Experiences with the Learning Resource Exchange for schools in Europe

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Summary

This paper reports on the experiences of the first large scale effort to share educational resources for schools in Europe. As such it does not address authoring or the use of learning resources, but provides experiences of interest to any organisation wishing to act as an educational content broker, matching supply with demand.

Even though there are many educational resource repositories, they are many times inaccessible to teachers due to a number of reasons, such as not knowing about their existence, the different ways of describing the content, language barriers, etc. In order to overcome these difficulties, the Learning Resource Exchange (LRE) brings together educational content from trusted providers from all over Europe and makes it available again to interested parties. This requires the implementation of a number of technical solutions, including a so-called "federation of repositories" with a common application profile for the metadata standard used and its accompanying validation services.

Concerning educational content, this paper reports on the use of open content licenses and the difficulties of implementing them; the indexing of content by experienced professionals and by casual users; automatic translation and automatic metadata generation, and perceived pedagogical benefits of the resources provided.

By implementing and using a portal for the LRE, European teachers have obtained deeper insights in searching and browsing, finding the offered learning resources useful for the classroom and appreciating the cross-linguistic and cross-border use of content. The concept of an international portal was also considered as an important opportunity for cultural exchange and a way to broaden horizons in terms of getting new ideas for teaching from other countries.

Keywords: LRE, Learning Resource Exchange, educational content, classroom material, content exchange, multi linguistic, repositories, European schools, elearning, teachers, portal

1 Introduction

Educational content involves a number of activities going from its creation to its use (see [Van Assche, Vuorikari, 2006] for a detailed coverage of the different activities). However, the work reported here focuses on the different aspects of **sharing content** and not on the authoring or the use of content (except indirectly). More particularly the focus is on sharing content in a European school context which is by nature multi-lingual and multi-cultural. Across Europe, Ministries of Education, regional educational authorities, commercial publishers, cultural institutions and other commercial and non-profit organisations are now offering extensive

catalogues and repositories of online content to schools. For example Tzikopolous, et al., [2009] give an overview of 59 Learning Object Repositories, and the number is growing.

While an abundance of learning resources is available today, they are difficult to access for teachers outside their own environment for a number of practical reasons, such as not knowing the existence of the dozens of learning repositories, different search mechanisms, different ways of describing the educational content, language barriers, etc. The problem is multi-faceted and complex. It requires interoperability of heterogeneous technical environments, harmonisation of ways of describing, exposing, discovering, and obtaining content, as well as approaches for its introduction into a classroom environment. Any solid solution will need to address these different aspects and hence this paper reports on the experiences in these different areas.

The Learning Resource Exchange (LRE) tackles this multi-faceted problem in the following way. First, it brings together educational content from trusted providers from all over Europe and makes it available to interested parties. Such functionality is implemented using a technical architecture known as a *federation* of learning object repositories. Second, the LRE provides improved facilities for content enrichment with metadata as well as the harmonisation of metadata. Third, while partners can have access to all content available in the federation, European Schoolnet also provides a portal that offers different discovery possibilities such as search, browse, tag clouds and social networking, to a wide audience. In addition, this paper also reflects on its introduction as an international resource service. To reflect this, this paper is organised in four sections:

- Federating learning object repositories (section 2)
- Content and metadata (section 3)
- The use of a discovery and social networking portal (section 4)
- The introduction of an international resource service in schools (section 5)

But first a few words on the background of the LRE as well as the evaluation methodology. Since December 2008, the LRE has been made available by European Schoolnet as a service that enables schools to find educational content from many different countries and providers. It initially included content from Ministries of Education (MoE) and other partners working with European Schoolnet in the EC-funded projects CALIBRATE [CAL 2008] and MELT [MELT 2009]. The work reported here is primarily the result of the MELT project[1]. Further details of these project results can be found in [Van Assche 2009].

When the Learning Resource Exchange was first offered as a public service to schools and teachers [LRE 2009], with a first phase dedicated to more than 60,000 schools in the eTwinning[2] initiative of the Commission, over 130,000 learning resources and assets were made available. Anyone is able to browse content in the LRE federation of repositories and users that register have access to additional functionalities such as social tagging tools, bookmarking, etc.

The experiences and lessons learned are based on the observation of the usage of the LRE portal by more than 1500 users, the close follow-up of work performed by 100 teachers involving attention metadata analysis and questionnaires and in-depth interviews with 40 teachers. In addition more than 25 content providers contributed to the lessons learned. The evaluation was done over the period: 1 September 2008 to 28 February 2009. The instruments for the evaluation consisted of;

– A questionnaire on searching and finding content, investigating the effectiveness and efficiency of the search and retrieval process
– A questionnaire on the usage of content investigating the context of use, overall advantages of the resource, its overall quality, educational intentions for its use, technical problems, modifications, to and the sharing of the resource
– In-depth interviews with teachers
– Log data on the tagging, bookmarking, rating, searching, and use, correlated with user related data
– Snapshots of social tags
– Snapshots of structured metadata and quality metrics for metadata

A full report on the evaluation and the evaluation methodology can be found in [Zens, et al., 2009]

2 The LRE federation

A federation of learning object repositories means that the partners in the federation are operating in an independent way and manage their own repository of learning resources, but that they are sharing learning resources for the benefit of all the partners. The content in the LRE federation comes mostly from partners affiliated to Ministries of Education in Europe as well as from LRE Associate Partners (see Table 1). Some of these partners such as the Swedish MoE and the ARIADNE foundation [ARIADNE 2009] are themselves federations and other partners such as the Austrian MoE and OER Commons collect learning content from various sources.

Ministries of Education	Publishers
– Austria	– FWU
– Czech Republic	– Cambridge-Hitachi
– Estonia	– Cambridge University
– Finland	Press
– Flanders (Belgium)	– Skolavefurinn
– France	– Young Digital Planet
– Hungary	– Dunlem e-Learning
– Iceland	
– Israel	**Others**
– Ireland	– European Schoolnet
– Italy	– ARIADNE Foundation
– Lithuania	– KULeuven
– Norway	– OER Commons
– Poland	– Contento
– Portugal	– Promethean
– Region of Catalonia	– Cité des Sciences
– Slovenia	– Open University (UK)
– Spain	– Siveco
– Sweden	

Table 1: Partners in the LRE federation

The LRE federation not only collects metadata about learning resources but makes them also available to others such as national/regional educational portals and VLE's through the LRE infrastructure (see figure 1 for a graphic representation of the federation) developed in a close collaboration between European Schoolnet and the ARIADNE foundation. The infrastructure supporting the LRE federation is described in [Massart 2009b].
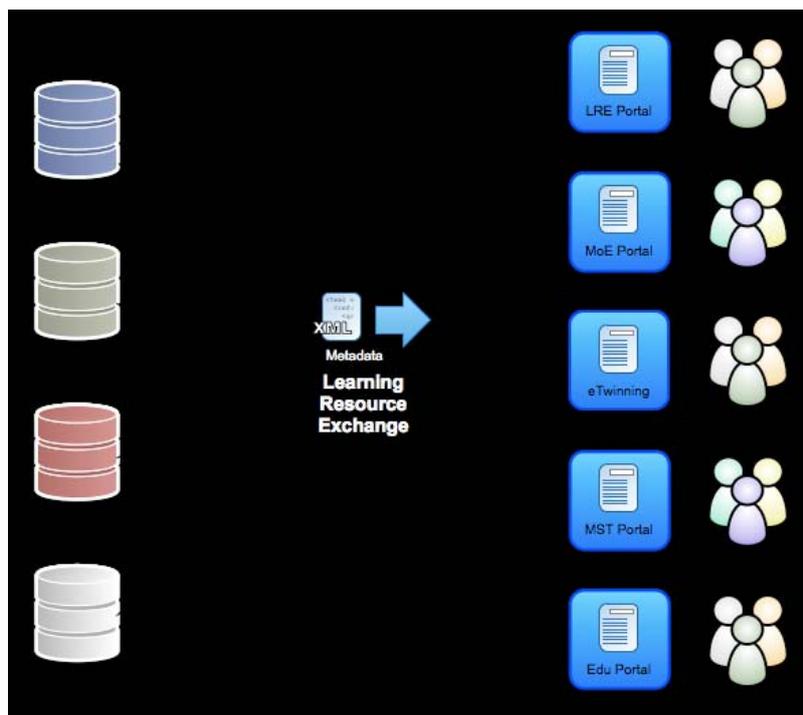
Figure 1: *The LRE federation. On the left content metadata providers are depicted, on the right the content metadata consumers with the users.*

A federation means that partners are collaborating, in our case in order to share educational content, while keeping their own identity and way of working. Thus, the LRE federation is heterogeneous in terms, of hardware and software infrastructure, metadata storage, indexing mechanisms, and implementations.

The common approach lies in the way that exchanging metadata is established and two agreements are essential. First, the metadata should be exposed by the partners in a uniform way. This is achieved by using the IEEE LOM standard for metadata [LOM 2002] and developing an application profile of the LOM for schools in Europe [Massart 2009a]. Second, the metadata are exchanged using common protocols. In the LRE federation two protocols have been used: the OAI-PMH protocol [Logoze et al. 2004] and the SQI protocol [Duval et al. 2005]. The first protocol is used for *harvesting metadata* whereby metadata are gathered on a regular basis and stored centrally for further querying. The second protocol is used for *federated search* whereby the repositories of the partners are queried at the time the query is expressed by the user. The federation members each provide an answer to the same query, consulting their own repository. Both approaches can be combined in a hybrid architecture.

2.1 Experiences with the LRE infrastructure

Initially the LRE followed such a hybrid architecture, allowing both harvesting and federated search. This displays the behaviour that, when searching or browsing, the results arrive in groups from different members in the federation. The effect is that, as the result list grows, it can change from one search to another (e.g. when a provider connects/disconnects) and what one found yesterday might not be found today. Consequently, the order of results may be different between two identical searches dependent on which provider answers first. While this was not a problem in previous implementations by European Schoolnet nor in similar implementations of federated search such as MACE [Mace 2009] and the European Digital Library [EDL 2009], it was rejected by the focus groups of school teachers while testing it out in a real life setting. Usability improvements and further explanations helped but were insufficient to give us confidence that it would work with a larger audience.

In order to rectify this problem, the architecture of the search was completely revised and a search cache implemented. The cache holds all the metadata for searching in indexes and all the metadata that are displayed in search results, ideally in the language of the end-user. Pre-processing the existing metadata and extracting only the required information, together with advanced indexing techniques showed dramatic improvements both in stable search results as well as performance. New experiments with end-users showed that the behaviour was now more than satisfactory.

As the metadata are relatively stable, the advantages of caching metadata significantly outweigh the disadvantage of being not up-to-date. Teachers who had been using the portal since the beginning praised its increased quality and functioning.

One should take care not to jump to the conclusion that this experience invalidates the usefulness of the federated search. There are circumstances e.g. with less metadata and a smaller number of repositories in a federation, where federated search will still perform very satisfactorily. In addition, the context may also play a role. Teachers, accustomed to Google, have different expectations to, users coming from a research community, for example.

2.2 Experiences with using a common application profile

An application profile gives guidelines on how a standard, in our case IEEE LOM, should be used for the benefit of a specific community; in our case schools in Europe. As most of the metadata gathered from partners in the LRE originates from a non LOM-based scheme (and thus are not LRE Application Profile compliant), it is not uncommon for errors to occur in the transformation to LOM metadata in order to be compliant with the LRE Application Profile.

In the initial phase of building the LRE, the metadata that the members of the federation exposed (through the OAI-PMH targets) had to be checked manually. First, a lot of time was spent in going through the actual metadata in order to spot errors of all kinds. Then, several mails were usually sent back and forth proposing solutions for the existing errors. This whole process took so much effort that a more automated way of checking these errors was investigated and a validation framework was created, with the focus on expressiveness and flexibility of validating against a certain application profile (in this case the LRE application profile).

In addition, the following tools have been developed in order to ease the process of metadata validation:

-   An online validation tool where one single metadata record can be validated against the appropriate scheme. The tool is available at http://ariadne.cs.kuleuven.be/validationService/.
-   The validation tool has recently been upgraded and now also allows the validation of the results that an OAI-PMH target returns on the various requests.
-   Reports are automatically generated which give an overview of the validation errors left in all the records exposed by the content provider. These reports are generated directly after a harvesting round, and thus, on average, a new report is available every few days.

Members of the LRE federation have commented on the extent to which the LRE LOM-based application profile has already impacted on national metadata strategies. This was particularly noticeable in the cases of those partners that joined the federation with repositories that were still at a very early stage of development and that had little or no metadata.

An important component of the LRE application profile is the LRE multilingual thesaurus for schools. It contains seventeen micro thesauri as depicted in Table 2. The LRE thesaurus exists in seventeen languages and is used by dozens of applications and web-sites from European Schoolnet as well as Ministries of Education.

Communication / information / document	International organisations
Content of education: 8 sub-groups	Languages
Countries and geopolitical areas	Learning / research
Culture	Leisure activities
Educational system	Political /social / interpersonal relations
Environment	School activities
Facilities / equipment / materials : 3 sub-groups	Society
Health / safety / handicap	Teaching / training / evaluation / guidance
Individual development	

Table 2: The micro thesauri of the LRE multilingual thesaurus

2.3 Experiences with gathering metadata in a heterogeneous environment

As the LRE deals with metadata records coming from a multitude of sources and as these records are cached in different locations, it was difficult to get a clear overview of how many metadata records come from where.

In order to address this issue, a format for exchanging statistics on the amount and type of metadata records available for each repository was agreed. These statistics have been visualized in a dashboard, so that synchronisation problems can be easily identified.

3 Content and metadata

The LRE has resources on virtually every curriculum subject taught in schools and includes those directly produced by or for MoE and other public bodies, as well as resources developed by teachers themselves. Some private sector organisations are also contributing content that can be freely used in schools. All LRE content can currently be thought of as 'open educational resources' or educational materials that are offered freely and openly for anyone to use and in some cases they can also be adapted and redistributed.

LRE content also comes in all different sizes, shapes and languages. It includes both larger or more complex learning resources (including what some people call 'learning objects') and smaller learning assets (which might just be an individual photo, a short piece of text or an small audio file). Teachers are also encouraged to submit lessons plans related to LRE content and, later on, will be able to upload resources they have developed themselves.

3.1 Addressing copyright issues

While free content is much advocated today (see for example [OECD 2007]), teachers and pupils frequently find content on the web and are not sure if they can use it in their lessons, make copies of it or modify it and give it to someone else. The description of each item in the LRE includes clear information on what can be done with it.

For example, the vast majority of LRE content is made available under Creative Commons' licenses [CC 2009]. This internationally recognised licensing scheme is growing in popularity and provides a small number of easily understood license types that defines the spectrum of possibilities between full copyright – *all rights reserved* – and the public domain – *no rights reserved*.

Teachers found the Creative Commons licensing scheme extremely useful when it comes to the exchange of learning materials as IPR agreements are clear and can be easily understood. However, experience with the assignments of rights to learning content shows that for casual users it is not obvious how to assign rights correctly – even creative commons. Indeed, all too often one overlooks the fact that some components are not in the public domain. In our

experience, the problem can be mitigated by a carefully designed user interface for users not familiar with rights expressions.

Initially, the LRE is responding to the wish of Ministries of Education to make 'open content' more widely available to schools. Increasingly at national and regional levels, digital educational resources are being offered freely and openly for educators, pupils and self-learners to use and re-use for teaching and learning. As a first stage, the LRE is being designed to make it easier for Ministries to share these resources and make them more widely available across national borders.

However, the LRE system can also be adapted to support a range of standards-compliant rights management schemes and can accommodate a wide variety of content distribution and business models. If required, for example, the LRE can also support fully authenticated licensing models involving end-to-end authenticated exchanges and complete tracking of end user actions.

3.2 Experiences with content enrichment

Metadata content enrichment using expert indexers is a time consuming - and therefore expensive - activity for all producers of educational content and repository owners. In order to achieve the maximum return on this investment, the development of the LRE has demonstrated that expert indexers need to be both knowledgeable subject and pedagogical experts and that teachers are well suited to this task if they are properly trained and supported by others who fully understand the complexities of application profiles. This is not to say that other approaches should not be explored. For example, librarians could well have a role to play in this process.

The metadata task was facilitated by the use of an automatic metadata generator [Meire 2007], which provided additional metadata. In general, automatic metadata generation works well if the learning objects are offered within a certain structure. This can be a file hierarchy, a structured web site or a connection to a LMS. For example, if information about rights, if at all present, occurs always in the footer or header of a web page, it will be easier to extract than when it is to be found at a random location, due to the diverse nature of learning objects and habits of their authors.

A number of LRE expert indexers reported that they would prefer to have a more fine-grained thesaurus for the classification purposes. The LRE thesaurus used was felt to stop at too high a conceptual level. Thesaurus experts, however, point to the dangers of too large a thesaurus which leads to a reduced semantic interoperability. Furthermore, other fields of the application profile, like free keywords and especially tags, allowed for narrowing down the classification of the learning resources in a more detailed way. In conclusion we can say that after 10 years of existence, it is worth revisiting the LRE thesaurus, and re-investigating its granularity. Other alternatives could for instance be the automatic association of tags and free keywords to existing thesaurus terms by means of known proximity algorithms. This would allow tags and free keywords to be used as related non-descriptors.

3.3 Metadata translations

Translation of metadata has been an extremely important issue in the LRE and in the development of a pan-European LRE for schools. Before a teacher can view a resource and decide if it (or a particular part of it) 'travels well', they first have to find the resource. The LRE has made an important contribution here in that the enrichment process has also involved the translation of metadata into a second language. At the LRE portal one can see the results of this work. It is clear that teachers have been able to successfully find useful resources that are not in their own language and have gone on to tag these in many different languages, thus creating a virtuous circle and enabling LRE content to be increasingly discovered by a broader set of users.

More than 90% of the learning resources offered by the LRE have now English metadata. This does not only facilitate the discovery but is also the basis for automatic metadata translation. Indeed, SYSTRAN the machine translation tool used in the LRE for translating metadata has the most language pairs from and to English.

3.4 Use of content and pedagogical benefit

The evaluation done by teachers revealed very high pedagogical benefits of the learning materials that the teachers had introduced in their teaching activities: 80 percent of the participants in the evaluation rated the pedagogical benefit as high or very high.

Likewise, all interviewees indicated that deployed content was pedagogically beneficial for their teaching. When asked to be specific about their reasons, the teachers indicated that; the content facilitated and promoted students' creativity; made teaching more interesting; encouraged self-reflection; and encouraged the students' initiative. Furthermore, the usage of LRE content promoted interdisciplinary learning activities, promoted cultural exchanges, and provided the teachers with fresh and new ideas for their classroom activities. In addition, teachers saw the potential of enhancing students' comprehension of difficult or invisible processes, such as molecular biology.

The pedagogical intention for the usage of LRE resources was most frequently to encourage learning by independent exploration - "learning by doing", and to motivate students to study in a self-reliant fashion. In connection with self-reliant learning, supporting the students' information management skills was also mentioned. This finding supports the hypothesis that high quality interactive digital material is a very important factor in the success of self-reliant learning or learning by independent exploration.

4 The LRE portal

The European Schoolnet officially launched the LRE portal in December 2008 http://lreforschools.eun.org (see fig. 4), a unique public service initially offering over 130,000 open educational resources on virtually every curriculum topic for pupils of all age ranges.

4.1 Experiences with searching and browsing

The LRE portal offers various discovery features such as simple and advanced search, browsing by subject or social tags, filtering and faceted search, viewing bookmarks from others. Teachers appreciated this variety of possibilities. It corresponds to the different behaviours. At certain times teachers will look for something specific, at other times teachers will browse without specific results in mind. In addition, when there are (too) many results from using a discovery feature, teachers need the possibility to refine the search. When there are only a few results teachers wish to extend and see other results that have some characteristics in common.

The effectiveness of different search strategies was analyzed by quantitative and qualitative questionnaire data, individual interviews with teachers, and log data of the portal. The results indicate that subject, language, and search term were salient options for finding and obtaining content. This result corresponds with the results of the interviews and the questionnaire data. The selection of language and subject was most important for most of the teachers. Tags were not very useful for specific searches, but for searching without a specific intention.

However, one needs to consider that the indicator "bookmarking" does not necessarily determine effectiveness. It might, for example, be possible that users bookmarked the results using their browser, or other services such as delicious (formerly del.icio.us). Further analysis would be required drawing definite conclusions on bookmarking. The portal provides ways of annotating resources, rating, and bookmarking learning resources. These features can be used by other users for helping in the evaluation of the resources. Indeed, result lists can be sorted

by popularity and rating. In addition, users can see the annotations from others in order to form their own opinion.

Figure 4: The public LRE portal

4.2 Experiences with the assessment of the suitability of a resource

Finding a good resource involves discovery as well as an assessment concerning the suitability of a resource. Despite the extended metadata tagging and the fact that metadata are considered very good to excellent according to the Learnometrics [Ochoa 2007] parameters, open comments concerning the relevance of the retrieved resources particularly revealed problems with insufficient or misleading descriptions. Hence, improvements of this information were frequently suggested. As one might expect, the log data show that search was very often followed by viewing the resource but there was much less real interest in actually bookmarking and rating resources. Clearly many users decide that the only way to really assess the suitability of a resource is to click on it and actually view it.

Given this behaviour, instead of providing a complete set of metadata, it might be sufficient to provide a minimal set of metadata supplemented with social tags, in order to support the discovery and evaluation of open learning resources that can be accessed directly. The minimal set of metadata should be selected with discovery in mind.

MELT was working solely with open content and there is no way that we can extend the above conclusion to commercial content that cannot be accessed directly. However, most likely, providing a direct accessible preview will make a difference in evaluating the resource. In addition, commercial content providers might still want to provide high quality metadata for commercial reasons. As the evaluation shows, however, high quality metadata might not be as effective as experienced indexers anticipate.

4.3 Experiences with cross-linguistic and cross-border use of content

Observation of teacher behaviour revealed that about 25 percent of all used resources were used across languages. The log data revealed a much higher proportion of cross-linguistic bookmarking. In total, more than 60 percent of all bookmarks were saved across languages. Most of the resources that had been used or stored by teachers for a later use were used across borders.

The individual interviews revealed that the teachers highly valued the availability of an international portal containing learning resources within a European context. The concept of an international portal was considered as an important opportunity for cultural exchange and a way to broaden one's horizon in terms of getting new ideas for teaching from other countries.

Challenges were seen in the highly diverging educational systems and language barriers, particularly if the text was in a language not understood by the user. In order to facilitate the international use of resources, it was pointed out that, in many cases, the translation of basic points in English would be sufficient.

It is interesting to see that the evaluation did not reveal substantial language barriers[3] for the metadata. This is probably due to: the extensive use of multilingual controlled vocabularies; the fact that English translations of the metadata were provided for almost all learning resources; as well as the language competencies of the teachers involved in the evaluation.

4.4 Experiences with social tagging

Social tagging of educational resources potentially offers added value for both teachers involved in the tagging process and using the LRE as well as for managers of educational content repositories (see also [Vuorikari and Van Assche 2007]).

For example, social tagging can provide new ways for teachers and other LRE users to *better manage* digital learning resources that reside in different repositories and platforms. Using tags and considering the preferences of other users also can help teachers *to discover and access new resources* from different educational systems and in other languages. For managers of content repositories, social tagging provides *new third party metadata* for their resources and enables them *to create affinities* (e.g. link structure) between separate resources (either in their own repository, or those elsewhere in the LRE federation) that were not cross-referenced before.

We are just beginning to see the tip of the social tagging iceberg as far as its potential added value is concerned. Further work will undoubtedly be needed in order that the full potential of social tagging can be realised and below we list a few of the key issues (for simplicity just one per topic) where progress is required.

1. User knowledge management related to digital learning resources could be improved if it is possible to export bookmarks (including title, URL and tags) in standard web feed formats. This would allow users to access and manage their specific LRE resources as

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[3] Except for social tags in a language that users did not understand. They were experienced as noise.

part of their other resource collections, whereas now users need to be logged on to the LRE portal to do this.

2. Pivotal browsing of social bookmarks takes advantage of the affinities between the users, resources and tags. In the LRE context, more metadata could be added to support pivotal browsing, such as: the country of the user; interests in specific topics; resource metadata such as multilingual indexing keywords. This could result in novel ways to access resources that other users have already discovered within the federation and thus build on users' social interactions and the co-construction of knowledge.

3. Tags added by users of the LRE portal have been shown to be of good quality as additional metadata descriptors of resources, including as part of a metadata ecology that exploits the features of the LRE multilingual Thesaurus. Apart from working on ways to automatically generate LOM from tags, consideration also needs to be given to the hierarchical structure and multilingual features of the LRE Thesaurus so that it is easier to leverage user-generated tags (see also [Vuorikari 2009]).

5 Experiences with the introduction of an international learning resource service

When introducing the LRE to teachers, a number of problems that must be managed when scaling up in a successful way were identified.

National reflexes

From the experimentation it became clear that a solid strategy has to be set up to introduce teachers to a European repository of learning objects. Within all teacher groups, we observed an initial reluctance to use learning objects that were not developed in their own country. Initially, most teachers seemed to be satisfied with resources that they could find in national collections that matched the national curriculum and are easy to understand.

Nearly all teachers in the group, although they had a positive attitude towards European colleagues and were willing to participate in a European project, had to be convinced of the value of looking at learning repositories beyond their borders. Initially they were satisfied with the supply of content in their own language; some even wondered why they should make an effort to carry out searches in a European database. It was only when they were presented with some remarkable, high quality learning objects from other European colleagues that they were able to make the mental jump and begin to realise why they should engage in a European LRE. This failure to appreciate what is available in Europe is widespread.

A conclusion from the experimentation is that there is a need to first showcase the value of learning objects and ideas from other countries by means of a selection of high quality learning objects that travel well. Only then is it possible to start talking about the value of a European LRE system. People must first be aware that it is really worth the effort to look beyond their own borders and national repositories.

Quality

At the start of the experimentation, the coordinators had to make a difficult decision. We had two choices:

- Quality. Present from the start a selection of European high quality learning objects that will be present in the LRE.
- Quantity. Present teachers all kinds of learning objects in a developing but clearly unfinished repository, with the idea that tags could highlight the best ones quite soon.

After some discussion, the coordinating group opted for the second approach. After a short time, however, we learned that the first one fitted more with the actual attitude of the teachers that participated in the experiment. It is better to show some excellent examples than to overload teachers with a large quantity of (in their eyes) irrelevant learning objects.

The lifecycle

During the initial experimentation, we observed some very interesting discussions and international interactions taking place when teachers presented their learning objects to colleagues from the same subject discipline. Initially teachers appeared to be highly satisfied as a result of discovering new learning objects and sharing ideas with colleagues. At this stage, teachers did not seem ready or motivated to immediately start developing own materials. In general, it was only later on that teachers' thoughts turned to how they could develop or adapt materials for classroom use.

It was only as they thought about how they would use LRE resources with their own class that teachers really started to think about how the content could be more specifically tailored to their own requirements. At that stage, they started to be more concerned about whether the learning resource was flexible enough (both technically and in terms of IPR) so that it could be adapted.

The virtual environment

In the experiment, teachers worked very intensively with each other during face-to-face meetings. In between meetings, however, it was quite difficult to keep teachers motivated after the meetings and to maintain contacts between teachers in different countries. It is possible that that this (older) generation of teachers prefer other ways of communication than younger colleagues. Once back home, it is easy for teachers to forget ideas presented by their colleagues and more difficult to find time to regularly share their experiences and provide feedback on their use of learning objects.

International collaboration over the internet is difficult to maintain if it is not rooted in collaboration and activities at the local level. Once this is established, teachers will be more inclined to continue the work at an international level. In some countries or regions, collaboration emerges naturally. In other countries, a strong national or local support system needs to be put in place to keep the fire burning. In this case, the exploitation of the learning objects and development of new learning scenarios has to be organized at a local level.

Not only the learning resource

Sharing learning objects with international colleagues is not usually the first thing that teachers want to do. From observations of what they did, it is obvious that they are first interested in picking up an interesting idea. For example, the development of lesson scenarios for interactive whiteboards was the reason why some Flemish teachers have kept in touch with their Italian colleagues. The focus is not simply on the learning resource the Italian teacher presented.

Innovative teachers, therefore, do not simply use the learning objects of others; they look behind the learning resource for the *ideas* provided by other teachers and transform these into scenarios that work in their own learning environments. They want to be inspired by others. First and foremost, therefore, the LRE is a place where teachers go to find ideas not simply learning objects. This is an important distinction.

The national curriculum

The efficacy of the teachers' work is optimal when it is linked to their own curriculum. National curricula and local contexts should always be taken into account if one wants to motivate teachers and to encourage them to start working with international learning objects. The promotion and delivery of learning objects can certainly be made on a large international scale,

as evidenced by the MELT project. However, the creative process of building new learning objects from the ones teachers have found in the LRE happens at a 'local' level. At this stage, the individual teaching needs and viewpoints of other colleagues in an individual school are vital. When introducing an international educational resource portal such as the LRE, one should always refer to the national curricula and start from the teaching job of the individual teacher. Otherwise s/he will experience work in the project as an artificial activity and as a loss of valuable time.

The finished product

During the experimentation, teachers very much liked the content approach of the Catalonian Ministry of Education. They present finished products, ready to be used by teachers and fitting the national curriculum as well as more open portals with tools and assets (e.g. the JClic portal http://clic.xtec.net/en/jclic/). In the JClic portal, a diverse range of materials is offered including a simple, high quality tool that allows teachers to author all kinds of exercises and a set of finished products. Particularly useful are resources that can be disaggregated into smaller assets that can often be relevant for an international audience.

What teachers want is some inspiring examples or scenarios, a good tool (like scissors and glue in the past) and assets to develop their own learning materials, all integrated in an international community. A finished international resource will seldom be used as such; teachers – at this stage - want to be inspired by it and develop one that more fits the needs of their learners and curricula. They want to have the building blocks and get to work on their own. In short, teachers want open materials.

6 Conclusion

Over the last years, the development of the LRE provided experiences about different aspects of sharing content in an international, multilingual, multicultural setting. These experiences have been shared with different stakeholders. In particular, several Ministries of Education have been very much influenced by the work reported here for improving the practice in their role of broker of educational content. The construction of the LRE received wide attention also from other communities. For example the OLCOS project [Geser 2007] reported that:

"The most important Europe-wide (and potential global) player in e-learning content may become the European SchoolNet (EUN) through their European Learning Resource Exchange which is currently under development."

The Learning Resource Exchange received also an IMS[4] Learning Impact 2009 Leadership Award in the category for Best Cross-National Solution. With the launch of the LRE as a public service an important milestone has been achieved in the provision of educational content to schools in Europe.

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[4] The IMS Global Learning Consortium is an organisation developing and promoting specifications in the field of learning technologies (see http://www.imsglobal.org/)

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