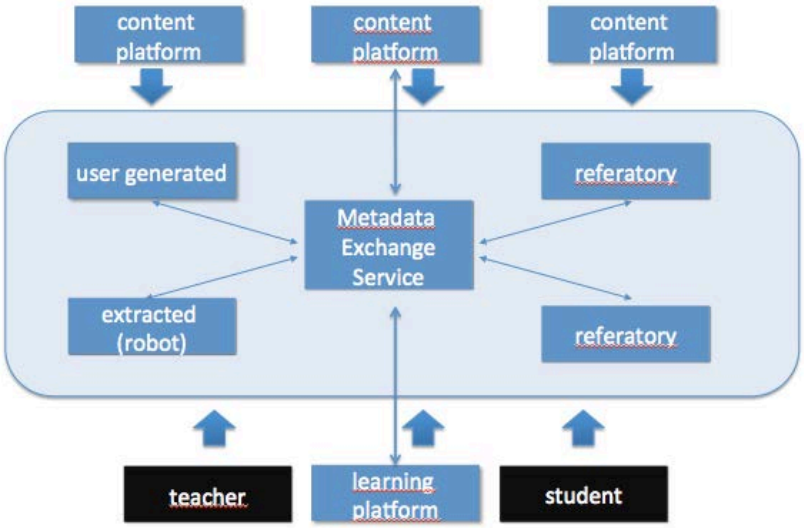

Figure 2: Federated reference Infrastructure as open informational Ecosystem

The example of the German educational system

The German educational system and its federated configuration are not fond of the establishment of a centralized OER system. But while each federal state has its cultural sovereignty (e.g. school system) with its own curricula and quality process for schoolbooks it offered the chance to establish a decentralized OER reference infrastructure, which entails an open ecosystem.

In Germany, the federal states established in the 1990s educational servers ("Landesbildungsserver") to inform about their educational system. Most of the educational servers begun as well to create references for educational resources on the Web and aggregated these in resource databases, which were recently linked to local curricula. On the nation state level the German Educational Server ("Deutsche Bildungsserver")[1] creates together with the federal state servers a network of expertise and infrastructural development. On this base the network of educational servers started 2007 the federated reference infrastructure ELIXIER[2] by developing a LOM-oriented metadata standard to exchange the references and offering one common search interface to the shared pool.[3] To address the needs of teachers to have the capability to decide, which resource fits best for their educational situation, open and non-open educational resources (O/ER) are indexed.[4] Additionally, it offers a first developmental step for a federated infrastructure, where various providers of educational resources (e.g. publisher, NPOs) would be able to contribute for a

[1] See www.eduserver.de
[2] See a German description at http://www.bildungsserver.de/elixier/ueberuns.html
[3] The educational server of Switzerland (educa.ch) followed a similar approach for his digital schoolbook library (http://biblio.educa.ch/de). On a European level act the portal (http://www.openeducationeuropa.eu/) and the European Schoolnet (http://www.eun.org/).
[4] So far eight federal educational servers and four partners created a common pool of more than 50.000 O/ER, whereby nearly 5.000 are described as OER.

networked reference pool of O/ER instead of competing against each other and building closed ecosystems.

The network of educational server in German can be regarded as a prototype for an open ecosystem. Such an ecosystem that focuses on integrating diverse repositories has to cope with at least two main problem dimensions.

On the one hand there are problems with a multitude of different controlled vocabularies for repositories. The particular federal states have diverging subject classifications, curricula and accordingly a plurality of metadata frameworks and editorial processes. By the development process of the ELIXIER project the heterogeneity of 16 state specific standards are integrated in one framework, also called ELIXIER.[5] There are bidirectional mappings: for the export of proprietary metadata into the joint target format (=ELIXIER) and vice versa for the import into the state specific classifications and further regional characteristic educational entities.

A workaround helps to integrate more content providers that also have their own taxonomies. There are some often used repositories of educational content in Germany like Lehrer-Online, Zentrale für Unterrichtsmedien or the community driven Serlo. For their resources there is a harvesting procedure with edutags.de – itself an accompanying project for ELIXIER that concentrates more on crowdsourcing and evaluating of resources by the community. By this edutags.de contains several thousands of OER that are reworked and enriched by editorial staff in a pilot project according the ELIXIER standard. In so doing semantic mappings for these partial collections are built, whereby further subsets of these repositories can be integrated into ELIXIER and the repositories get the chance to import suitable resources from the entire ELIXIER collection to integrate them systematically into their taxonomies. The connectivity of additional repositories and their controlled vocabulary can be extended in that way, the human editorial matching eventually supported by methods of natural language processing.

On the other hand there are problems with different metadata schemes. There are basically two scenarios to approach them (Ziedorn et al. 2013).

The first scenario consists in the usage of one unitized standard. On that central standard all other standards could be mapped. And it yields the potential for the unifying of search options. For example search engines like Google could better index the resources. A standard named LRMI6 was created for that very semantically enriching of search indexes and could thus in principle facilitate the findability of OER without the need of having a special portal for this.

But a dedicated platform for educational use is also furthered by a unitized standard. And despite additional effort for building and maintaining of such a platform it yields some substantial advantages compared with the problems of delegating the whole job to search engines. A first risk of delegating is the interference of search results by

[5] Elaborated Lists in XML for Internet Educational Resources
[6] Learning Resources Metadata Initiative

SEO. A second risk is the imponderability if and how the richness of metadata will really be implemented for the sake of the user. It is not so sure that search engines will consider domain specific search filters in their development. This leads to the third risk that the discoverability of educational resources will be made dependent of the interests of search engine providers that can hardly be predicted let alone controlled. The advantages of an independent platform of e.g. a neutral public provider would be a ranking of search results solely by topicality, the customizable design of the search interface and the capacity of control over the deployed technology.

But besides the problem with a loss of domain specific semantics by melting down to a least common denominator there is the problem that to some evidence it is very improbable that a multitude of content providers would be able to agree on one standard. Rather there will be to some extent a coexistence of metadata schemes and interfaces. That leads to the second scenario for the handling of metadata problems: the coexisting schemes are left unaltered no one is preferred.

But surely then comes problems with federated search and interoperability. A pragmatic approach should be a metadata exchange service that is able to integrate as many as possible resources by collecting a set of widely accepted schemes, translating them within that service and providing them for reuse in that diversity or if required making them accessible by an integrated search facility.

Actual joint efforts of ELIXIER with other collections may illustrate requirements of a metadata exchange service. The metadata specification of ELIXIER is designed in the spirit of the Learning Objects Metadata (LOM) standard, the metadata exchange is run by the import or export of XML files or by the use of a REST-API with JSON data format. Open Education Europa is a portal initiated by the European Commission with the aim of making OER accessible and discoverable from all over Europe. For metadata exchange the OAI-PMH interface is used in combination with the mandatory Dublin Core (DC) standard. It has to be said that Dublin Core is not so suitable for educational purpose because characteristics like e.g. learning resource type, typical age range or intended end user role (teacher, student) are not included. I2geo is also a collection with a European Commitment that aggregates interactive geometry resources complemented with some community and evaluation features. Consequently i2geo has a LOM application profile and a DC specification as fallback option, the interface is implemented with OAI-PMH.[7]

These examples recommend that there be a central instance for collecting, providing and translating that is: a metadata exchange service. The apt metadata specifications should be LOM – including the German application profile variant ELIXIER – and LRMI yielding extra connectivity for search engines. First approaches for mapping

[7] http://i2geo.net/files/deliverables/D2.4-Metadata-Spec.pdf

ELIXIER, LOM and LRMI can be found on the site of DINI-KIM-AG[8]. If it necessary to account for DC the due granularity reduction is easily been made. Interfaces of choice can be a lightweight REST-API with JSON like in ELIXIER or the more regulated OAI-PMH that firstly was designed for library applications but is also common in the educational realm. The metadata exchange service can be expanded stepwise with additional interfaces and metadata schemes depending on future acceptance and the importance of repositories that want to join the OER network.

[8] https://wiki.dnb.de/pages/viewpage.action?pageId=94678918 ; DINI-KIM-AG is a working group at the German Initiative for Network Information named compentence centre for interoperable metadata, http://dini.de/ag/standards/

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