Project no.
28051
Project acronym
eMapps.com

Project title
MOTIVATING ACTIVE PARTICIPATION OF PRIMARY SCHOOLCHILDREN IN DIGITAL ONLINE TECHNOLOGIES FOR CREATIVE OPPORTUNITIES THROUGH MULTIMEDIA

Instrument SPECIFIC TARGETED RESEARCH OR INNOVATION PROJECT

Thematic Priority Information Society Technologies

Deliverable D9: Validation Report

Due date of deliverable: 30.9.06
Actual submission date: December 2007 – revised version

Start date of project: 01.10.2005 **Duration**: 30 months

Organisation name of lead contractor for this deliverable : MMU
Revision : 2.2
Author: **Peter Brophy**

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Table of Contents

eMapps.com Deliverable D9: Validation report

Professor Peter Brophy, Centre for Research in Library & Information Management,
Manchester Metropolitan University, UK <p.brophy@mmu.ac.uk>

Introduction

This deliverable report is an output from Workpackage 4 of the eMapps project: Sharing eLearning content. The purpose of the Workpackage is "Establishing processes and facilities for teachers and children to access relevant digital content available through a variety of sources while playing the eMapps.com games - and to make the multilingual and multicultural local content created during the games to be shared and repurposed for use in the wider eLearning context of schools and children in new member states (NMS)."[1]

The development of appropriate services to enable resource sharing has been ongoing in the Project, but has taken place against a rapidly developing background of work across Europe – indeed across the world – on developing and exploiting eLearning. Inevitably, great interest has been expressed in the benefits to be gained from reusing learning objects created at considerable effort and expense.

When the eMapps project was being conceived, the emphasis was placed on the development of our own standalone repository for learning objects which we believed might be of use to others, and on searching other repositories for objects which could be used in eMapps games. Work for D7, the Inventory of Available Learning Content, demonstrated that while there was a huge number of repository developments worldwide, those which were available in NMS languages and which contained content suitable for schools use in the context of learning games were severely limited. The nature of the eMapps games also introduced an unforeseen issue, namely that most objects needed to be tagged with

[1] An interim version of this Deliverable Report was prepared for the eMapps.com project review in November 2006. At that stage the repository development was still ongoing, as anticipated in the Technical Annex. In order to validate the repository it was necessary both for its full functionality to be released and for project partners to make use of it in the context of the project as a whole. Thus D9 could not logically have been delivered to the timescale envisaged in the project's Technical Annex. This document has been delivered in time for the second review, reflecting the state of the project's work in this area at the end of November 2007.

geographic metadata if they were to be used, but this was not provided in most current repositories (this is discussed further below). Nevertheless we were committed to producing a search interface and indeed delivered this on time in month 6 (D8) – see below.

A more pressing issue concerned the repository for eMapps objects (i.e. objects acquired or created by eMapps participants). Here our discussions led rapidly to the conclusion that rather than an independent standalone repository with its own interface, we should seek to interoperate with others in the field. EUN's experience here proved invaluable, and the decision was taken that they should develop the eMapps repository as part of, and compliant with, the Learning Resource Exchange (LRE)[2], a federation of learning resource repositories primarily developed within the CALIBRATE[3] and MELT[4] projects with support from the European Commission's IST and eContent*plus* programmes. Because it is standards-based, the LRE federation is itself interoperable with other repositories and clusters which are compliant.

We were also influenced by ongoing discussions in the broad eLearning community about the need to avoid further proliferation of monolithic systems. The UK JISC and Australia's DEST, for example, started work on their E-Learning Framework (ELF) under the "conviction that exposing networked functions such as user and group data or learning content as simple services rather than as features locked up inside monolithic systems offers institutions more flexibility, more scope for pedagogic innovation and better return on present and future investment."[5]

A further consideration is that as learning systems develop, particularly within a Web 2.0 environment, it will be vital that repositories can interoperate seamlessly with front-end systems i.e. interoperability is not just a matter of federating repositories using agreed standards so that they can be cross-searched, but of ensuring that those same standards support embedding in learning systems. While this requirement takes us well beyond the scope of eMapps as a project, it is an important consideration in our design of a repository service.

---

[2] http://lre.eun.org/

[3] http://calibrate.eun.org/

[4] http://info.melt-project.eu/

[5] http://www.elframework.org/about/

On the basis of these considerations, we determined to develop eMapps repository function within the standards and (design) framework of one of these federated systems, and because of EUN's experience in the area we decided that this federation should be LRE. Since September 2007, LRE has been part of the Global Learning Objects Brokered Exchange[6] (GLOBE), an international consortium that aims at making shared online learning resources available to educators and students around the world. Currently, other GLOBE partners include the Ariadne foundation[7], education.au limited[8], LORNET[9], Multimedia Educational Resource for Learning and Online Teaching[10] (MERLOT), the National Institute of Multimedia Education[11] (NIME), Korea Education & Research Information Service[12] (KERIS), and the Center for Open Sustainable Learning and the Latin American Community of Learning Objects[13] (LACLO). We believe that the emergence of this grouping confirms the correctness of our decision to develop in this manner.

The LRE is a service designed to unlock the educational content hidden in digital repositories across Europe and beyond and to share it among all partners of the LRE and their users. The service is offered to actors providing digital content: Ministries of Education, regional educational authorities, commercial publishers, broadcasters, cultural institutions and other non-profit organisations who are offering extensive but heterogeneous catalogues and repositories of online content to schools.

From a technical standpoint, the LRE consists of an infrastructure based on a 'brokerage system' to which independent systems (e.g. learning resource repositories, educational portals, learning (content) management systems) connect to share learning resources in a federated way. This architecture has been adopted because it offers maximum flexibility: it is decentralised enough to allow content providers to manage their collections

[6] http://globe.edna.edu.au/globe/go

[7] http://www.ariadne-eu.org/

[8] http://www.educationau.edu.au/jahia/jsp/index.jsp

[9] http://www.lornet.org/

[10] http://www.merlot.org/merlot/index.htm

[11] http://www.nime.ac.jp/en/

[12] http://www.keris.or.kr/english/index.html

[13] http://www.laclo.org/index.php?lang=en

autonomously, and is secure enough to ensure the trust needed when dealing with content for school pupils.

The actual repository being developed for eMapps is an instance of MINOR ('MINOR Is Not an Object Repository ') and is fully interoperable with the LRE federation. The functional specification for the repository was at draft stage when Deliverable D8 was delivered and subsequently minor amendments have been made. During 2007, a prototype repository was delivered by EUN and demonstrated at the project meeting in Torun in early June 2007. Feedback was obtained from partners and MMU then undertook a validation exercise. This resulted in the identification of a number of essential changes and enhancements. At the time of writing this report, EUN is still working on delivering a fully-functional repository, although – as noted above – both test usage and feasibility have been demonstrated. We believe that eMapps would therefore be able to use this technology in an exploitation phase.

This, then, provides the basis within which the validation and evaluation activity of WP4 reported here has taken place.

Learning objects: standards compliance

It is clearly important within any reusable learning objects (RLOs) intended for more than single project/service use that the objects and their metadata should conform to appropriate standards. In terms of objects themselves this is relatively straightforward, and the repository supports all common file formats which can be displayed using an internet browser.

In terms of metadata, the specification was delivered within D8 and the compliance with the specification is noted in the Tables 1, 2 and 3 below.

Element name	**Brief description**	**eMapps Implementation**
1.1 General.Identifier	A globally unique label that identifies a resource. It is composed of 2 sub-elements.	
1.1.1 Catalog	Identified by 'eMapps.com'	Compliant
1.1.2 Entry	Uniquely identifies the resources in the eMapps.com repository.	Compliant
1.3 General.Language	To identify the primary human language(s) used within the resource. There can be up to ten language elements. Value space is:- (1) Use a 2 letter code from ISO 639-1 (2) Use a 3 letter code from ISO 639-2. (3) Add the ISO Country code [ISO3166] when necessary, separated by a dash. (4) Use the value 'x-none' when it is not possible to identify any language for a resource (e.g. the picture of a flower)	Field is used when entering metadata. Compliant
1.4 General.Description	To provide a textual description of the content of the resource. Is a LangString element, allowing the language used to be defined. Permits up to ten elements, not likely be more than one description per language. Value space for the language	Compliant.

Element name	**Brief description**	**eMapps Implementation**
	itself is: (1) Use a 2 letter code from ISO 639-1 (2) Use a 3 letter code from ISO 639-2. (3) Add the ISO Country code [ISO3166] when necessary, separated by a dash.	
3.1 Meta-Metadata.Identifier	A globally unique label that identifies the metadata record itself.	
3.1.1 Catalog	Identified by 'eMapps.com'	Compliant
3.1.2 Entry	Uniquely identifies the metadata in the eMapps.com repository.	Compliant
3.2 Meta-Metadata.Contribute	Describes who has contributed to the metadata instance during its life cycle.	
3.2.1 Meta-Metadata.Contribute. Role	Describes the role of the contributor -: Creator or Validator	Can be taken from user type (Ordinary user or Moderator) Compliant
3.2.2 Meta-Metadata.Contribute. Entity	Identifies entities (i.e., people, organizations) contributing to the metadata instance.	Can be taken from User profile. Compliant.
3.2.3 Life Cycle. Contribute.Date (Meta-Metadata.Contribute. Date)	Date and time of contribution.	Can be populated automatically. Compliant
3.3 Meta-Metadata.Schema	Identifies the authoritative specification used to create the metadata instance; fixed to	Compliant

Element name	**Brief description**	**eMapps Implementation**
	"LOMv1.0".	
3.4 Meta-Metadata.Language	Describes the language of the metadata instance There can be only one value. The value space is:- (1) Use a 2 letter code from ISO 639-1 (2) Use a 3 letter code from ISO 639-2. (3) Add the ISO Country code [ISO3166] when necessary, separated by a dash.	Compliant
4.3 Technical.Location	Provides the physical location of a resource; is a Universal Resource Locator	Compliant
6.1 Rights.Cost	Indicates if use of this resource requires payment.	Since the eMapps.com repository is only intended to host resources licensed under creative commons, the only possible value for this element is ‘no’. Compliant.
6.2 Rights.Copyright and Other Restrictions	Indicates if any copyright or other restrictions apply to the resource.	Since the eMapps.com repository is only intended to host resources licensed under creative commons, the only possible value for this element is ‘yes’. Compliant.
6.3 Rights.Description.	Provides a textual description of copyrights or other restrictions that apply to the LO.	Since the eMapps.com repository is only intended to host resources licensed under creative commons, this will usually be a URL identifying the selected creative commons

Element name	Brief description	eMapps Implementation
		license or 'public domain'. Compliant.

Table 1: Metadata implementation in the eMapps Repository: Mandatory elements

Element name	Brief description	eMapps Implementation
1.2 General.Title	Gives to the resource a human readable name. There can be multiple values but they must be each in a different language	Compliant.
1.5 General.Keywords	Provides free text keywords describing the resource. The tagging user interface should allow the entering individual keywords in different languages in one element.	Restricted range of keywords available (to ensure consistency of terminology). Partially compliant.
4.1 Technical.Format	Provides information about the MIME Types of the resource.	Compliant.
`4.2 Technical.Size	Provides information about the actual file size of the resource	Compliant.
5.7 Educational.Typical Age Range	Indicates the typical age of the user of the LO.	Field is used when entering metadata. Compliant.

Table 2: Metadata implementation in the eMapps Repository: Recommended Elements

Element name	Brief description	eMapps Implementation
1.6 General.Coverage	Indicates the time, culture, geography or region to which the resource applies.	Used as "x-eMapps" for eMapps.com GIS coordinates. Compliant for eMapps (but refer to text re

Element name	Brief description	eMapps Implementation
		LOM)
9.1 Classification.Purpose 9.4 Classification.Keyword	These elements follow the rules of the EUN Learning Resource Exchange application profile where 9.4 Classification.Keyword is intended to describe the resources content with a multilingual thesaurus. 1.5 General.Keyword is to be used in place of 9.4 Classification. Keyword when values are free text.	See 1.5

Table 3: Metadata implementation in the eMapps Repository: Optional Elements

In examining the use of metadata elements we have also compared the eMapps Application profile with an analysis carried out by OCLC[14] (see Table 4 below), which examined elements selected by different RLO metadata profiles in Europe, the Pacific region and North America.

eMapps (Mandatory)	*Godby (Europe)*	*Godby (Pacific)*	*Godby (North America)*
General Identifier Language Description **Lifecycle** Contribute Role Entity Date	**General** Identifier Title Language Description **Lifecycle** Contribute Role Entity Date	**General** Identifier Title Language Description Keyword **Lifecycle** Contribute Entity Date	**General** Identifier Title Description Keyword **Lifecycle** Status

[14] Godby, C.A. What Do Application Profiles Reveal about the Learning Object Metadata Standard? *Ariadne*, 41, October 2004.

Meta-metadata Identifier Schema Language **Technical** Location **Educational** IntendedEndUserRole Context **Rights** Cost CopyrightAndOtherRestrictions Description	**Technical** Format Location **Educational** LearningResourceType **Rights** Cost CopyrightAndOtherRestrictions Description **Classification** Purpose	**Technical** Format **Educational** IntendedEndUserRole Context **Classification** TaxonPath Purpose Source Taxon	**Meta-metadata** Identifier MetadataScheme **Technical** Format Location **Educational** TypicalLearningtime **Rights** Cost CopyrightAndOtherRestrictions **Relation** Identifier
Total: 15	Total: 18	Total: 9	Total: 8

Table 4: Comparison of LOM metadata profiles

It will be seen that there is considerable commonality between the profiles as well as considerable differences. One of the decision points in designing a profile is to balance the conflicting requirements for simplicity and richness of description. In general it is desirable to limit the number of mandatory fields as much as possible to encourage compliance – the larger the number of required fields the less likely are contributors to complete acceptable records. As eMapps was designing for busy teachers and for children this very much influenced the design.

It needs to be borne in mind that Table 1 lists mandatory fields, while others are optional. For example, General (Title) was omitted from the eMapps profile of mandatory fields because it was expected that a considerable number of objects would be images which would require a description but would not have a formal title. On this basis the data in Tables 1 to 3 do not suggest any omissions in the eMapps implementation.

Thus, testing of the repository functionality shows that the work undertaken fully complies with the profile. However, one weakness is the lack of a standard way in LOM of describing GIS identifiers associated with objects. While eMapps metadata does include GIS, other systems would be unable to identify it. This is a major barrier to re-use, as all our schools were using games and creating objects which are location-specific and sharing of objects would depend on this. The mobile learning community has become interested in this issue recently. For example, Moulin and Pilas have suggested the need to define a new kind of GeoReferenced Learning Object (GRLO)[15] while McGreal has noted that "few papers focus on the pedagogical metadata needed to ensure the interoperability of multimedia learning content using mobile devices"[16]. In Canada, CANCORE[17] has taken a leading position on recommending a subset of LOM for ubiquitous computing, while others have suggested that GIS co-ordinates can be recorded in the Entity element, which can use the VCard data model in its value space[18], although we are not aware that this has been implemented in schools level RLOs (or for that matter elsewhere). Our conclusion is that future work in this area, and exploitation of the eMapps work, should examine this issue carefully and consider how further development of the LOM specification could be supported along these lines.

The search interface

As noted above the search interface (D8) was delivered in month 6 as required. It is illustrated (in multilingual versions) in Fig. 1. In validating this interface we made reference to the initial functional specification and to a number of other federated search services available for comparison. These include: EDNA[19], MERLOT[20], ARIADNE[21], PALOMA[22]

---

[15] Moulin C. and Piras A., Geobook: Enhancing Mobile Learning with GPS and Multimedia Book, in Proc. IADIS International Conference Mobile Learning, (Dublin, Ireland, 2006), pp.163-169.

[16] McGreal, R. Implementing learning object metadata for mobile devices using CanCore. AICT-ICIW '06. International Conference on Internet and Web Applications and Services/Advanced International Conference on Telecommunications, 2006. http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=1602137

[17] http://www.cancore.ca/en/

[18] See Friesen, N. International LOM Survey Report. http://mdlet.jtc1sc36.org/doc/SC36_WG4_N0109.pdf

[19] http://www.edna.edu.au/edna/go/search?SearchMode=distributed&lastQuery=

[20] http://fedsearch.merlot.org/main/search.jsp

[21] http://ariadne.cs.kuleuven.be/silo2006/NewFederatedQuery.do

[22] http://helios.licef.teluq.uquebec.ca:8080/PalomaWebGlobe/

and the Japanese NIME service[23]. We also undertook internal evaluation by engaging the NMS partners in assessing the usefulness and usability of the interface – and they were also involved, obviously, in arranging translation so that teachers and pupils could access it in their own languages – this had been identified in the Technical Annex as a key requirement.

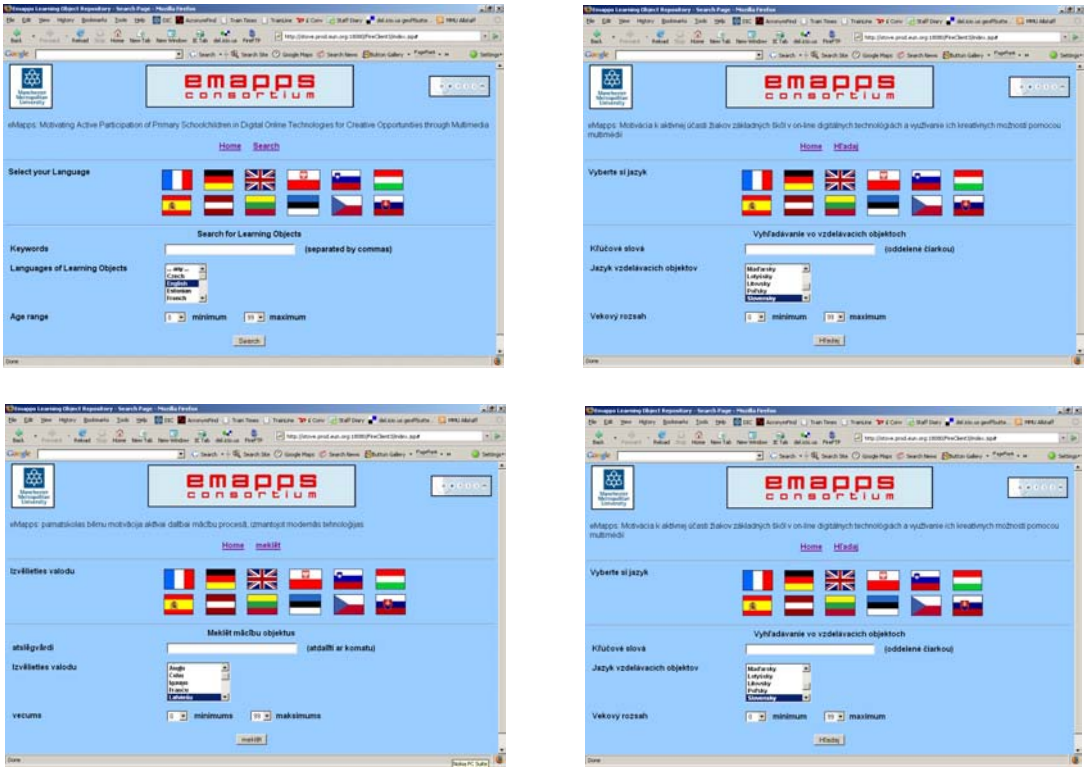


Fig. 1: eMapps Repository Search (Multilingual instances)

Although the search interface has been validated in relation to the initial specification, further testing and analysis of potential use, as well as related work undertaken by MMU in the UK context[24], suggested that the specification should be revised. This version is included as Appendix A. The significant issues to have arisen during our analysis are:

- Federated search is critical to achieving mass acceptance of RLOs, since separate search of every repository is neither feasible nor acceptable to users. A sign of maturity of the field will be when individual search interfaces are replaced either by more generic approaches (exactly as internet search engines and portals have largely replaced individual interfaces on the desktop) or with customisable middleware

[23] http://nime-glad.nime.ac.jp/en/

[24] In particular our evaluation of the Information Environment Service Registry. See http://iesr.ac.uk/

approaches which integrate easily into different end-user environments. The individual end-user interface will then be maintained only for specialist use.

- There seems little point in requiring users to register to search learning object repositories. Users regard this as a barrier and it is likely to prevent widespread use.
- The approach of listing targets on the web page is not scalable. Not only does the list become unwieldy but it is difficult for users to identify the scope of each service. This is a familiar problem with information search services, where alternative approaches are offered. We also noted that most of the other federated search systems (referred to above) do not offer this functionality. Clearly, however, users need to be able to specify the scope of their queries. Our advice would be that a more sophisticated solution is needed once the number of repositories exceeds the threshold for individual selection, probably making use of a service registry which supports subject data within service profiles. This kind of service is starting to emerge and will be particularly useful in Web 2.0 applications because it will enable user profile data to be matched with a dynamic database of service descriptions, thus hiding the selection functionality from the user. Furthermore, this solution removes the need for each search interface to be rewritten/updated every time a new repository comes on stream, since selection takes place in the middleware layer. Thus we recommend this approach for the long term exploitation of this work, although it goes beyond the scope of the eMapps project to develop it.
- It seems doubtful that many 'Advanced' search features are worthwhile until a much larger volume of RLOs becomes available. Certainly our research showed that level and language are important to users, but other advanced features are not generally requested. This is not surprising, since it is well known that the mainstream internet search engines find little use made of most advanced search features, while usability studies show that nearly all users rely on simple search. We would suggest therefore that designing advanced search options should be a low priority.
- Help facilities need to be minimised. A general finding from usability research is that a search system (or similar, we are not talking here of complex user-oriented applications) should be self-explanatory and if users are continually having to consult 'Help' screens, FAQs and the like, then there has been a design failure. We

would recommend that effort is put into design rather than help facilities. Again, the principle must be that of simplicity using a Design for All approach.

- All of the above assumes that there remains a place for a search service for RLOs. There must be a question mark over whether a better strategy would be simply to expose all the repository content to the main search engines. The LOM metadata is important when there is re-use (for example, so that rights can be embedded) but it is unclear whether it offers a better solution for search than simple keywords.

The specification for a simplified search interface is provided in Appendix A.

The eMapps repository

The functional specification for the Repository was presented in draft form as Appendix B of D8. Minor amendments were made to the draft in subsequent months and during the development phase, where the system was trialled and feedback from the validation team and users taken into account. This iterative development took longer than originally anticipated, itself delaying the current validation report (Note: an interim version of this report in June 2007 was used to guide some further work needed to achieve the desired functionality).

Table 5 below provides the detailed assessment of the repository functionality.

Specification	**Validation result**
1 Project	
1.1 The project name is MINOR, which stands for 'MINOR Is Not an Object Repository'.	Compliant
1.2 The project source code and documentation are hosted on http://minor.sourceforge.net.	Compliant
1.3 MINOR source code is released under the GNU LGPL licence.	Compliant
2 Storage	
2.1 MINOR stores metadata and resources.	Compliant
2.2 Identifiers uniquely identify resources.	Compliant

Specification	**Validation result**
2.3 Each resource is directly accessible via a URL.	Compliant
2.4 Each connected instance of MINOR that is connected to the federation is uniquely identified.	Unable to test – this is an issue for validation of the federation.
2.5 MINOR uniquely identifies each resource.	Compliant
2.6 Metadata describes either a resource stored in MINOR or an external resource.	Compliant
2.7 MINOR supports different DBMS (e.g., Oracle, MySQL).	Unable to test
2.8 MINOR'S default implementation supports Oracle and MySQL.	Compliant
3 Resources submissions	
3.1 Only authenticated users get access to the MINOR.	Compliant
3.2 Authenticated users submit resources through a web interface.	Compliant
3.2.1 Users submit metadata through a web interface.	Compliant
3.2.1.1 Metadata might be pre-filled on the basis of user's profile.	Compliant
3.2.2 Controlled vocabularies are used during metadata submission.	Compliant
3.2.3 A user can either upload a resource or submit a link (URL) to an external resource.	Compliant.
3.2.4 The licence used for the resources is Creative Commons (CC)[25]	Compliant
3.2.4.1 CC implies that resources are accessible by a URL.	Compliant
3.3 A moderator approves or rejects submitted resources.	Not yet available

[25] http://creativecommons.org/

Specification	**Validation result**
3.4 Only approved resources are discoverable.	Not yet testable (see 3.3)
3.5 Only approved resources are accessible.	Not yet testable (see 3.3)
3.6 A user can only modify the resources that (s)he submitted.	Because users can only access their own resources, the system is compliant.
3.6.1 Metadata are modifiable.	Not yet available
3.6.2 A moderator approves or rejects metadata modifications.	Not yet available
3.6.3 Resources are modifiable.	Not yet available
3.6.4 A moderator approves or rejects resource modifications.	Not yet available
3.7 A user can remove the resources that (s)he submitted.	Compliant
3.8 Mass metadata upload is possible.	Not relevant to eMapps – possible extension?
4 Resources collections	
4.1 Users can define collections of resources.	Not relevant to eMapps – possible extension?
4.2 Resources may belong to one or more collections.	Not relevant to eMapps – possible extension?
5 Federated search	
5.1 MINOR is connected to LRE	See 2.4
5.2 Queries are submitted through the Simple Query Interface.	See 2.4
5.3 Query Languages.	
5.3.1 Multiple query languages are supported.	See 2.4
5.3.2 Provisionally, the default query language is	See 2.4

Specification	**Validation result**
S2QL.	
5.3.3 It is possible to easily add new supported query languages.	See 2.4
5.4 Metadata Formats.	
5.4.1 Metadata can be exported in various formats.	Unable to test.
5.4.2 Provisionally, the default metadata format is Strict LOM.	Compliant but note issue re GIS
5.4.3 It is possible to easily add new supported metadata formats.	Unable to test
6 Discoverability	
6.1 Approved metadata are exposed to web crawlers.	Not yet testable
7 User management	
7.1 The system allows users to register.	Compliant
7.2 Roles are assigned to registered users.	Compliant
7.3 A user can have multiple roles.	Compliant
7.4 Authorizations depend on user roles.	Compliant
7.4.1 Simple User.	
7.4.1.1 A simple user can submit resources.	Compliant
7.4.1.2 A simple user can modify the resources (s)he submitted.	Not yet available
7.4.1.3 A simple user can delete the resources (s)he submitted.	Compliant
7.4.1.4 A simple user can manage his/her collections.	See 4.1
7.4.2 Resource Moderator.	
7.4.2.1 Moderation consists of approval or rejection.	Not yet available
7.4.2.2 A resource moderator moderates resource	Not yet available

Specification	**Validation result**
submissions.	
7.4.2.3 A resource moderator moderates resource modifications.	Not yet available
7.4.2.4 A resource moderator moderates metadata submissions.	Not yet available
7.4.2.5 A resource moderator moderates metadata modifications.	Not yet available
7.4.2.6 A resource moderator has the possibility to motivate his/her moderation decisions.	Not yet available
7.4.3 User Moderator.	
7.4.3.1 A user moderator moderates user registrations.	Not yet available
7.4.4 Administrator.	Administrator rights not yet available to the validation team..
7.4.4.1 There is at least one administrator.	
7.4.4.2 An administrator is also a user, a resources moderator and a user moderator.	
7.4.4.3 An administrator has all permissions on all resources.	
7.4.4.4 An administrator can delete resources.	
7.4.4.5 An administrator can delete metadata.	
7.4.4.6 An administrator can assign roles to users.	
7.4.4.7 An administrator can banish users.	
7.4.4.8 An administrator has the possibility to motivate his/her administration decisions.	
7.4.9 An administrator has all rights on all collections.	
7.4.4.10 An administrator manages supported query languages.	

Specification	**Validation result**
7.4.4.11 An administrator manages supported metadata formats.	
8 Supported (natural) languages	
8.1 MINOR'S first release supports English.	Compliant
8.2 The repository supports internationalisation (i18n/UTF-8).	Unable to test without administrator access – see 7.4.4
8.3 The second release will support the languages of the eMapps.com partners from new members states.	Issue for exploitation phase
8.4 One resource can be described in many languages.	Compliant.
8.5 One resource can be in zero, one or more languages (for example, an picture has no language).	Compliant
9 User interfaces	
9.1 A management interface handles the connection to the federation.	Unable to test without administrator credentials.
9.2 A user interface allows users to browse collections.	Browsing not supported in this release. Collections see 3.8.
9.3 An admin interface manages the supported metadata formats.	Unable to test without administrator credentials.
9.4 An admin interface manages the supported query languages.	Unable to test without administrator credentials.
9.5 The GUIs are *'skinnable'*.	Not compliant in this release – probably more suited to exploitation release

Specification	Validation result
10 Technical considerations	
10.1 The Management interface is built on dynamic pages deployed on TOMCAT[26]	Compliant
10.2 The Resources submission interface is built on dynamic pages deployed on TOMCAT.	Compliant
11 Licensing summary	
11.1 Gnu LGPL applies to the project.	Compliant
11.2 Creative Commons applies to resources.	Compliant

Table 5: Validation of the eMapps repository: end November 2007

Use of learning objects: general findings

Re-use of Learning Objects

Use of external and internal RLOs during the emapps.com project was very low. There were a number of reasons for this:

- Timing. The fact that games were designed and played simultaneously meant that there was limited scope for using each others' objects. As has been found with other repositories, there is a need to build up a critical mass of objects before re-use becomes significant.
- Location. The nature of the eMapps games means that they are location-specific. In the longer term there will be value in depositing objects created for one game instance so that they can be re-used by children playing a new game in the same location. Unfortunately this was not feasible during the timescale of the project.
- Skills development. Teachers were novice games designers, and were learning how to create objects for use in the games they designed. This left them little time to explore the possibilities of reusing objects created by others. They expressed interest in doing so, but at the time this was theoretical rather than practical.

[26] http://tomcat.apache.org

- Types of object. Many of the objects used in the game are images and on the surface it would seem that there is great scope for making these available for re-use via a repository. However, project participants questioned whether it would not be better to make these available from a website via Google (for example, Google image search will provide many images that have not been created as 'learning objects' but are perfectly usable as such).
- Language. We found that language is a major barrier in the NMS when games are targeted at schoolchildren, since most available school-level RLOs are in English or other Western European languages (or are described in those languages in the case of images). Again, there is a lack of critical mass of RLOs in local languages. D7, the Inventory of Available Learning Content, confirms this. (See also below.)

Complex Learning Objects

We had intended at the start of the project to explore the possibility of using the repository for complex objects such as games scripts. In fact there is no barrier to this, since games scripts are digital objects like any other and may in any case be stored at any remote location addressable by a URL. However, as eMapps evolved it became clear that the concept of the 'script' was not one which would lend itself to re-use. This is because each instance of each game is entirely different. Decisions taken by players change the direction of the game. While it would be possible to share games transcripts, these are not very meaningful out of context.

Encouraging re-purposing

We have examined the factors which would encourage the re-use of learning objects. First it needs to be acknowledged that this is an issue throughout the eLearning community. Following the debate in that community, it is helpful to distinguish between re-use and re-purposing:

- *Reuse* is use of the learning object by a third party virtually as it is, but with a different group of learners and/or for a different presentation. The object may be used in a standalone manner or may be part of a wider presentation.

- *Repurposing* is use of the learning object for a different purpose than that for which it was created, usually but not necessarily by a third party. This may involve adding material to the object or removing unwanted material. It often means disaggregating the initial object. It often includes changes made to enable re-use on a different platform.

In eMapps it is unlikely that simple re-use would be required, because each game design involves a search for (or creation of) objects which meet the specific aims and purposes

Therefore, following Duncan[27], we would categorise the issues concerned with re-use and re-purposing under the following headings:

- *Personal*. The creation of learning objects requires personal investment of time and effort. The aim is almost always to add to a particular eLearning (in our case game) instance in order to pose a challenge related to a particular learning objective. Thus the primary personal motivation is focused on the particular instance of the game itself. The question which arises with potential re-purposing is how the originator's intellectual creation is protected. eMapps participants welcomed the use of CreativeCommons licences for this and appeared to feel that this was an adequate safeguard (although with some queries about the legal acceptance of CreativeCommons in some NMS). However, the question of *motivation* to deposit RLOs remains a critical one.[28]
- *Societal*. The focus of participation in a game, whether from the designer or the active participant's perspective, is on the game itself. In the eMapps Learning Impact report[29] we have noted that eMapps games have been successful in encouraging children to work in informal and dynamic groups with their peers and teachers. The effect of this is that learning objects, such as images, become 'owned' by the group. Releasing them to others can appear to be counter to the group's interests and

[27] Duncan, C. *Learning Object Economies: Barriers and Drivers.* Intrallect, 2005. http://www.intrallect.com/index.php/intrallect/content/download/420/1760/file/Learning_Object_Economies_Barriers_and_Drivers.pdf

[28] It is worth noting that this is a problem with all repositories, including those developed for eprints.

[29] D14: this is at draft stage and due for delivery in month 30.

dynamic. Achieving a 'society of game players', with a critical mass of shared learning objects, is an objective for the long-term.

- *Technical*. At one level eMapps overcomes the technical interoperability issues of RLOs by making the repository hospitable to almost any kind of simple object (image, text, video whatever). However, at the *game* level eMapps is technically non-interoperable. It is literally impossible to take an eMapps game and play it on another platform (or even, realistically, on the eMapps platform at another location). This is quite deliberate – part of the games infrastructure is the locations in which they are played[30].
- *Pedagogical*. The issue here is that the pedagogical purpose of an RLO may not itself be reusable in any real sense. It could again be argued that eMapps objects avoid this problem by being at a low level of granularity, and this is true, but the lack of pedagogical 'wrapping' makes them of less use to others. Thus we find that as well as the *location* context being vital to eMapps, so too is the *pedagogical* context. Even a simple quiz can have many pedagogical purposes, and its instance within any school setting will have related that instance to the pedagogical framework of the school.[31]
- *Culture*. We have mentioned the issue of language above, but in many ways this is a microcosm of the real issue, which is about culture. The culture of any one country, region, district, town, community or school is different from any other. Attempts to share learning objects have to invest this process with considerable effort to reach mutual understanding of the cultural assumptions of each party. While in eMapps there was great and sympathetic interest shown in each others' games, there simply was not time to invest in a national or international sharing of objects. This must be a challenge for the future.

IPR Issues

The use of Creative Commons licences has been referred to above. Apart from this eMapps has been remarkably free of IPR issues. It seems that because games cannot be transferred – only the platform is transferable – there is no danger of the teacher/designer or child/player

[30] This is not, of course, a problem limited to eMapps. Many observers have noted that the granularity of an object is closely related to its re-usability, which is why many RLOs are low level objects.

[31] Again, more will be said of this in D14.

being ripped off in the way that might happen with a computer-based game. The 'reality' of the gaming environment protects the intellectual property of the participants.

Conclusions

In validating and evaluating the eMapps repository we have concluded that despite only receiving a small amount of use, the principle of sharing reusable learning objects is a sound one. The LOM profile developed for the project has been validated, with the need for an agreed method to describe geographic (GIS) data identified and a suggested way forward in this regard.

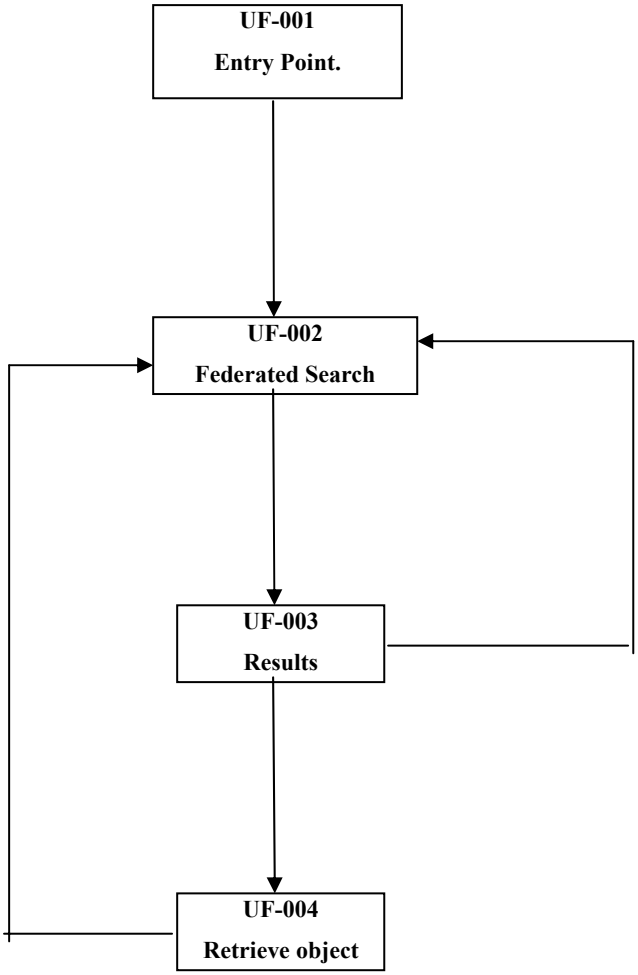
Learning from the implementation and use of the search interface has produced a series of recommendations for future work. Probably the most important of these is that there should be a move towards the use of a suitable registry to enable dynamic selection of targets, thus removing the need for individual presentation and selection and opening up services to personalisation.

The repository itself is late in full implementation, but was developed within the context of the federated Learning Resource Exchange (LRE). This places eMapps within a concerted effort by eLearning developers and practitioners to avoid proliferation of independent repositories and to create an interoperable network capable of presentation to the end user as a unified resource. Clearly this introduces a level of complexity and requires conformance to standards-based solutions, but these are desirable rather than constraints.

The operation of the search interface and repository in the context of eMapps has enabled us to draw some conclusions about use within the context of a games environment. The constraints of a 30 month project have limited the conclusions that can be drawn, but it is clear that there are many non-technical factors which will need to be overcome before repository usage reaches a critical mass. The context of games played in a mobile but location-specific context adds to the complexity. Nevertheless the goal of extracting additional value from the effort required to create learning objects is a valid one.

Appendix A: Simplified requirements for search and retrieve interface to available repositories of Reusable Learning Objects.

Simplified User Framework Diagram



Simplified User Framework

This section provides an explanation of the functional areas shown in the diagram. For full details see the individual requirements specifications.

UF-001 Entry Point

The home page(s) of the site and the URL to which external links and services should point.

UF-002 Federated Search

A search function that will allow the user to enter a search term(s) which will be matched against a range of searchable attributes.

UF-003 Results

The results list display will be consistent, each result displaying title, abbreviated description and a link to the object. (The fields are those it is believed are likely to be returned by the majority of targets.)

UF-004 Retrieve Object

Objects in results can be accessed directly via a hyperlink to a URL or URI.

Search can be iterated from either the results list or the retrieve object function.

Requirements Catalogue

Ref	Title	UF ref	Functional Description
R-001	Web environment	All	System must operate within a web-based environment; all functional components must be web compatible
R-002	Navigation control	All	System will provide navigation options. Links must be at the top of the screen with a 'Back to top' link at foot of page.
R-003	Accessibility	All	System should adhere to commonly accepted guidelines for accessibility and ease of use by disabled persons. Ref WCAG recommendations. e.g. Font must be legible both in terms of size and visibility (i.e. Colour contrast)
R-004	System appearance	All	System must have consistent appearance in typesetting, colour and layout
R-005	Search capabilities	002	Search engines must search a range of targets using pre-determined information about those

Ref	Title	UF ref	Functional Description
			targets.
R-006	Search consistency	002	Searches should operate in a consistent and logical manner across sources regardless of the index searched.
R-007	Search structure	002	Search will consist of one search string. Keyword operators will have a default of OR applied to multiple terms entered as search string.
R-008	Search fields	002	Indexes to be searched will be:- Title; description; keywords; author/creator/contributor; subject (if field available); language; age range.
R-009	Search operators	002	Multiple search words to be joined by Boolean 'OR'.
R-010	Federated Parallel searching	002	Searching of multiple targets must be in parallel and asynchronous.
R-011	Results transmission cessation	003	Transmission can be halted to allow a new (or refined) search to be started.
R-012	Results - initial display	003	Hits must be displayed initially while transmission continues.
R-013	Results page standard information	003	A summary of the current search terms should be presented to the user on the results page.
R-014	Results Formatting	003	Each record recovered by a search must be displayed in a common brief display format:- - Title; - abbreviated description; - a link to the object. If a record has not returned a value for any field, the field will not be displayed.
R-015	Results records linkages	003	Each results record should link to a URL to retrieve the object, or to the full record (where available).

Ref	Title	UF ref	Functional Description
R-006	Retrieve object information	004	System should be able to display file size information (where available) on a retrievable object.
R-017	Results record URL display	003, 004	Any URL within a displayed record should act as hyperlink.