ICOPER Deliverable 4.3 ISURE: Recommendations for extending effective reuse, embodied in the ICOPER CD&R

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ISURE: Recommendations for extending effective reuse, embodied in the ICOPER CD&R

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[1] OJ L 79, 24.3.2005, p. 1.

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LIST OF ACRONYMS

HTTP	Hypertext Transfer Protocol
IMS LD	IMS Learning Design
IEEE	Institute of Electrical and Electronics Engineers
IRM	ICOPER Reference Model
ICT	Information and Communication Technologies
LMS	Learning management system
LOM	Learning Object Metadata
OAI-PMH	Open Archives Initiative – Protocol for Metadata Harvesting
OER	Open Educational Resources
OICS	Open ICOPER Content Space
OLAT	Online Learning and Training
RLC	Reusable Learning Content
SCORM,	**Sharable Content Object Reference Model**
SER	Shareable educational resource
SIG	Special Interest Group
SPI	Simple Publishing Interface
URL	Uniform Resource Locator
VLE	Virtual Learning Environment
XML	Extensible Markup Language

iCOPER

Executive Summary

The overall aim of this document (an ICOPER Suitability Report for better practice: ISURE) is to present significant recommendations for extending the effective reuse of educational resources embodied in the ICOPER Community. It is drawn upon and extends the investigation that started from the previous two deliverables:

- D4.1: *Content Development Methodologies Survey* outlined key topics related to best practice issues, associated standards and specifications to develop educational resources open for reuse, tailored to the European dimension.

- D4.2: *Quality Control and Web 2.0 technologies report*, analysed best practices related to the use of Web 2.0 and quality control mechanisms within the ICOPER community.

This ISURE document, therefore, promotes a set of key issues that summarise the established and recommended methods for the effective remixing and repurposing of educational resources tailored to a European dimension. It also includes a detailed description of an ICOPER application for authoring Reusable Learning Content (RLC) known as the "Authoring for Reuse" application.

The thematic analysis of our investigation has revealed valuable best practice experience in our SIG (Special Interest Group) with respect to standards and specifications of reusable learning content, in addition to highlighting many significant barriers of content development for reuse. The benefits of adopting standards and specifications, embracing current challenges as well key trends for extending effective reuse have also been considered. The variety and shape of the collected best practice case studies gathered in our research work has demonstrated that there is much variety within and across institutions. Several popular scenarios were analysed: Open Educational Resources (OER) for Higher Education and those covering the areas of Teacher training, Educational Podcasting OERs, as well as examining a number of best practice networks in competency-driven Higher Education institutions and Schools.

Thematic findings from this report indicated an interesting range of standards and specifications that may be used to extend effective reuse of learning content. These are described in detail in Appendix A and summarised in Section 5. The majority of best practices highlighted by the SIG demonstrated **key factors** for increasing reusability, for instance, adopting a variety of specifications, developing as many different download formats as possible, improving collaborations for the global standardization efforts and making the authoring content process very easy for end users. In addition, the SIG also indicated several **key benefits** of developing reusable learning content, such as time reduction, improved quality, wide coverage of key educational concepts and fostering expertise. Many of the interviewed experts remarked, however, upon **significant barriers** to be overcome, particularly the lack of a culture of reuse, which includes social, technical, pedagogical and legal aspects.

Several examples were mentioned such as the lack of interest for developing open reusable content, efficient technologies for facilitating and simplifying reusability, communication among different stakeholders, social collaboration for discoverability and credibility around the content. In addition, several others barriers were indicated, such as understanding and meeting the changing learners' needs, designing reusable resources taking into consideration several requirements, implementing appropriate legal aspects and disseminating clear issues with respect to copyright. Some of the **important challenges** described by the SIG focussed on the need to offer appropriate and efficient tools for searching, managing, adapting and developing reusable learning content. Some of the **important trends** indicated by the SIG were developing innovative strategies for extending effective reuse such as promoting different workflows for developing RLC, freeing different OER assets to be reused independently and content tracking facility. Group members also commented on deploying content by dynamic transformation, adopting open standards, developing new concepts related to reusability and offering training and support for users. This should improve their practice, as well as identifying perceived barriers and thus avoiding the direction in which the disruptions are headed.

Additionally, the associated literature review and the collection of best practice case studies, including the ICOPER Application: Authoring for Reuse, have contributed to this research work. This ICOPER application has demonstrated how authoring tools might be used for reusing learning materials. Its implementation also analyses how the OAI-PMH standard might be significant in connecting repositories of learning objects. This interoperability protocol is particularly relevant for connecting the different steps of the authoring process for reuse. It was also recognised that the infrastructure, as realized by the ICOPER application, might be appropriate for a number of different learning delivery scenarios.

A combination of the findings from the SIG survey and the implementation of ICOPER Application has led to a series of recommendations and key actions in this report, which were grouped into **seven key categories** for extending effective reuse, embodied in the ICOPER content development for reuse arena. The primary recommendation of this report highlights the endorsement of a broad initiative to promote a "culture of reuse" in tandem with the promotion of a philosophy of "openness" and the provision of meaningful and effective support and training. For industry, particularly for technology providers, the importance of encouraging the development of tools that meet the needs of users, easy-to-use and efficient for saving time as well as effort is noted. With respect to standards and specifications, it is recommended that technology providers keep standards and specifications implicit and thoroughly tested by different stakeholders. The recommendation for the Higher Education Management and Faculty stakeholder group is to encourage them to promote effective reuse through raising a range of OER-related skills and expertise amongst colleagues. Our report concludes that appropriate training and support, to help identify and develop the necessary processes involved in searching, authoring, adapting, delivering and sharing, are essential to increase our understanding and awareness of the key issues related to the area of Content Development for Reuse.

Contents

1   Introduction

The purpose of this document is to capture the ideas and recommendations, within and beyond the ICOPER community, concerning the reuse of learning content, including appropriate methodologies as well as established strategies for remixing and repurposing reusable resources. The overall remit of this work focuses on describing the key issues that are related to extending effective reuse embodied in such materials. The objective of this investigation, is to support the reuse of learning content whilst considering how it could be originally created and then adapted with that 'reuse' in mind. In these circumstances a survey on effective reuse best practices can often provide an insight into the main challenges and benefits involved in the process of creating, remixing and repurposing what we are now designating as Reusable Learning Content (RLC).

Several key issues are analysed in this report: *Recommendations for extending effective reuse*, building upon those described in the previous related deliverables 4.1 *Content Development Methodologies* and 4.2 *Quality Control and Web 2.0 technologies*. The findings of this current survey, however, provide further recommendations and strategies for using and developing this reusable learning content. In the spirit of 'reuse', this work also aims to serve as a foundation for the many different stakeholders and users within, and beyond, the ICOPER community who are interested in reusing learning resources.

This report analyses a variety of information. Evidence has been gathered from a qualitative survey that has focused on the technical and pedagogical recommendations suggested by a Special Interest Group (SIG) on the most innovative practices with respect to new media content authors (for content authoring or modification) and course designers (for unit creation). This extended community includes a wider collection of OER specialists. This collected evidence, in the form of video and audio interviews, has also been represented as multimedia assets potentially helpful for learning and useful as learning content in the New Media Space (See section 4 for further details).

Section 2 of this report introduces the concept of reusable learning content and reusability. Section 3 discusses an application created by the ICOPER community to enhance the opportunities for developing reusable content. Section 4 of this report provides an overview of the methodology used for the qualitative survey. Section 5 presents a summary of thematic findings. Section 6 highlights a list of recommendations for effective reuse of educational content, which were derived from thematic analysis described in Appendix A. Finally, section 7 summarises the key outcomes of this work.

2 Background

Findings in the previous deliverables (Connolly, 2009; Connolly and Scott, 2009) highlight some important topics in reuse and it is very clear that the majority of best practices from within the ICOPER community show more evidence about 'first use' quality aspects rather than specifically presenting evidence of 're-use' quality.

The aim of this section, therefore, is to introduce the key concepts related to RLC from a number of sources including the relevant contemporary literature. It is important for the research work to identify current studies that can be analysed to identify the very real challenges and potential benefits related to the authoring and reusing of learning content. These key concepts also form a foundation for the subsequent survey methodology and, thus, shape the findings of the investigation. Implicitly these key concepts also relate directly to those of the ICOPER Reference Model (IRM) thus further promoting the idea of interoperability and best practice. (See Deliverable D7.3a, page 13).

The contemporary literature suggests that learning content today may be insufficient to meet the increasing needs of the higher education sector (a sector that is also witnessing rapid expansion around the world, including in developing countries). Equally experts recognise that the initial creation of digital education resources requires large investment, and the process of developing such materials from scratch may only be viable for courses with large numbers of students or sizeable budgets. It has been suggested, therefore, that reusing learning content can offer one of the essential strategies for a sustainable approach to eLearning (Littlejohn, 2003, Pawlowski, 2003, Thorpe et al, 2003).

Likewise Koper (2003) argues that many educational institutions are adopting other approaches to increase the effectiveness of their educational materials, potentially, through the increasing using of reusable learning content. There are several reasons, he proposes, that highlight the importance of adopting reusable learning content such as the need for:

- a more personalized approach to learning that can address different learner's cognitive styles
- collaboration, discussion and product creation, which plays an important role for learning facilitators
- teaching complex skills such as analysis and argumentation
- lifelong learning and accreditation of competences and performance improvement

2.1 Definition of Reusable Learning Content

The varying definitions of reusable resources have resulted in much debate. Different approaches have been described and contrast from a definition of: *"… discrete*

elements of learning content that meet a defined learning objective and are independently assessable (Online Courseware Factory)" to that of: "… (a) digitized entity which can be used, reused or referenced during technology supported learning" (Rehak and Mason, 2003).

A broad definition was adopted by the Institute of Electrical and Electronics Engineers (IEEE) who describe reusable resources as learning objects either "*digital or non-digital, that may be used for learning, education or training*" (Learning Technology Standards Committee, 2002). Some other current definitions, however, have focused on digital entities, such as "*any digital resource that can be reused to support learning*" (Wiley 2002). Another refined definition states that digital resources must be reproducible, addressable (i.e. connected with a URL and have metadata) and are used to perform learning or support activities, as well as being made available for others to use (Hummel, Manderveld, Tattersall, & Koper, 2004). A similar approach, by the Le@rning Federation, describes reusable resources as digital educational components that can be "*identified, tracked, referenced, used and reused for a variety of learning purposes*" (The Le@rning Federation schools online curriculum content initiative, 2002).

The definition adopted in this study, as previously mentioned, is also grounded on the IRM. Thus reusable learning content (RLC) is defined in this report as: digital content, reproducible and addressable that can be reused multiple times in multiple ways, in multiples purposes, in multiple formats and in multiple contexts by multiple users in this ICOPER setting. Using further defined nomenclature from the IRM concept model, RLC can, therefore, include "content of learning" (also see Mueller et al, 2009), "learning objects" (ibid), "teaching materials", "rich media content" (ibid), "interactive components" and "open educational resources" (see Lane, 2008, Lane et al, 2009), all of these are designed to be reused.

It is important to remember that the effectiveness of the reusability (Downes, 2003) can be further enhanced by a formal description of the online resource through associated metadata. Metadata is structured information that describes a resource and should make it easier to be located, retrieved and reused. Metadata is often called data about data or information about information.

2.2 *The concept of reusability*

In order to clarify key issues around reusable learning content, it is essential to understand the concept of reusability – the property, or degree, of being reusable. The literature in the field of educational technology over last decade has been discussing the concept of "reusable resources" with the aim to promote efficiency and quality gains in education (Koper, 2003, Baker et al. 2004, Wetterling & Collis, 2003) through adaptable learning contents (Berlanga & Gracía, 2005). The concept of reusability was initially introduced with the concept of learning objects grounded on

the "*object-oriented approach*" in the field of software engineering (Blair et al, 1991; Booch, 1991; Meyer, 1988).

In this domain, reusability is an attribute of components that can be used again to add new functionalities with slight or no modification. The main aim is to reduce time and costs related to development and tests for improvements. The high level of reusability relies on the ability to develop larger contents from smaller parts, and being able to establish commonalities among those parts.

Several studies (Blair et al, 1991; Booch, 1991; Meyer, 1988; Koper, 2003) highlight that reusable educational resources, follow at least three features: abstracted, granular and encapsulated. First, learning resources must be abstracted from a specific pedagogy, context and media in order to be applied in different scenarios. Second, the learning resources must be granular, that means small (e.g. smaller than a course) in order to be applied in different courses. Third, learning resources must stand on their own in order to be aggregated in several ways.

Criticisms around these features, however, have highlighted that well-specified rules, formats and sizes might also destroy the potential reusability. Without some sense for designing an educational resource for reuse, it has been suggested that they might become nothing more than a grab of unrelated and insignificant stuff (Wiley, 2003). Some of this current literature has been highlighting more flexible and pragmatic principles for content development for reuse which have been summarised by the five issues presented in the list below. More details related to these key issues can be found in the publically available series of ICOPER deliverables: D2.1, D4.1, D5.1, D6.1 and D7.3a. In summary the five significant issues are:

- **Clear learning outcomes:** reusable resources can be designed in a way that address our own learner's needs, and then generalise to hypothetical cases of reuse from there (Wiley, 2003). More information about learning outcomes can be found in the ICOPER deliverable D2.1 (Najjar et al, 2009).
- **Well-described content**: either small chunks or large sections of courses can be pedagogically effective resources for reuse when their content is simple to understand and makes sense (Laurillard and McAndrew, 2003). More information about content development can be found in the ICOPER deliverable D4.1 (Connolly, 2009).
- **Opportunities for meaningful discourse**: reusable content can be more significant when they are designed to be scalable, sustainable (Oliver and McLoughlin, 2003) and sociable (Wiley, 2003). More information about learning design can be found in the ICOPER deliverable D5.1 (Mueller et al, 2009).
- **Non-authoritative metadata**: reusable resources can be more helpful when they offer the opportunity for (re)users to contribute to the metadata, for instance, by cataloguing the variety of real cases in which context can be wrapped around pre-existing resources (Wiley, 2003), or can be versioned for particular groups of learners. (Thorpe et al, 2003). More information about

metadata can be found in the ICOPER deliverable D7.3a (Simon and Pulkkinen, 2009).

- **Principles for accessibility**: accessible principles can be very useful for designing resources that can be reused by users with different needs (Treviranus and Brewer, 2003). More information about accessibility and assessment can be found in the ICOPER deliverable D6.1 (Agea et al, 2009).

According to Wiley (2000), reusability can be classified at three levels:

1. **Reusing** in terms of using material as-is;
2. **Reworking** in terms of making small changes;
3. **Remixing** whereby a user takes materials and substantially changes and/or adds to them.

In addition, UNESCO (2010:1), for example, indicates four levels for reusing content:

- **Level 1, Re-branding:** adding institutional name, logo, and contact information;
- **Level 2, Localizing:** adding local examples;
- **Level 3, Contextualizing:** changing the content and syntax to match characteristics of the local audience and principles espoused by the organization;
- **Level 4, Adapting** materials for e-learning.

With respect to attributes for reusability, relevant online resources can be reused only if users can find them, and if they are available to be retrieved and modified with permission or an appropriate license. It would be helpful, therefore, if RLC had a number of inherent attributes such as those described below:

- **Searchable**: users can find RLC easily through search engines
- **Accessible**: RLC can be indexed for easy retrieval using metadata standards
- **Available**: RLC can be modified and versioned for different courses under appropriate reusable license
- **Addressable**: RLC can be addressed through a recognised URL
- **Interoperable**: RLC can operate across different hardware and software
- **Durable**: RLC can remain intact through upgrades to the hardware and software

Reusability should be an essential feature of online resources for users having the facility and flexibility for adopting and/or adapting them. In this context these terms can be defined as follows: **adopting** can mean selecting the material or part of the material as it is. Adopting can also involve finding, accessing and making a resource available to be used. **Adapting** includes small or significant changes in the content. Thus, reusing learning content can be described in numerous forms such as those listed in Table 1 below.

Once again it is important to remember that, within this ICOPER investigation about content development for reuse, it is essential to define, and therefore, clarify the many different ways in which learning content can be reused. Table 1 outlines some if these ideas:

Reusing Learning Content	Description
Assembling	Integrate the content with other content in order to develop a module or new unit.
Decomposing	Separate content in different sections, break out content down into parts.
Contextualizing	Change content or adding new information in order to assign meaning, make sense through examples and scenarios.
Personalising	Aggregate tools to match individual progress and performance
Re-authoring	Transform the content by adding your own interpretation, reflection, practice or knowledge.
Redesigning	Convert a content from one form to another, present pre-existing content into a different delivery format.
Remixing	Connect the content with new media, interactive interfaces or different components
Repurposing	Reuse for a different purpose or alter to make more suited for a different learning goals or outcome
Resequencing	Change the order or sequence
Summarising	Reduce the content by selecting the essential ideas
Translating	Restate Content From One Language Into Another Language
Versioning	Implement specific changes to update the resource or adapt it for different scenario.

Table 1: Reusing Learning Content (Okada, 2010)

Additionally there are a number of further important features to take into account within this context. These are: attributes, specifications, standards and metadata, all of whom are considered to be key concepts related to the reusability of learning content. These will now be considered in the next sections (3.1 - 3.3) as well as a description of this report's methodology and findings (Sections 4 and 5).

In relation to the wider ICOPER setting the broad concept of reusability has also been referred to and cross-referenced in a variety of the project's deliverables. The following list represents a selection of those contexts:

- D1.2 Design principles for service descriptions, page 17
- D2.3 IEEE Reusable Competency Definition (RCD), page 13
- D3.2 Learning Design as a key concept and metadata model, page 15
- D5.3 Learning materials, Learning Designs and opportunities, page 8
- D6.3 LRN assessment package (reuse questions), page 10

- D7.3a Learning outcomes and Learning Design, page 14
- D8.6 Sharing Learning Design: collaborating around Course design, page 93
- D9.2a Links to Standards: content development and reuse, page 6

The next section of this report "An ICOPER Application: Authoring for Reuse" will examine how some of these important features have actually been implemented directly in the ICOPER setting. The section illustrates how a learning content related application can be researched, developed and applied in an authoring environment, namely within the Open ICOPER Content System (OICS).

3   An ICOPER Application: Authoring for Reuse

The ICOPER project has set out to identify and recommend methods and practical applications to improve the standards and interoperability of learning content. The ICOPER Application: Authoring for Reuse focuses on the reusability of such content and, in this respect, it is important to demonstrate that the project has also put into practice, what it purports to recommend to the wider community, in its own working environment. The OICS is a search and find service helping potential users of learning content to identify appropriate materials for use and reuse purposes. In this context it's authoring facilities and, indeed, re-authoring possibilities are of the utmost importance. This section will focus one tool: the ICOPER **A**pplication**:** Authoring for Reuse as well as describe the relevant reusable learning content standards and relationships to the OICS as a practical application of such work.

This particular ICOPER application is defined fully in section 3.3 below but, in summary, it can be described as a combination of a variety of tools, namely: the MediaLibrary asset management software, the author42 authoring environment[2], the open source learning management system (LMS) OLAT (Online Learning and Training)[3], and the OICS service infrastructure.

In general terms this ICOPER application addresses the authoring and creation of RLC. The overall aim is to support the multiple and different authoring processes that may be required to create increasingly complex learning content. Ultimately this is achieved by producing multiple variants from the same original material.

Keeping in mind that the ICOPER project promotes learning outcome-based materials via the OICS, it is important to reflect upon the creation as well as the reuse potential of them. Understanding their original formats, types and styles (as well as suitable recommendations for future materials developments) is dealt with elsewhere in the ICOPER project (see Najjar and Klobučar, 2009; Mueller et al, 2009; Simon et al, 2009, Totschnig, 2010; for example) but it is opportune here to acknowledge that the cost of the production of good outcomes-based learning content may be higher than anticipated. Such materials have to be customised to particular audiences, aligned with particular learning scenarios and that this may be in complete contrast to the classical "one-off" premise that many Higher Education providers are currently applying to their mass production of non-outcomes-based digital learning materials.

It could be argued that the issue of cost, therefore, may encourage learning content providers to embed the idea of reuse into their materials per se as their investment is higher than "normal" and returns on their initial outlay would thus be beneficial all

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[2] See http://author42.bureau42.de/ for details

[3] See http://www.olat.org/ for details

round. It could also be argued that simply meeting the "cost" of additional interoperability standards in this context are also similarly high but, again, that matter is dealt with elsewhere in the ICOPER project.

The premise here is that an OICS-based authoring tool must acknowledge the history and development of the potential learning content taking into account a number of important issues. These will be examined in further detail, after a description of the use case: authoring for reuse.

3.1   Use Case: Authoring for Reuse

The content authoring use case for the OICS is described in the following sections in broad overview. This use case presents the following application and is composed of four steps:

Step 1: Retrieve appropriate content

An author has the task to create a course unit to a certain topic. In order to find out, what is already available she logs in to the authoring environment, which is connected to the OICS. There, she can perform searches in the connected repositories and retrieve a set of results. Besides information about the retrieved contents, the result-set also states the terms of reuse (i.e. cost, license), and the technical aspects that apply (i.e. the format).

Contents retrieved in the OICS may vary along several dimensions, for example:

- **Granularity** (individual media assets, learning objects, learning modules, complete courses)

- **Technology** (web-based content, standalone content, mobile content, documents)

- **Type of learning media** (assessment, learning game, expository learning material, exploratory learning material, dynamic community content)

Step 2: Reuse retrieved content

In the case of reusable learning media (that fits the author's goals), the author can copy/link selected content to her authoring workspace and recombine/reorganize it according to her targeted content structure.

Step 3: Change/Edit/Enhance content

With respect to different licensing/reusing constraints the author may wish to change the contents to a different form. Missing parts can also be inserted/extended. New versions/variants of the existing contents are often developed this way. Also, translations may be performed at this stage.

Step 4: Contribute new/changed content

Finally, the author can attribute the newly created content in order to state reusing/licensing rules that apply for further reuse.

In the following sections   the underlying aspects of the ICOPER Reference Model (IRM) and the Open ICOPER Content Space (OICS) are described in order to relate the authoring for reuse application to the core ICOPER outcomes.

3.2 Underlying ICOPER Outcomes: IRM and OICS

3.2.1 The ICOPER Reference Model (IRM)

In the Surveying profession there is a well-known idiom that describes the basic premise of all surveying techniques: *relating the whole to the part*. Thus in the context of reusable learning content it is important to relate this idea directly to the work of the IRM (see ICOPER D7.3a reporting on the premise of reusability and ICOPER D1.2 describing SER Shareable Learning Resource).

As previously indicated an important aspect of the ICOPER project is that of the necessity of adhering to standards. Effectively there are four relevant standards to consider in respect of the OICS and reusable learning content context, namely:

- **Sharable Content Object Reference Model (SCORM)**
  A standard to describe structure and behaviour of content and components (ADL SCORM, 2004). It comprises the Content Aggregation Model (CAM), the Run Time Environment (RTE), as well as Sequencing and Navigation (SN)
- **Learning Object Metadata (LOM)**
  An IEEE standard to describe metadata for learning objects in a standardized way (IEEE LTSC, 2002)
- **Open Archive Initiative's Protocol for Metadata Harvesting (OAI-PMH)**
  A protocol specifying the harvesting of metadata for learning objects residing in repositories (Lagoze and van de Sompel, 2001)
- **CEN Simple Publishing Interface (SPI)**
  An upcoming standard in draft status that enables authoring tools and other content management environments to actively push metadata and/or content into repositories (CWA 16097, 2010).

These all support device-independent "information models" in terms of format that enable the exchange of appropriate learning content objects. In reality this means that the information required to describe and store such objects need to be standardised and stored in a recognised structure that has regulated metadata and is fully understood by all associated software applications. It is important, therefore, that any learning content in the OICS, for example, is based on such standards. These are also

essential prerequisites for locating, aggregating and reusing the same learning content objects.

In addition it is also worth noting that these standards also enhance the interoperability and cross-platform compatibility of such learning content resources. Once again these standards have been described elsewhere in further detail (see Najjar et al, 2010; Mueller, 2010 and Simon & Pulkkinen, 2010; for example)

The *ICOPER Reference Model* (IRM) aims at defining a framework through which innovative learning processes can be stored, shared and delivered through standardized services and data formats. These processes exploit rich linkages between teaching methods, learning designs, learner assessments, learning content, learning outcome definitions, user profiles for achieved learning outcomes and learning needs, and learning opportunities.

In the IRM everything is centred on the **Shareable Educational Resource** notion. A Shareable Educational Resource is an addressable object in a repository that is relevant in the context of teaching and learning. It is described via metadata and identifiable through an identifier. In its universal applicability, the notion is comparable to the 'learning object' concept, however not all Sharable Educational Resources can be adequately expressed using the Learning Object Metadata (LOM) Standard.

A **Repository** is a managed directory for Shareable Educational Resources. A Repository that only contains metadata, but does not contain the resources themselves is also called referatory. In the IRM, the Repository concept does not imply that the storage of a Shareable Educational Resources is performed in a centralized manner. A repository can, both technically and organisationally, manifest as a decentralized system. Hence a repository can range from a private storage place for Learning Content to a cross-institutional site harvesting metadata of Learning Opportunities provided by several higher education institutions.

In the context of outcome-oriented higher education the **Personal Achievement Profile** concept plays a central role. A Personal Achievement Profile is a collection of Learner's achievements. Achievement refers to a potentially individualized description of an attained Learning Outcome. In order to provide evidence an achievement record can for example refer to an assessment record documenting a Learners knowledge, skill, or competency as assessed in an Assessment Opportunity.

A **Learning Outcome** refers to statements of what a learner knows, understands and is able to do on completion of a Learning Opportunity. A **Learning Opportunity** refers to a contextualized, complete, self-contained educational activity that implements a specific Learning Design in a particular physical or virtual location. Examples of Learning Opportunities are web-based learning modules, face-to-face courses, instantiations of study programs, etc. An **Assessment *Opportunity*** is an instantiation of an Assessment Design involving Learners for the purpose of assessing their knowledge, skills, or competencies. It describes the activity of testing the Learning

Outcomes attained by a Learner and providing corresponding information regarding a Learner's achievements potentially also including indications for improving them. An Assessment Opportunity is a special type of Learning Opportunity that can be, but does not have to be, part of a Learning Opportunity.

A *Learning Design* is a reusable representation of a concrete Learning Opportunity. A Learning Design arranges Teaching Methods, Assessment Designs, Learning Content and other elements of a learning environment such as learning tools towards Learning Outcome attainment. An *Assessment Design* is a reusable representation of a concrete Assessment Opportunity. An Assessment Design arranges Assessment Methods and Assessment Resources for the purpose of measuring or informing learning outcome attainment. It can be, but does not have to be, part of a Learning Design. *Learning Content* refers to any digital and non-digital material that can be used in a Learning Opportunity. Examples of Learning Content are simple web pages, lecture slides, a textbook, SCORM-compliant web-based training modules. An *Assessment Resource* is a special type of Learning Content that can be used in an Assessment Design. An Assessment Resources stimulates some kind of interaction with or reaction by a Learner. A test, for example, may contain multiple assessment items (i.e. questions) constitutes a typical example of an Assessment Resource.

A *Teaching Method* is an outcome-oriented set of activities to be performed by Learners and Learning Facilitators (Supporters). Examples for teaching methods are the Jigsaw Method, Problem-based Learning, and Think-Pair-Share. Typically, teaching methods are generic descriptions of activities, independent of specific content or an application context, hence independent from specific Learning Opportunities or Learning Designs. An *Assessment Method* is the way of deployment that the assessment activities, formalised into a set of specifications, which fully characterise the process, but without being put in a concrete educational context, hence independent from specific Assessment Opportunities or Assessment Designs. Peer assessment, where a Learner assesses the achievements of another Learner and vice-versa, also constitutes an example of an assessment opportunity.

A *Learner* is a person that engages in educational activities with the ultimate objective of attaining intended Learning Outcomes. A Learner is a high-level role that can for example be specified by a specific Teaching Method with various concrete roles. For example in the Jigsaw Method Learners assume the role of experts, and presenters.

A *Learning Facilitator* is a person that supports the Learner in the context of educational activities in attaining Learning Outcomes. Learning Facilitator is a high-level role that can for example be specified by a Teaching Method with various concrete roles. Typical instantiations of such learning support roles are teacher, instructor, facilitator, external expert, moderator, etc.

In our conceptual model Learning Facilitators and Learners are subsumed under the *User* concept, stressing the importance of technology.

In order to acknowledge the heterogeneity of metadata requirements put forward by the different concepts, the IRM explicitly differentiates between two types of SERs: Educational Activity Descriptions, and Educational Content.

An ***Educational Activity Description*** is understood as a machine-readable documentation of a sequence of measures users can get involved in order to achieve an educational objective. Educational Activity Descriptions represent the dynamic part of the domain model. They can range from micro formatted documentations of learning events (e.g. a public guest lecture) to full-fledged descriptions of units-of-learning as proposed by IMS LD.

In the dynamic part of the domain model the IRM further differentiates between run-time and design-time concepts. Hence, design time concepts such as Learning or Assessment Designs refer to the design-time part of delivering teaching and learning, while concepts such as Learning and Assessment Opportunity refer to the run-time part.

Educational Content addresses the static part of the domain model and subsumes all educational resources that can be used or are created as a result of an educational process. It subsumes the concepts: Learning Outcome, Learning Content, Assessment Resource, Personal Achievement Profile, and Evaluation Resources.

The concept map in Figure 1 provides a graphical representation of the ICOPER conceptual model.
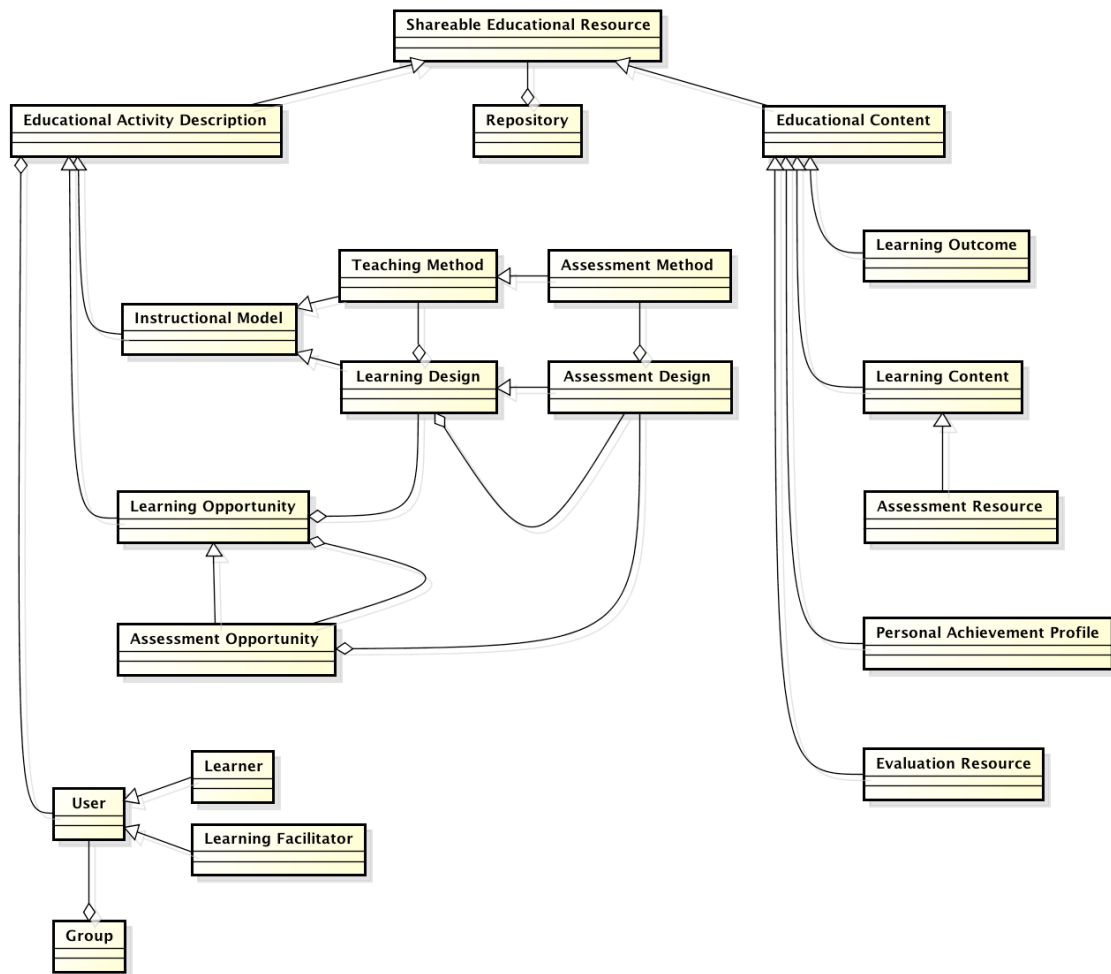
Figure 1. ICOPER Concept Map

3.2.2 The Open ICOPER Content Space (OICS)

The OICS has been defined within the context of the overall ICOPER project as the umbrella that combines a portfolio of interoperable repositories, content and tools, and as a test bed for the specifications and standards of the IRM. The main challenge during the establishment of the first version of the OICS appeared to be in setting up "*an architecture capable of dealing with heterogeneous types of metadata from various sources* (see Table 2 below) and *delivering innovative learning outcome oriented services*" (Totschnig et al, 2009).

In order to meet the demands of testing interoperability formats and standards, a number of OER repositories have been integrated into the OICS, namely:

Repository name	Institution	Type	Quantity & definition	IPR
The Spider, The Swedish learning repository federation	Umea University	Text, images, sound, movie, learning objects	2229 resources (no information about learning time currently encoded)	Mostly free resources
OpenER	Open University of the Netherlands	Self learning materials for High School / MBO level	750 hours (25 ECTS) in units of max. 25 hours (not yet encoded in metadata)	Creative Commons License 2.5 (byncsa)
OpenLearn	Open University (UK)	Structured learning online courses	5970 hours according to metadata information	Creative Commons ShareAlike v2.0

Table 2: OER repositories integrated into the OICS (see Totschnig et al, 2009).

3.3 Technical description of the ICOPER Application: Authoring for Reuse

The ICOPER Application**:** Authoring for Reuse focuses on three main processes (listed below) which are mapped additionally in Figure 2 in relation to the system architecture. The processes are:

1. **The collaborative collection and organization of media assets.** Media assets comprise individual content elements such as texts, pictures, videos, and audios. These atomic elements (i.e. elements which are reused as is) form the basis of all content productions. Complex learning objects are built from media assets.
2. **The collaborative creation of learning content based on these media assets.** Learning content are navigable and interactive learning contents are built out of individual media assets.
3. **Preparation for re-use.** A background harvesting process, which updates the metadata repository of OICS in order to make updated contents searchable and retrievable, supports the previous two processes
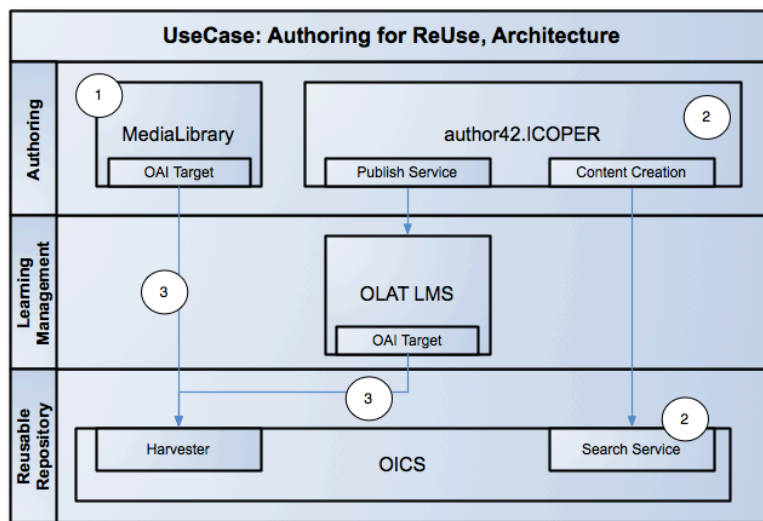
Figure 2: Architecture of the ICOPER Application: Authoring for Reuse

3.3.1 Collaborative collection of multi-media assets using the MediaLibrary

A common problem in collaborative, re-use based production processes is the retrieval, organization and management of media assets. This is especially true when production processes have to cope with heterogeneous target groups (e.g. different languages, support for disabled people) or dynamic topic domains (with many subsequent content versions) so consequently media asset management becomes challenging.

As part of the ICOPER Application**:** Authoring for Reuse a dedicated MediaLibrary tool was developed to try and resolve some of these issues. This online tool provides the opportunity to share all kinds of media within a designated community. In relation to other publicly available Media-sharing platforms (such as Flickr or YouTube), the ICOPER MediaLibrary is designed to support a variety of media production processes, content-re-use and complex media models (with different versions, variants, languages, media formats) as well as handling the corresponding metadata. Figure 3 shows a screenshot of the MediaLibrary to indicate its visual format.
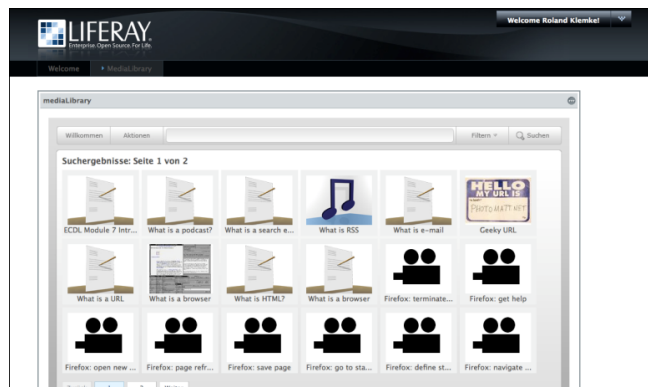
Figure 3: the ICOPER MediaLibrary displaying a preview with metadata

The ICOPER MediaLibrary supports authors in organising and re-using their media assets by offering a clear structure within which they can develop content using various tools.

It creates the possibility for keeping track of different versions, variants, translations and media types of multiple objects. These so-called MediaAssets (which are fine grained objects) can take the form of individual text and images as well as audio and video files.

At a broader level the ICOPER MediaLibrary allows authors to enrich content production processes towards the creation of learning content, in other words, promoting a more flexible approach to the use and reuse of such materials. In reality the learning content is held as a series of main objects that consist of different media elements or MediaAssets.

Thus the ICOPER MediaLibrary is able to provide further flexibility in the production process by allowing one single instance of a learning content to be repurposed as multiple outputs such as language translations, an audio or "talking book" version as well as offering facilities to create accessible transcripts for those with visual disabilities.

The ICOPER MediaLibrary is connected to the OICS via an OAI-PMH interface, through which media assets within the MediaLibrary can be searched, browsed, and re-used. This way, media asset collections become part of larger learning content and metadata repositories (see Figure 4 for a shematic diagram representing the underlying process).
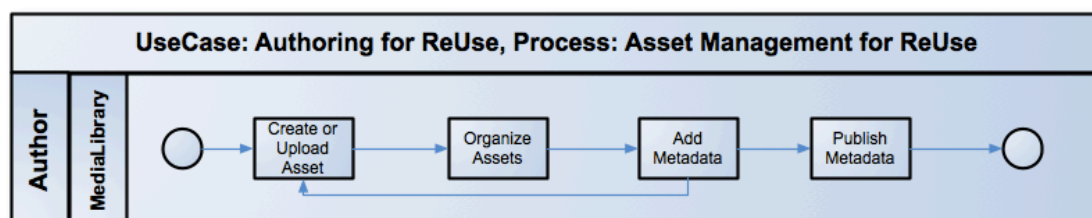
Figure 4: Asset Management for re-use using the MediaLibrary

3.3.2   The author42.ICOPER application in the OICS

The creation of learning content involves different tasks, encompassing the development of didactical concepts, storyboards and the actual content production. The content production step can be supported with content authoring environments. In our ICOPER Application**:** Authoring for Reuse, a customized version of author42 (named author42.ICOPER) is used, effectively providing a web-based authoring environment with extensible interfaces (Cristea, 2006, p. 35). This enables teams of authors to create learning contents in a collaborative setting.

The author42.ICOPER application is integrated with the OICS: as a result the whole repository (including contents from the MediaLibrary and other sources) can be searched directly from the content production environment and retrieved results can be seamlessly integrated in the current production process (see Figure 5).
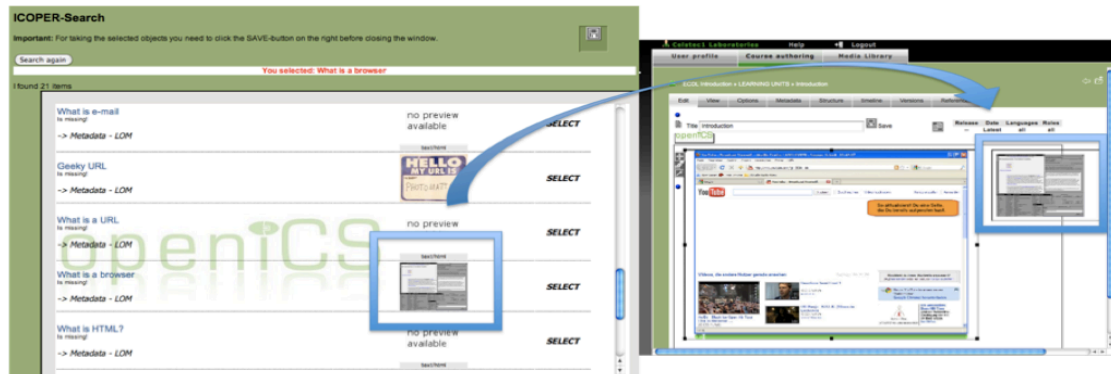
Figure 5: author42.ICOPER search integration with OICS demonstrating how re-use of content may be retrieved

To enable this integration author42.ICOPER was extended with a customized search interface that can be launched from within any content production step. The search interface allows examination of the OICS content using a combination of different metadata terms and keyword fields. Users can restrict search results to specific formats (e.g. images, audio, video, or text). Search results are displayed in a thumbnail enhanced preview that allows depicting metadata details. Search results can be selected and integrated into the current content page just as the users own content would be: page layout, element sizing and positioning functionalities can be used to fit the search results into the content page (see Figure 6 for a schematic diagram representing this process).
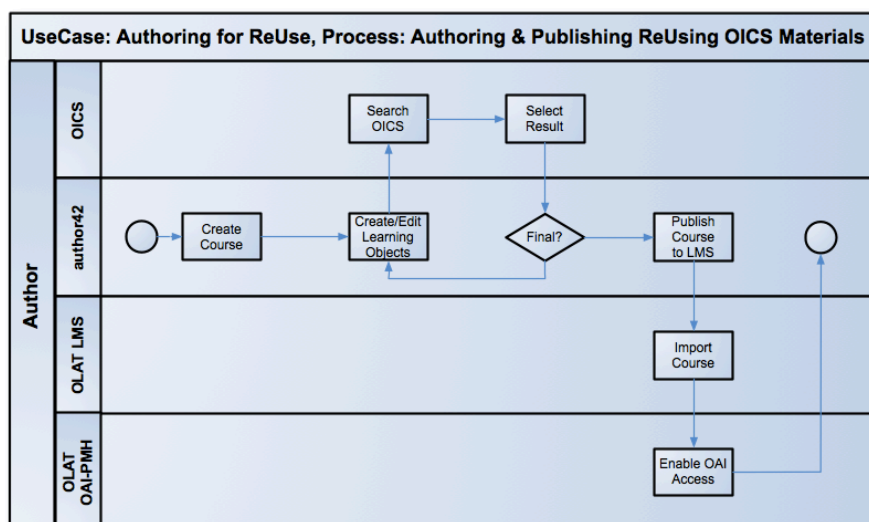
Figure 6: The authoring process using the OICS to retrieve reusable contents

The content created can then be published from author42.ICOPER into different repositories, through a web-service-based publishing interface. In our application, we chose the open source learning management system OLAT, (Fisler & Schneider, 2008) which we extended with a publishing web-service to receive author42.ICOPER contents and an OAI-PMH target to connect it to the OICS again. This way, the result of the content creation process is available for further re-use processes and for learning processes with one publishing step (Figure 7 shows the process model).

3.3.3 Preparation for Re-use

Both ICOPER applications, the MediaLibrary and the author42.ICOPER, offer OAI-PMH targets to access their metadata and contents from external repositories. As previously mentioned the OICS already contains an OAI-PMH compliant harvesting module (Totschnig et al., 2009) that is capable of accessing these targets and retrieving the metadata accordingly. In this way the OICS maintains a searchable repository of metadata that refers to the original contents. Figure 7 depicts the corresponding process model as a schematic diagram.
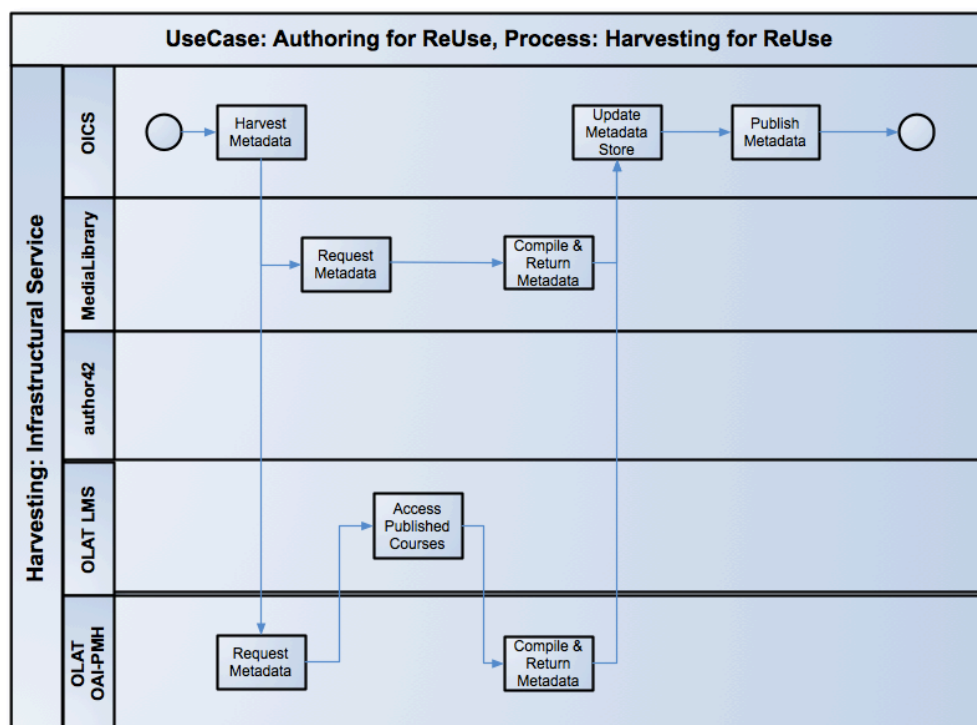
Figure 7: The harvesting process model: updating metadata for MediaLibrary and content published from author42 to OLAT

The search function of the OICS can be used in two different ways: (a) directly, through the OICS' own search interface, or (b) integrated into other applications using the OICS' web-service interface. The latter being the case in the author42.ICOPER integration of the OICS, which enables search results to be automatically and seamlessly embedded into the content production process.

3.4 Evaluation of the authoring for reuse application

For a first appraisal of the ICOPER Application: Authoring for Reuse as well as an assessment of its interoperability with the OICS, an evaluation workshop was carried out at the JTEL SummerSchool 2010 in Ohrid, Macedonia. The workshop was based on the ECDL as the topic domain. As a preparatory step, the ECDL Syllabus was transformed into the LOD format and stored in the LOD repository of the OICS.

In a first evaluation step, participants were asked to select a LOD from the OICS repository and to find freely available media assets on the web that are related to the chosen LOD. These assets had to be organized in the ICOPER MediaLibrary application and tagged with appropriate keywords to help later retrieval.

The second evaluation step involved the use of the previously described authoring tool, author42.ICOPER, in order to produce learning content related to the chosen LOD. Participants were, therefore, asked to use the re-use functionality of the authoring tool connected to the OICS. With the tool participants were requested to retrieve available media assets in order to re-use them in the authoring process. This process step results in content pages created from re-used assets mixed with content directly entered by participants.

As a final step, the participants were asked to publish the results to the learning management system OLAT, from where again it was possible to access the results via the OICS.

Ten participants with different backgrounds covering teachers, researchers, and students from computer science, technology enhanced learning and other fields took part in the evaluation. Initially, participants were asked to rate their competences in relation to Information and Communication Technologies (ICT) and e-Learning as well as their familiarity with standards and specifications ranging from 1 (strongly disagree) to 7 (strongly agree). On average, they had a fairly rich experience with ICT as well as with technology enhanced learning approaches (Figure 8, left). The knowledge of relevant standards in the field (SCORM, OAI-PMH, LOM) was heterogeneously distributed (Figure 8, right).
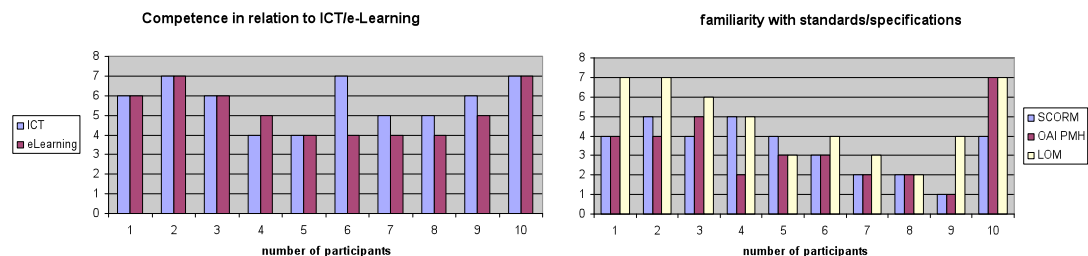
Figure 8. Distribution of competence and knowledge of relevant standards in the field

The participants were organized in teams of two. Each team was asked to perform the evaluation steps previously described.. Eventually, post test questionnaires were distributed to evaluate aspects such as perceived usefulness, perceived ease of use (see Figure 9), system quality or output quality (See Figure 10). The participants were all able to successfully complete the tasks but discovered some problems. The replies (8 questionnaires filled in) show that the process of using the ICOPER Application: Authoring for Reuse was rated to be rather unpleasant. This was expected partly due to the comparatively weak internet access available that caused the Media Library and the authoring tool to perform rather slow and interruptive for the actual interaction with the prototype was rated mostly clear and understandable and its use fairly simple.
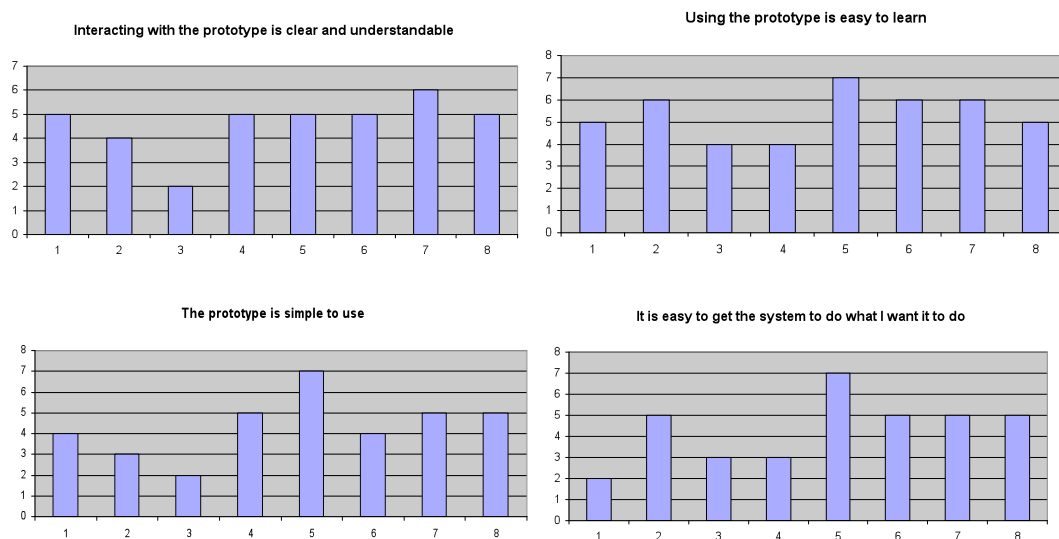
Figure 9. Distribution of the perceived ease of use.

Another problem was due to the current status of the ICOPER Application: Authoring for Reuse: it relies on OAI-PMH for the integration of repositories. OAI-PMH is an asynchronous protocol, relying on the repositories to actively pull new and updated metadata from the provider tools. In a real time collaborative environment this approach leads to delays: content published from one tool is not immediately available in another but only when the OAI-PMH tools have re-harvested the metadata from the corresponding targets. While in a practical situation this aspect may be of less importance, in the evaluation workshop with only limited time available, this turned out to be a drawback.

Despite the technical problems stated (no reliable recovering from error, no clear error messages), most participants rated the use of the ICOPER Application: Authoring for Reuse as rather enjoyable. They valued its functions and interface and rated the output to be understandable, consistent and relevant. Thus the ICOPER Application: Authoring for Reuse is proof of concept for the technical scaffolding and provides the elements necessary the three main process of collaborative online authoring for reuse:

1. The collaborative collection and organization of media assets.

2. The collaborative creation of learning content based on these media assets.
3. Preparation for re-use.

The output I get from the prototype is ...
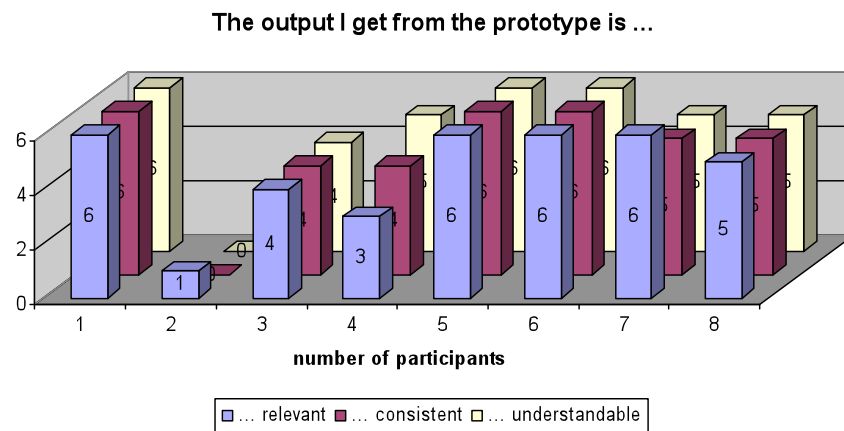
Figure 10. Distribution of the output quality rated.

Regarding the behavioral intention, participants were rather hesitant. Though 7 out of 8 participants (1 not applicable) considered to use it, if they had access to it only 3 out of 8 answered that they really planned to use the prototype within the next 6 months.

3.5 Strengths, weaknesses, opportunities and threats of the integration activity

One of the main drawbacks of the current ICOPER **A**pplication**:** Authoring for Reuse is that the implementation uses the OAI-PMH as an interoperability protocol that connects the different steps of the authoring process. While the OAI-PMH is highly relevant for connecting repositories of learning objects that only occasionally change, it is difficult to use for a collaborative authoring scenario because in this context authors need their changes to be reflected immediately throughout the whole process chain.

Whilst realizing this application, a new approach to connect repositories and authoring tools has undergone the standardization process i.e. the Simple Publishing Interface (SPI). This draft standard (CWA 16097, 2010) especially focuses on the integration of publishing tools (like the authoring tools used in our ICOPER application) and repositories (like the OICS). It is anticipated that SPI may be used for the next versions of othe ICOPER application to support direct collaboration and immediate re-use of results.

Apart from technical improvements it is also foreseen that the infrastructure, as realized by the ICOPER application, can serve different learning delivery scenarios. Related to this and in order to be able to allow the reuse concepts described here to be applied more generally to different educational settings and content production scenarios, an additional survey with a Special Interest Group (SIG) has been performed. This survey is reported in the next section.

4   Research Methodology

Building upon the outcomes of the previous investigations, a qualitative survey was carried out with the Special Interest Group SIG (see Appendix C). This sought to identify innovative practices with respect to new media content and was achieved by interviewing both authors (who create or modify learning content) and course designers (who are responsible for overall learning content unit implementation). Thus the survey effectively focused on the best practices of both individuals and institutions across Europe (and beyond) who use, adapt and innovate with so-called reusable learning content as well as working with a variety of educational computer based platforms and tools.

The methodology used in this study was a qualitative one based around a series of semi-structured in-depth interviews within the SIG. The intent of this qualitative survey was to gain detailed information about identifiable key issues for effective reuse from the experts in the SIG and ICOPER network. The SIG also included stakeholders from other relevant international projects related to content development for reuse. The following list outlines the four phases of the research methodology:

1. Identifying issues
2. Sample selection
3. Semi-structured in-depth interviews
4. Thematic analysis

4.1   Identifying issues

The first phase of the research was focused upon identifying issues deemed to be of importance to extending effective reuse. In other words delimiting our research to the content development for reuse domain. This work built upon on the key findings described in our previous two ICOPER deliverables:

- Deliverable 4.1 **Content Development Methodologies Survey** (Connolly, 2009). This report outlines key topics related to best practices issues, associated standards and specifications to develop educational resources for reuse, tailored to a European dimension. It contains emergent themes identifying the importance of:

  1. Understanding the context of the target audience
  2. Recognising the expectations of a wide variety of users in particular scenarios
  3. Offering 'accessible and reusable' tools in multiple systems
  4. Providing accessible and reusable content.
  5. Disseminating clear guidelines for "licensing" – ideally as open as possible.
  6. Establishing baseline standards to enhance interoperability
  7. Fostering a community of practice as well as improving and enhancing training opportunities for learners and learners' facilitators.

- Deliverable 4. 2 **Quality Control and Web 2.0 technologies report** (Connolly and Scott, 2009). This report describes a further series of recommendations related

to enabling technologies, standards and specifications that can be used to promote content development for reuse. Again a number of emergent themes were identified, namely the importance of:

- Promotion of an institutional perspective
- Development of communities outside the HE institutions
- Encouraging staff development in HE institutions
- Learning by doing

All of these emergent key themes from the previous deliverables were used to construct a suitable semi-structured interview template (see Appendix B). Thus the survey interviews contained a series of open-ended questions that were, as appropriate, adapted for different stakeholder groups or types of projects. This also contributed to the next step – Sample Selection.

4.2 Sample Selection

Interviewees were selected based upon a number of criteria, namely the relevance of their projects and practice as well as their experience of reusability. The latter selection criterion was based upon the identified key issues that emerged in the preceding investigations and can be summarised as necessitating careful consideration of the following, for example:

- Inter-institutional perspective
- Different types of RLC audiences who may have a wide variety of users
- Accessible and reusable' tools and content
- Clear guidelines for licensing
- Baseline standards for interoperability
- Communities of practice promoting training opportunities and staff development.

The importance of these key issues cannot be underestimated. It became apparent both during the interviews and later in the thematic analysis that they are significant factors for content development for reuse. Effectively many of these issues later manifested as key recommendations for this report.

Another criterion to consider when selecting different interviewees was their role in their respective organisations. In other words various types of stakeholders were selected (listed below) and these came from different international projects:

- Higher education managers, Faculty directors and Professors
- Content developers, Educational consultants
- Technology specialists and Educational technology consultants
- Standardization experts

Again these stakeholder groups related directly to those identified within the ICOPER project as important participants not only in the area of content development for reuse but also to help deliver the overall project themes of promoting interoperability and

encouraging increased use of standards primarily in the educational environment. Thus the SIG comprised of a variety of stakeholders. As a result of the selection process and ensuing interviews, a number of best practice reusable learning content case studies emerged. These are summarised in table 3, below, and in further detail in Appendix C.

Best practice	Short description	Target audience
OPENLEARN	OER repository and experimental area for reusing, remixing and republishing learning content.	Open content communities: learners, educators, institutions, professional agencies and commercial companies
ICOPER	Best practice project examining the design, the development and the delivery of interoperable eContent which supports competency-driven higher education.	Higher Education Management Faculties, Technology Providers and Standardization Bodies
OLNET	Open content project collecting evidence and methods about how such research and understanding may contribute to ways to learn in a more open world.	OER Community of researchers, developers, technologists and consultants
CURVE	Collaborative cross-university project for advice and support to faculties within the Open University on the reuse of distance learning course materials and their versioning for a range of purposes.	The OU UK staff involved in advising faculties in reusing course materials including online delivery and learning in other countries.
STEEPLE	Sustainable institutional infrastructure to support university wide educational podcasting includes help and advice for the UK-HE educational community	The UK-HE sector in the areas of automated video/audio capture, video/audio processing, and video/audio delivery ("podcasting")
TESSA	The Teacher Education in Sub-Saharan Africa programme whose aim is to provide localized OER to support school based teacher education and training	School Based Teacher Education and HE based Teacher Training community in 13 African countries
CETIS	Centre for Educational Technology and Interoperability Standards for advice on educational technology and standards.	UK Higher and Post-16 Education sectors
ASPECT	Best Practice Network for improving the adoption of learning technology standards and specifications	Technology providers, Content providers, eLearning support unit staff, Content authors
OPENSCOUT	Skill based scouting of open user-generated and community-improved content for management education and training project	Open content user community interested in management education and training

Table 3: Extending effective reuse best practice case studies from the SIG

4.3   Semi-structured in-depth interviews

Interviews were conducted using a semi-structured thematic methodology. This was documented in the earlier deliverable D4.1 (see Connolly et al 2009). In total a series of 14 interviews were conducted for this study. Most interviews were conducted either face-to-face or online through the FM web videoconferencing application using the previously described interview template (see section 4.1). Face-to-face interviews were also recorded in FM as this enabled both transcription of the audio as well as forming the basis of potential reusable media objects (described in further details below). Additional details about the interview template and the interviewees can be found in Appendix B (containing the interview template) and in Appendix C (listing the SIG interviewees) of this report.

The interviews were carried out using a semi-structured methodology enabling participants to focus on the emergent key themes based on our earlier work. As indicated the recordings were later fully transcribed, and then thematically coded to identify further new issues that could, potentially, extend the framework established in our previous deliverables: D4.1 and D4.2.

It should be noted that the FM web videoconferencing tool is delivered via the UK Open University's OpenLearn Project and, therefore, is available publically. This choice of tool enabled the reproduction, or reuse, of the interviews (with permission) as evidence of how simple media objects can easily be used again in a variety of environments. In other words not only were semi-structured interviews recorded for analysis but the contents were also reused in a number of different places.

Thus the interview contents, presented as media objects, were also published in the newly developed ICOPER Open Educational Resource (OER) course called "Reusing Educational eContent" (See Figure 10 and the online course at: http://labspace.open.ac.uk/course/view.php?id=5571 This OER course focuses on how to create and reuse learning content and is part of a series of 6 ICOPER courses revolving around the main themes of the ICOPER project. The interviews in this context were used as media objects demonstrating how such assets can be created and easily reused.

One further point worth noting here is that one of the underlying premises of these ICOPER courses is to put into action some of the project's main themes, namely encouraging the wider participation and dissemination of issues related to interoperability and the use of standards in promoting the exchange of learning content. With this in mind the learning outcomes of the OER "Reusing Educational eContent" are reproduced here, underlining the necessity to situate and state appropriate guidance for both learners and educators.

By the end of this course, learners and educators should be able to:

- *describe the concepts of Reusable Learning Resources including attributes and specifications*
- *give examples of recommendations for extending effective reuse*
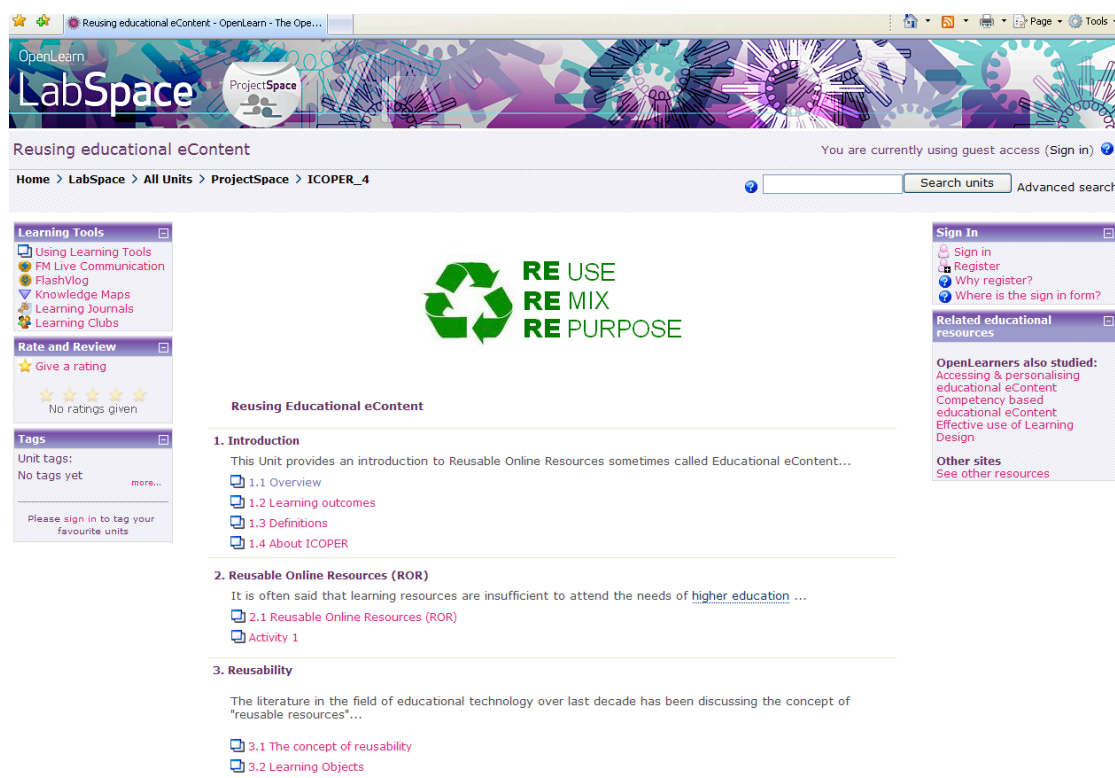
Figure 10: OER Reusing Educational eContent:
http://labspace.open.ac.uk/course/view.php?id=5571

Additionally, as indicated earlier, the interviews/media objects were also incorporated elsewhere into the ICOPER New Media Space (see Figure 11 also the website development at http://projects.kmi.open.ac.uk/icoper/news/) Once fully integrated (the site is under development at present) this will be a dedicated area of the main ICOPER website which not only presents the collected best practices but also will present the emergent recommendations for extending effective reuse from this report.

Effectively the ICOPER New Media Space is a living environment that portrays the best practices of a variety of institutions/individuals, including those from the SIG, who are innovating in their re-use of learning content. A diversity of materials are presented within a showcase blog environment including all the semi-structured interviews and consequent key information that was captured during the survey.

This space has also integrated a variety of new media objects in different formats such as clips from the interview/FM footage, relevant associated slide presentations, related

conceptual maps, significant open videos, as well as a series of the interview audio files.

Finally it should be noted that an underlying premise of including all of these new media components is that they are interoperable and can be reused in many other environments too.
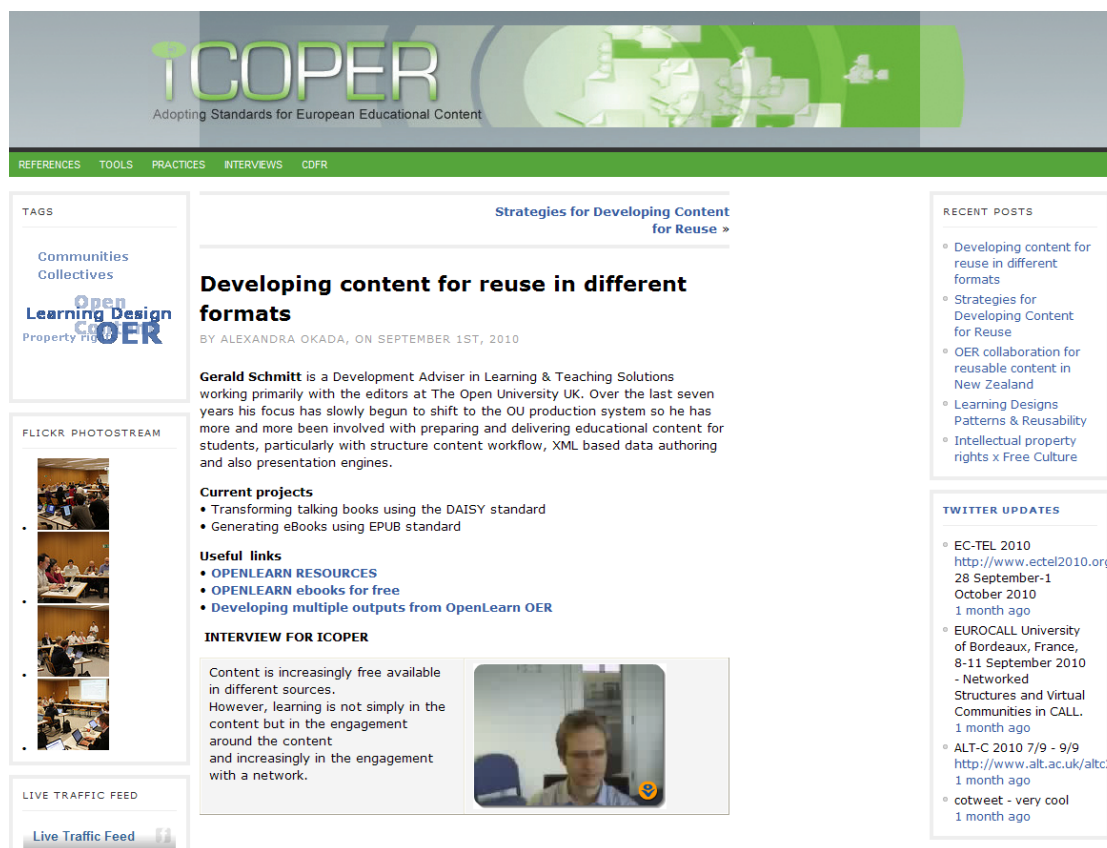
Figure 11: New Media Space
http://projects.kmi.open.ac.uk/icoper/news/ (in development)

4.4 Thematic analysis

Once the semi-structured interviews were completed it was necessary to analyse the contents. The subsequent thematic analysis, therefore, built upon the foundations established by the previous investigation carried out in deliverable D4.1 and D4.2 (Connolly, 2009 and Connolly and Scott, 2009). A fully description of the thematic analysis can be found in the Appendix A.

The premise being to improve our understanding of significant information related to best practices by identifying relevant evidence from recognised experts particularly in relation to creating a series of recommendations for the broad area of content development for reuse (the themes of this report) both within and beyond the ICOPER Community.

Findings from the previous investigations indicated that there was little significant evidence forthcoming about active reusability within the surveyed community. Thus the previous case studies provided little supporting evidence for such content development for reuse. This manifested as a confirmation that there were: "*more issues about 'first use' quality rather than specifically 're-use' quality*" (Connolly & Scott, 2009).

The thematic analysis revealed a number of issues, namely those that centred around:

- Standards and specifications for extending effective reuse in several scenarios
- Significant barriers for reusing learning content
- Benefits for adopting standards and specifications
- Current challenges for extending effective reuse
- Key trends for extending effective reuse

It is, of course, important to link these key thematic findings to the concluding suggestions of this report. First of all, however, it is necessary to describe them in some detail before making the final recommendations. The next section will elaborate on the numerous thematic findings that have emerged from our research.

5   Thematic Findings

5.1   Standards and specifications for developing content for reuse

This survey revealed an interesting range of standards and specifications used in conjunction with content development for reuse. Several examples of adopting standards and specifications were described by interviewees from within the SIG addressing various different scenarios. They also offered clear descriptions of several factors that represent strengths or key issues in their current projects related to standards and specifications.

The majority of highlighted best practices demonstrate that many people are adopting a variety of specifications and developing several formats of learning content materials. As a consequence, a diversity of format, standards and specifications have been used to enhance an increasing number of opportunities that enable further reuse of learning content including more efficient ways of extracting and exchanging information.

The following list outlines a selection of the learning content formats that the SIG described as useful and practical applications to encourage reuse:

- *Text documents that are properly formatted*
- *Information represented as simple HTML or HTML 5*
- *Increased Moodle module options*
- *A Moodle component format that would install into any Moodle installation*
- *An expansion of e-books and use of ePub formats*
- *Presenting audio in an MP3 format*

In addition, they indicated the following standards that had been adopted within their learning content based projects:

- *Rich XML format*
- *IMS content packaging*
- *SCORM package*
- *IMS Common Cartridge package*
- *RSS format*
- *OAI-PMH services*
- *Dublin Core*
- *LOM*
- *ISO/IEC JTC1 SC36*
- *CEN/ISSS TC 353*
- *IMS RDCEO AND IEEE RCD*
- *IMS LEARNING DESIGN IMS*
- *XCRI The eXchanging Course-Related Information (XCRI)*
- *LEAP2A*

Contributors emphasised that the opportunities for extending the effective reuse are higher when learning content can be transformed in as many different download formats as possible. The flexible way of importing and exporting content in and out of any system in an integral and systematic manner, therefore, is a key issue for extending the effective reuse of that learning content.

It was also revealed that where projects were early adopters of a variety of standards i.e. that developers or users acknowledged the importance of these interoperable standards this has also encouraged the embracement of newer formats too, encompassing the media technologies of e-books and audio. A key requirement for extending effective reuse to emerge, however, is enabling the facility to make the actual process of authoring structured content very easy for end users. This helps engender more active communities of practice who share and promote reusable learning content resources.

In effect a combination of these initial issues can be summarised by the first recommendation of this report namely that it is important to "develop easy-to-use and efficient tools". This recommendation is fully described in Section 6.2.

Other key features emerging from the SIG, particularly from those working in the competency-driven Higher Education projects, is developing the context specification and improving collaborations for the global standardization efforts in terms of sharing key benefits of extending effective reuse. In this scenario some described examples were time reduction, improved quality and fostering expertise. In addition, another recognised benefit is that users can also establish multiple connections amongst their own profiles, competencies and achievements. It was suggested that the advantage of this phenomena is, in fact, the ease of which one can reassemble these elements.

A number of contributors, who have been coordinating and developing applications for the reuse of learning content, mentioned how important it was to adhere to standards when considering or anticipating the future reusability aspect. They also presented examples of key issues that both highlighted and emphasized intrinsic strengths of competency-driven Higher Education projects, such as: wide adoption and coverage of key educational concepts which constitute a common language. This, they argued, facilitates reusability in several ways.

In addition, it appears that another key aspect is creating a strategy to ensure effective reuse. This could take the form of combining the opportunity of evaluated workshops following on from training sessions. Providing support and training for end users is indeed a crucial requirement for promoting reusability, ensuring improvement, as well as disseminating benefits in adopting standards and specifications in the learning content community. Again this has led to another key recommendation of this report: "provide meaningful support and training" (full details in Section 6.1)

The importance of adopting specifications and standards, particularly for exchanging new media content such as educational podcasting, was described by a number of

survey participants. Some key benefits of standardization listed by them were the ability of creating meaningful aggregation of RSS and Atom feeds as well as the ability to search on the metadata rather than just harvest it. Standardisation is important for finding and exchanging information for users to bookmark, play and combine learning materials across a large number of repositories. Some examples described by the SIG highlighted the benefits of the RSS specification for exchanging audio and visual material. Additionally this also allows content to be found more easily by other users.

Some contributors also described their best practice networks for school scenarios. They presented the most popular specifications and formats used in practice for the school scenario such as SCORM 2004, the Common Cartridge and QTI. Three special qualities of this best practice were also described.

Firstly it is important to produce and test specifications to extend effective reuse. Feedback from content providers, teachers and standards experts are, indeed, crucial for improving the practice and further disseminating those standards. New specifications can also take into account what really matters for end users or for regular standards users.

Secondly, another key issue highlighted by one interviewee is to refrain from exposing end users directly to standards at all. End users may not be particularly interested in or aware of the role of standards, but probably would appreciate and want the benefits of using standards. In order to realize what those are, well-elaborated training and activities that make sense for them must be prepared and provided.

Thirdly another key is to provide functionalities for searching and, therefore, potential reuse of learning content. These functionalities are absolutely necessary, especially in a teacher's environment in order to facilitate the process and help them become more engaged in sharing their own and others resources as well as receiving and exchanging feedback. This suggests that users, then, do not necessarily need to have search resources in one educational portal or go to other environments, they may choose to or prefer to use their own favourite or personal workspace.

The SIG also highlighted that extending effective reuse should cover a vast range of subject areas across the Higher Education sector including the development of specialized training materials for teaching used in the context of continuing professional development. Some examples described by survey participants clearly indicated the importance of developing multi-cultural materials, through multi-organisational, multi-country, and multi-lingual OERs. It emerged that in order to promote widening participation around OERs across different countries, reusability attributes of learning content must highlight many of the following: accessibility, institutional commitment, support for end-users (e.g. teachers and learners) and active learning styles.

Several strengths were emphasised by SIG members particularly regarding the wide range of contexts available for reusability that include: translation, versioning, adaptation, integration, localisation and contextualisation. Some examples illustrate these significant features, for instance, adapted resources have been integrated into either new courses or existing courses' programmes that are used by the participating institutions. Once the original generic set of materials are developed using a template then they can be adapted or localised for each of the different (country) contexts.

Another key issue for the increased use of OERs in multi-cultural scenarios is a focus on valuing authorship in order to help end-users (in this case: teachers). This enables them to feel confident to create, reuse and adapt OERs in their own contexts.

5.2 **Significant barriers for reusing learning content**

Evidence from this survey also indicates that there are a number of problems around the development of reusable learning content as well as around the process of making this reuse effective. These issues have many different aspects. Whilst the common denominator for all surveyed experts focussed on a '*culture of reuse*', it is important to acknowledge that there was a wide variation of examples related to the term "barrier". Several experts in the survey considered the lack of a culture of reuse one of the most significant barriers for content development for reuse. Other interviewees, however, gave different interpretations and examples to describe the meaning of a "culture of reuse". In order to integrate these different perspectives and understand this concept from the viewpoint of our interviewees, several examples were analysed and are illustrated in the following text.

Initially a number of experts from the SIG emphasised that the culture of reuse includes several technical key issues such as tooling, metadata, standards and open formats that must be coherent, integrated and seamlessly implemented. In relation to other technical issues, further interviewees added that the culture of reuse should present efficient tools for facilitating and simplifying reusability, for example, tools to produce it and to find appropriate learning content.

The culture of reuse also appears to comprise of some social aspects, described in detail by the subsequent examples, but summarised here as: people interested and engaged in sharing reusable resources; communication among different stakeholders; communities of practice and the social collaboration for discoverability and credibility around the content. Many of examples given by those surveyed highlighted these issues, such as the importance of:

- Engaging people in sharing reusable resources and thus sharing their interests
- Fostering Communities of Practice for people centred on content development for reuse

- Promoting collaborations among communities who work together on the same key issues
- Encouraging communities to share reviews and feedback collaboratively focused on the area of content development for reuse

In addition to social aspects, examples described by the SIG also indicated the lack of interest from universities and publishing houses in developing open reusable content, whilst continuing to value the role of high quality learning content in Higher Education as well as envisioning business and marketing benefits for extending effective reuse. In summary, there are a number of issues to resolve in this scenario, namely those related to the idea that:

- Open Reusable Content is not part of the goals of some HE Institutions
- Open Reusable Content is not valued by some HE Institutions
- Open Reusable Content is not considered as a big business by many publishing houses

The culture of reuse should also reinforce the importance of disseminating the key benefits around content development for reuse in order to convince more and more people to reuse learning content and develop appropriate reusable resources. These benefits should also include strategies for reducing time and any associated skill barriers. It appears that these strategies should also include multi-disciplinary teams and specialised staff to provide support and materials for facilitating this process of reusing, adapting and versioning learning resources.

Thus specific support and tailored materials offered by multi-disciplinary teams and specialised staff may include concepts that are unfamiliar to end-users such as terms related to versioning and/or adapting resources. Accordingly these guidelines should be written using non-technical terms so that end-users should, therefore, also be able to engage with what they may perceive as an easy versioning and adaptation process. This should, in effect, promote sufficient confidence for the novice end user to engage with the process.

Key issues to emerge from the survey also highlighted the continued need for a series of precise guidelines that ease the process of reuse. For example: raising awareness amongst end users about benefits of adopting standards; keeping up to date with changes in standards and the related technologies, i.e. the consequences of fast moving digital world. Many survey participants also remarked upon the fact that there is a trade-off between simplicity of the publishing process compared to the requirements for content development for reuse. SIG participants explained that the difficulty of use increases around complex resources and even when simplifying strategies are applied, e.g. processes such as packaging, reusing, editing and modifying resources, there is still a need for them to be easy for end users like educators. It seems that the process of reusing complex resources and adopting specific standards as well as specifications, particularly those developed outside an organisation, remains challenging for most end users.

Apart from technical and social aspects, the culture of reuse also contains a number of intrinsic pedagogic issues. Participants in the SIG mentioned that one of the big shifts is to move away from contextualised narratives to meaningful, granular and clearly structured content.

Regarding further pedagogic issues, interviewees also remarked upon the importance of understanding and meeting the changing learners' needs by designing reusable resources taking into consideration some of their requirements and, consequently, embracing more diverse yet subtly appropriate formats.

The culture of reuse also incorporates understanding and implementing appropriate legal aspects. Several examples illustrating this point. One interviewee, for example, reminded us that although users might be interested in sharing, they should remain aware of copyright issues and the drawbacks of releasing content that cannot be reused. Another interviewee added that, on occasion, rights may not a very clear issue even around OER especially in respect of new and different formats (e.g. ePub). This is can be applied to specific scenarios, e.g. commercial purposes, which differ from the original context that was created, say, in open repositories. Another example illustrated by a different expert highlighted the importance of understanding "composite rights" particularly for those involved in the production of audio and video based content. Rights can vary depending on how materials are composed in different channel or formats.

In summary, the culture of reuse should promote and disseminate clear issues with respect to copyright not only around OERs but also to related academic delivery e.g. broadcasting. One survey participant, for example, highlighted the importance of being aware of different models of licensing and rights as well as the sensitive handling of all concerned in order to be able to make the best use of it.

5.3 Benefits for adopting standards and specifications

The following examples highlight the key benefits of adopting standards and specifications for developing reusable resources. These positive aspects were considered from the perspective of content developers as well as encompassing the views of technology providers. It appears that in raising awareness about the advantages of using standards amongst producers, developers and trainers it is possible to encourage them to develop their content or tools further in such a way that future users can more easily use and reuse those resources.

In terms of institutional advantages, several key benefits were depicted by the SIG, for example:

- Opening up reusable content can increase student numbers
- Reusing resources often reduces content development costs

- Content development for reuse increases the opportunity to develop new distribution channels for cross-selling
- Being able to move content around different platforms can improve communication prospects e.g. engender international partnerships

In terms of the general benefits for developers, providers and users, several key advantages of adopting standards were also described by survey participants who provided the following examples as evidence of these advantages:

- Educators can not only reuse learning content but also can further develop their teaching methods from reusable resources
- Content Providers can transform the format of learning content on a relatively large scale
- Content can be described in different contexts as well as being integrated and handled from different repositories, authoring and runtime systems
- Learning content can also run on different environments, platforms and learning management systems
- Updating resources to follow new technology changes or to avoid proprietary software that might be discontinued
- A self-describing OER approach

Thus the results of our survey demonstrated that SIG participants recognised the numerous benefits of adopting standards and specifications in respect of developing learning content and, potentially, reusing it. They also acknowledged that there were still significant barriers to the adoption and use of standards and specifications but where they were made easily available and implicit their use increased. This led to another key recommendation of this report:" Keep standards implicit" and "thoroughly tested by different stakeholders (see Section 6.1 for full details)

5.4 Current Challenges for Extending Effective Reuse

The most reported challenge to emerge in this survey was the need to identify appropriate and efficient tools that facilitate the process of developing reusable learning content and, therefore, extend effective reuse of that content. Again there is a strong expectation on behalf of the educator or content developer, that great tools are, indeed, one of the biggest needs for facilitating the reusability of learning content. The following examples given by survey participants describe the importance of having appropriate tools for a variety of scenarios in this environment:

- **Developing content:** efficient tools for supporting (in a transparent way) standards to make the content easily reused and reusable and, additionally, to repurpose it in some cases

- **Managing content:** easy-to-use tools for tailoring content for different usage scenarios and usage contexts as well as being able to manage large amounts of content that may be available
- **Searching content:** well designed tools for refining, searching and filtering by criteria again in a transparent way
- **Simplifying the process:** simple tools that help educators who may prefer to focus on the educational aspects

Another key challenge highlighted in this survey for ensuring quality production of reusable resources, particularly new media, was enabling key stakeholders to work together. Key people in this participant group include academics, students, content designers and technical stakeholders.

Again as a means of highlighting another key issue for extending reusability, the following example from a SIG participant identified the importance of seeing all assets fully described with the same metadata. This idea leads to another great challenge of developing resources fully associated with the same metadata and generated automatically by the machine that holds all information.

5.5 **Key trends for extending effective reuse**

The survey also revealed a variety of key trends related to reusability. Several interviewees mentioned new issues, which are their current theme of interests and possible candidates, therefore, for extending effective reuse.An example given by a SIG participant highlighted the importance of an in depth understanding of a user's needs and requirements, particularly during the process of discovering, accessing and sharing educational resources.

In addition to user needs, another topic of interest emerging from this survey was the need for visual and practical user guides to improve the end users' experience as well as improving their skills for remix and reuse resources. A further example related to the importance of understanding a user's current practices was given by another expert who highlighted innovative strategies to encourage users to develop their own different content development for reuse workflows.

Regarding new issues related to learning content development, an innovative strategy mentioned by another interviewee was the idea of extending effective reuse at a very fine granular level through freeing different OER assets to be reused independently.

Another key theme of interest for promoting the effective reuse of learning content that emerged from this survey was the implementation of a content tracking facility. One of the interviewees highlighted the importance of understanding key features of reusable content in order to provide good recommendations for content providers.

In addition to new tendencies for extending effective reuse, some examples given by SIG participants described the need of being able to deploy content by dynamic transformation that engages users with environments of their interest (which might not be necessarily learning management system based). It appears that one of the key needs emerging here for new business models is to distribute content and label it clearly for reuse. These needs relate particularly to the new media content scenario.

In order to maximise future reuse, several interviewees highlighted, as a key trend, the use of open standards and the production of assets of a high quality that will ensure and lead to their future reuse.

New requirements for ensuring effective reuse were also described by many interviewees. These requirements also appear to include the necessity of developing new concepts for promoting reusability, such as the concept of "travels-well-content", and the concepts of "legal freedom", "technical freedom" as well as "cultural freedom". Such examples were highlighted by different experts who emphasized the importance of link theory and opportunities for users to improve their practice. They also highlighted the importance of realising that all these concepts potentially build upon each other.

Experts in the SIG also provided critical comments in relation to some of the issues that stakeholders need to consider. The first example highlighted conveys that standards alone may not be enough to ensure effective reuse of learning resources. Several arguments were given by survey participants to clarify some of the key issues around learning through reusable resources. In relation to this issue, one of the first topics highlighted in the interviews was framing the actual problem yet focussing on the technical reusability thus really missing the point. SIG participants emphasised the importance of recognising the direction in which the disruptions are headed and finding new ways that individuals, groups and communities of practice can work effectively in this new open virtual world.

Another topic was the importance of providing scaffolding for early learners rather than simply focussing primarily on experts and autodidacts i.e. the self-learner or teacher. In other words to widen participation it is necessary to expand learning opportunities for all levels and provide a variety of teaching methods, guidance and advice to many different stakeholder groups. This point was made by many of those surveyed in this and other categories of the semi-structured interviews and has led to one of the key recommendations of this report: "Raise OER-related skills and expertise (see Section 6.1 for full details).

Finally another topic to emerge in this category was that learning may not be simply restricted to the confines of the content. It can also be, in fact, implicit in the engagement process around the content. Additionally some SIG participants also commented upon the role of the ubiquitous social networks that also, in themselves, appear to provide many new, innovative and informal or previously unavailable learning opportunities.

6 Recommendations

The recommendations presented in this report come from the previously described multi-layered analysis of the current barriers, challenges, benefits and trends to extend the effective reuse of learning content. The best practice case studies and literature review associated with this research has also made a significant contribution to the underpinning of this work.

The recommendations presented in this report are derived primarily from a thematic analysis of this data (more details were presented in Appendix A). The key issues for extending effective reuse have been highlighted, therefore, with the support of summarized data extracts. Our data covers a wide variety of scenarios, such as: multiple formats and multiple specifications; competency driven factors; including a specialist focus on 'podcasting'; teacher training and schools; as well as professional learning.

Data also illustrates some of the barriers and benefits of adopting appropriate standards and specifications for reuse that has been described in Sections 5.2 and 5.3. Appendix A also contains some of the original data from transcripts of interviews that demonstrates individuals' views and thoughts on the key challenges and trends for reuse standards. These were presented, in synopsis, in Sections 5.4 and 5.3.

Two categories were established for the recommendations: global and specific. The following sections outline each of the seven recommendations in detail and include the context and stakeholder groups to whom the recommendation applies as well as how the recommendations relate to the wider ICOPER project. Each recommendation has been justified from the evidence collected from the qualitative survey, the associated literature review and best practice case studies. In addition examples for implementation have been described in the form of suggested key actions.

6.1 Global recommendations

R4.1 – Promote a culture of reuse

Stakeholders: Standardization Bodies, Technology Providers, Higher Education Management and Faculty

The primary recommendation of this report is the endorsement of a broad initiative to promote a "culture of reuse".

Justification

It was discovered in our analysis that there are several international OER projects developing reusable learning content and, consequently, they are promoting a wide range of best practices around reusing those resources. This was described in Section

5.1 Thematic findings as well as in the "Standards and specifications for developing content for reuse". Conversely, there also continues to be strong evidence emerging in the form of perceived barriers for extending effective reuse among other end users described in Section 5.2 "Significant barriers for reusing learning content".

Although the amount of OER content is increasing by a large amount, the ability to reuse these resources in flexible ways is not keeping pace with this growth. Findings in our survey revealed that most of these barriers are part of what we recognise to be the missing "culture of reuse". Whilst there are large investments being made globally by foundations and governments to promote the development of OERs, the culture of reuse should be implicit in that process too.

Key actions for implementing this recommendation

To engender a culture of reuse, the following key actions are recommended:

- Develop a cross-institutional-wide policy with appropriate information that covers diverse aspects (e.g. social, technical, pedagogical, cultural and legal) as well as the inclusion of key benefits and strategies to extending effective reuse locally – both within an institution and also externally between international partnerships and collaborators
- Foster communities of practice to engage different stakeholders to collaborate with each other by sharing best practices, resources, tools, problems, solutions, reviews, feedback and references around the broad area of Content Development for Reuse
- Provide easy access to content tracking data for all. This includes statistical evidence and review comments in order to understand the key features of the most popular reusable content. This also permits the identification of new needs and may lead to further, localised, recommendations

Relates to Recommendations:

- D2.3, R2.2: Use of Learning Outcomes in programmes and courses
- D2.3, R2.10: Multilingual metadata about Learning Outcomes is helpful
- D3.2, R3.10: Sharing of good practice
- D6.3, R6.8: Reuse of assessment resources across an organization to leverage the teacher workload
- D6.3, R6.9: Sharing of assessment resources across an organization improves Faculty coordination

> **R4.2 – Disseminate the Openness philosophy**
>
> Stakeholders: Standardization Bodies, Technology Providers, Higher Education
> Management and Faculty
>
> Another key recommendation of this report is the promotion of a wide dissemination
> of a philosophy of openness.

Justification

It appears that learning content resources developed using an openness philosophy
frequently include several features that facilitate reuse. To increase opportunities for
reusing resources, for example, stakeholders should be made aware of the advantages
and new trends of adopting open content, open standards, open specifications, open
formats, open license, open tools, open web, open communities and so on. There is
evidence from our survey, and associated research, that open features offer several
benefits to facilitate reusability, such as interoperability and accessibility. These
findings have been described as examples of best practices that promote appropriate
open features. Another significant message to emerge is the importance of endorsing a
wide dissemination of the openness philosophy, including promotion of best practices
and their key strengths, as well as understanding the associated challenges (described
in the Section 5.4) and new trends (described in the Section 5.5).

Key actions for implementing this recommendation

To deploy dissemination and promote the adoption of an open philosophy within
learning content projects, the following key actions are suggested:

- Commit to open standards and open specifications to enable interoperability.
  Whatever is sent out, users should be able to take the "stuff" apart, reuse,
  repurpose, remix and share it
- Support open formats. It is most important to keep all content editable at all stages
- Be aware of open licensing approaches as well as related key issues in terms of
  copyright and Intellectual Property Rights (IPR) in respect of different formats
  and scenarios, composite rights, academic licenses and so on, in order to make the
  best use of them
- Make resources available directly from open repositories or via open portals.
  These should be fully accessible to Open Web Search Engines in order to
  facilitate and promote their discoverability and reusability
- Foster open communities of users around the open resources and keep them
  updated in terms of new releases as well as relevant local and international
  information.

R4.3 – Provide meaningful support and training

Stakeholders: Standardization Bodies, Technology Providers, Higher Education Management and Faculty

A key recommendation of this report for extending effective reuse is providing meaningful support and training.

Justification

There are strong signals both from the previous investigations (D4.1 and D4.2) and from the current survey that indicate important aspects of adopting and applying successful strategies for extending effective reuse (described in Section 5.1 of this report in detail). Namely that it is absolutely necessary to provide appropriate support for all staff, including academics, as well as end users, in terms of raising awareness of the technology. Acknowledging the crucial role of standards in addition to the key advantages of the reusability of learning content (described in Section 5.3) is of the utmost importance. In order to deploy these strategies effectively and efficiently, not only for the reuse of existing resources but also for the development content for reuse, another primary recommendation, therefore, is to provide meaningful support and training.

Key actions for implementing this recommendation

With this in mind we recommend the following key actions:

- Promote an institutional investment in developing staff technology related skills. These should include training sessions, workshops and pedagogical based events
- Develop high-quality open training materials in multiple formats to disseminate not only conceptual information that users may not be familiar with, but also by circulating technical guidelines and promoting further methods for searching, reusing, adapting, and sharing learning resources
- Encourage all users (e.g. content providers, technical support staff, tool developers, course team members, Faculties managers, and so on) to adapt their training materials based on local needs and, then, encourage them to share those materials once again on the Open Web
- Make relevant tools and useful frameworks for reusable content development freely available, including key information about the standards that have been adapted to meet the local user's interests and needs
- Encourage and engage users to develop, as well as share, their own frameworks and methods to recreate learning content that has been adapted to reflect their local scenario.

Relates to Recommendations:

D2.3, R2.9: Introduction to Learning Outcomes aware systems requiring training
D3.2, R3.9: Support course planning procedures
D3.2, R3.11: Training and support
D6.3, R6.2: Provide relevant formative feedback to the student

6.2 Recommendations for Technology Providers and Standardization Bodies

R4.4 – Develop easy-to-use and efficient tools
Stakeholders: Technology Providers

The recommendation for technology providers is to encourage the development of tools that meet the needs of users, easy-to-use and efficient for saving time as well as effort.

Justification

Whilst there are several examples related to the use and creation of tools for facilitating reusability emerging from this survey, as well from the previous investigations (D4.1 and D4.2), there continues to be strong evidence highlighting the further need for more efficient tools to facilitate that creation and reuse. Based on the key barriers (described in Section 5.2) and challenges (described in Section 5.4) presented in this report, the recommendation for technology providers is, therefore, to encourage the development of tools that meet the needs of users, that are easy-to-use, efficient for saving time as well as effort and coupled with appropriate guidelines that will promote the culture of reuse.

Key actions for implementing this recommendation

In order to meet those current user needs that have emerged from the survey the following list presents some more detailed and specific key actions:

- User's needs and requirements should be taken into account not only during the development of new tools but also for improvements and updates
- Provide clear guidelines with relevant information about how to use the tools including listing the key advantages for adopting them in order to promote the culture of reuse
- Adopt learning content tools and resources that will enable content development at scale and in various contexts
- Ensure that content authoring tools implicitly use a structured content template so that the structured format will be automatically generated by users

- Offer structured content authoring tools that are flexible, including the creation of sophisticated rich interactivity for various scenarios and different languages
- Supply structured content authoring tools that allow users to add details of the original context in which the content was created to facilitate further adaptation and localisation
- Allow users to add reviews and recommendations about learning content in the form of metadata in order to enable enhanced discoverability of appropriate content
- Provide Filtering Content Tools transparency
- Offer search facilities that are flexible, easy to use, permit scanning through resources and allow users to make informed judgments
- Present clear guidelines for users including specific directions for the packaging of potentially complex resources
- Deliver tools that provide the opportunity for new and more efficient ways of presenting learning content resources
- Stress the importance of providing clear and unambiguous description of resources
- Ensure that tools can extend the effective reuse of resources at a fine granular level e.g. freeing individual assets within OERs for independent reuse.

- **Relates to Recommendations:**

- D1.2, R1j: Efficiency of API format
- D1.2, R1l: Rating and ranking
- D2.3, R2.12: Learning outcome indexation & finding should be simple
- D3.2, R3.4: Familiar vocabulary
- D3.2, R3.7: Study guides
- D3.2, R3.13: Teaching portfolios
- D5.3, RTPc: A Learning Outcome based IMS-LD learning delivery solution has to be easy to use

R4.5 – Keep standards implicit and thoroughly tested by different stakeholders
Stakeholders: Standardization Bodies

The recommendation for technology providers for facilitating the effective reuse is to keep standards implicit and thoroughly tested by different stakeholders.

Justification

The majority of the best practice case studies' evidence as well as details from the interviewees' experiences highlighted the importance of keeping learning content standards in the background. This should increase opportunities for the OER tools as well as related interoperability standards being reused by a wider community of users. In this instance the recommendation for technology providers and standardization bodies is, therefore, to keep the appropriate standards implicit in the resources as well as thoroughly testing them with different stakeholders in a variety of scenarios (described in detail in Section 5.1).

Key actions for implementing this recommendation

The necessary key actions to achieve this would, therefore, entail the following:

- Include standards seamlessly within OER processes. Standards do not need to be visible to end users but their benefits and requirements should be clear for the whole community. Both tools and associated standards should extend effective reuse in a way that encourages users to be focussed on the educational aspects rather than the perceived technical barriers. This could also lead to an implicit promotion of the culture of reuse
- Provide guidelines for the adoption of such OER related standards and tools including simple information in a straightforward and interesting way. Again this should contribute to the implicit promotion of a culture of reuse
- Endeavour to predict technology changes and ensure that content tracking of data can be used to enhance tools and standards effectively and efficiently
- Embrace fundamental and essential causes that enable the end user to make their own good sense of the learning content or tools before attempting to reuse the resources
- Deliver and evaluate a diversity of workshop formats and training sessions (face-to-face, virtual, blended learning opportunities) with a variety of OER creators and users e.g. content providers, teachers and standards experts
- Ensure that standards and tools are tested. Obtain and provide feedback in order to improve practice
- Keep OER standards and tools updated, therefore, enabling interoperability at different levels and using different platforms. Provide mechanisms whereby tools can be described easily as well as promoting new features and providing easy-to-use functions for the end user.

Relates to Recommendations

- D1.2, R1c: Maintain a managed process for the development of a new layer API
- D3.2, R3.5: Student surveys
- D5.3, RUMb: relevant stakeholders involved in Learning Outcome based IMS-LD
- D5.3, RUMg: Train Faculty members in a harmonized Learning outcome language
- D5.3, RUMh: Train Faculty members in designing 7 assessing Learning outcome based IMS-LD
- D6.3, R6.1: Use IMS QTI 1.2.1 and IMS CC 1.0 for assessment

6.3 Recommendations for Higher Education Management and Faculty

R4.6 – Raise OER-related skills and expertise

Stakeholders: Higher Education Management and Faculty

The recommendation for Higher Education Management and Faculty for encouraging the effective reuse is to contribute to raise OER-related skills and expertise.

Justification

Evidence from this best practice research also highlights that a large number of teaching and administrative staff still appear to be less interested or even resistant to using OERs. Many reasons were given for this attitude (described in Section 5.2): lack of awareness; lack of technology skills; disinterest or little experience with OERs; perceived time related requirements and so on. Our recommendation, therefore, would be to raise OER-related skills and the associated expertise required for effective reusability within any institution or educational environment – remembering that both the delivery and reuse of OERs can also take place partially or entirely in the "virtual" world, not just within the physical boundaries or conventions of an educational building or traditional face-to-face teaching scenarios. Reusability is most easily promoted when staff are engaged with new ideas as well as prepared for them.

Key actions for implementing this recommendation

In order to encourage such opportunities for users to develop appropriate OER-related skills and expertise, a list of specific actions are, therefore, recommended:

- Encourage academics to share best practice deployment and underline pedagogical reasons to support the adoption of the different educational delivery channels
- Provide support and appropriate multi-format materials clarifying processes that may be unfamiliar to end-users such as versioning and adapting resources
- Form multi-disciplinary teams. Combine expertise both from pedagogical and technological areas alongside the provision of clear workflows
- Raise awareness that there is no optimal way of looking at reuse for content. Recognise the direction in which the disruptions may head and find alternative ways to work in this new open virtual world
- Ensure that all key stakeholders working together: academics, media technicians, public relations staff, freelancers as well as learners
- Develop strategies to scaffold learning for the early adopters (e.g. a variety of educators, as well as learners) rather than being focussed primarily on the experts and autodidacts

- **Relates to Recommendations:**
- D3.2, R3.1: Evaluation/accreditation
- D3.2, R3.3: Institutional visibilities
- D3.2, R3.12: Professional development

R4.7 – Raise awareness of the key issues related to Content Development for Reuse
Stakeholders: Higher Education Management and Faculty

Justification

There are several key issues to be taken into account when reusable content is initially developed. Findings from our best practices case studies as well as previous investigations (D4.1 and D4.2) suggest that several factors can facilitate the effective reuse and creation of reusable resources (described in Section 5.2). There appear to be a number of recognisable phases: searching, authoring, adapting and publishing (described in Section 5.4). Our recommendation, therefore, is to raise awareness of the key issues around Content Development for Reuse at an early stage of development whilst continuing to keep communities of practice engaged in sharing all relevant OER-related information.

Key actions for implementing this recommendation

Based on the findings described in this report, the following and final list of specific actions is presented concerning those five different Content Development for Reuse phases, namely: Searching, Authoring, Adapting, Delivering and Sharing

1. Searching

- Engage the academic community to share in different ways ranging from initial searching for content in a simple form using open search engines tools to the use of advanced systems that filter and/or quality control the different OER repositories (e.g. constrained search engines, Google Custom Search Engine, RSS feed list, the OICS and so on)
- Raise awareness of new OER tools and functionalities that enable efficient and effective searching, especially ones that can be embedded in a user's own local environment
- Disseminate strategies that can facilitate the process of finding resources that were successfully used in other contexts such as incorporating meaningful (social) tagging systems, including opportunities for collaborative bookmarking, and so on. These strategies and tools can be delivered to, adopted and shared by the whole community.

2. Authoring

- Encourage academic and support staff to value collaborative authorship in order to help end users to feel confident to create, reuse and adapt OERs in their own contexts
- Raise awareness of important features that ensure high content quality for learners. Successful content must be fun, interactive, interesting, visual attractive, engaging and so on
- Remember that learning isn't simply related to content but that it is in the engagement with the materials and, possibly, the social networks that will enhance the whole experience. Authors should be inspired to create a holistic learning experience that is not only based on content
- Improve dissemination about the importance and benefits of structuring OER materials
- Embrace the developments of new concepts that promote reusability e.g. the concepts of: "travels-well-content", "legal freedom", "technical freedom" and "cultural freedom"
- Break down and define content into meaningful objects and in terms of meaningful content of learning
- Describe the context in which those components are actually useful. This should facilitate the ability to extract the smaller components from a larger resource
- Try to ensure ways to control the definitive and composed versions of the learning material with appropriate information that are clear for any user
- Separate the given information that is very target group-specific from the object used
- Embed Metadata generation as a core aspect within the content production of all different components and be able to be track it.

3. Adapting

- Raise awareness of strategies that may facilitate the process of successful adaptation such as templates for adapting or localising resources for different scenarios or contexts e.g. country
- Provide guidelines for end-users that include easy ways to facilitate versioning, remixing, and repurposing of OERs that promote confidence in the process
- Ensure that the learning content is structured and, therefore, ready to be converted into different formats
- Embrace as much metadata information as is appropriate. Make sure all the information provided can be accessed by a variety of recognised search engines. Expose the metadata so that search engines can scroll them.

4. Delivering

- Provide dynamic learning content via front end tools in a granular format
- Distribute that learning content in as many formats as possible
- Enable people to evaluate the learning content and share their feedback with as wide an audience as possible
- Supply a variety of import/export data formats taking into consideration different contexts e.g. low bandwidth
- Ensure that the learning content is easily downloadable including a print format option
- The data format should be as flexible as possible allowing not only import/export to many other different open content formats but also be able to be used on many different platforms.

5. Sharing

- Be able to publish OER materials to existing and new audiences
- Understand the full implications of licensing schemes and follow established approaches from the existing wider Open Content/Open Source community
- Ensure that all the rights information is associated with every reusable object as well as travelling with the end product so that any user will know which part can be reused and understand any restrictions in its use.

- **Relates to Recommendations:**
- D2.3, R2.4: Organise learning Outcomes of a programme into one collection
- D3.2, R3.2: Instructional alignment
- D3.2, R3.6: Translate strategies
- D6.3, R6.8: Reuse assessment resources across organizations to leverage teacher workload

7 Conclusion

The aim of this work was to capture best practices and recommendations for extending effective reuse of learning content, including appropriate methodologies as well as established strategies for authoring and repurposing Reusable Learning Content (RLC).

Building upon the outcomes of the previous investigations, a qualitative survey was carried out with a Special Interest Group (SIG) on the most innovative practices with respect to new media aspects of learning content by interviewing both authors (who create or modify learning content) and course designers (who are responsible for overall learning content unit implementation). This survey focused on the best practices of both individuals and institutions across Europe (and beyond) who use, adapt and innovate with so-called reusable learning content working with a variety of educational computer based platforms and tools. The ICOPER Application: Authoring for Reuse also contributed to this research in terms of analysing how authoring tools might be used for reusing learning materials and how OAI-PMH might be significant for connecting repositories of learning objects.

A common view of how these best practices have been located and later analysed was enabled through 14 in-depth semi-structured interviews within the designated SIG. These interviews focused on the technical and pedagogical recommendations suggested by experts from 9 international projects related to the area of content development for reuse. Learning content producers from the SIG (who were drawn from within and beyond the ICOPER Community) were able to describe, in some detail, the topics of Open Educational Resources (OER), New Media Objects as well as illustrating a variety of issues related to the broader arena of reusable learning content.

The survey results have been presented in a variety of formats: both as research reports as well as contributing to a bespoke interactive online course focusing on various reuse scenarios. Additionally the results have also been used as layered New Media Objects in a dedicated content development and reuse innovations space presented within the ICOPER website. This ICOPER New Media Space, developed in the form of an OER called *Reusing Learning Content*, was created based on the outcomes that emerged from this investigation. This is one of six such courses developed in conjunction within the ICOPER Project.

The ICOPER New Media Space has also emerged from the work with the SIG as a means to help improve and disseminate suitable best practice strategies. It also forms a method of publicising our recommendations from this deliverable, related to the area of Content Development for Reuse, to the wider community. The ICOPER application: Authoring for Reuse has also offered an opportunity for those interested to experience "reuse" in action.

Combined these events have led to the recommendations presented in this report. They thus arise from an in-depth, multi-layered analysis of the survey findings and were clustered into seven groups. These emergent themes have materialised from the current barriers, challenges, benefits and trends that are required to extend the effective reuse of learning content.

The primary recommendation of this report is the endorsement of a broad initiative to promote a "culture of reuse". We have also proposed that this must go in tandem with the promotion of a philosophy of "openness" and the provision of meaningful and effective support and training.

For industry, we have noted that it is important for technology providers to encourage the development of tools that meet the needs of users, are easy-to-use and efficient for saving time as well as effort.

With respect to standards and specifications, we have recommended that technology providers keep standards and specifications implicit and thoroughly tested by different stakeholders. The recommendation for Higher Education Management and Faculty, for example, involves encouraging them to promote the effective reuse by contributing to raising a range of OER-related skills and expertise amongst colleagues.

Finally, we have recommended that appropriate training and support are required to help identify and develop the necessary processes involved in searching, authoring, adapting, delivering and sharing of learning content. These are essential and vitally important to increase our understanding and awareness of the key issues related to Content Development for Reuse of all learning materials.

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APPENDIX A - Thematic Analysis

The following sections discuss the analysed responses of the interviewees and are used to group these topics by the previously described thematic headings.

A.1   Standards and specifications for developing content for reuse

This survey revealed an interesting range of standards and specifications that may be used to extend effective reuse of learning content. The majority of interviewed experts highlighted examples of their best practice. They also remarked upon several factors that represent strengths or key issues in their current projects and also offered clear descriptions of them. The subsections below describe standards and specifications adopted in different scenarios.

A1.1 Multi-Formats and Multi-Specifications OERS for HE

The majority of best practices described by interviewed experts demonstrate that many people are adopting a variety of specifications and developing several formats of learning materials. As a consequence, the diversity of format, standards and specifications have been used to enhance an increasing number of opportunities for the reuse of learning content including efficient ways of extracting and exchanging information.

The OpenLearn case study, for example, listed the following content formats that they support:

- *Print format that are properly formatted*
- *Simple HTML format and HTML 5*
- *Moodle module options*
- *Moodle component format that would install into any Moodle installation*
- *e-books, ePub format*
- *MP3 formats*

In addition the OpenLearn project also described the following standards that had been adopted:

- *Rich XML format*
- *IMS content packaging*
- *SCORM package*
- *IMS Common Cartridge package*
- *RSS format*
- *OAI-PMH services*
- *Dublin Core*
- *LOM*

The quote below, from a Strategic Development manager who leads the VLE development team of the Open University, indicates that the OU-UK may be considered as quite innovative and efficient in terms of a contemporary large-scale organization demonstrating that it is possible to adopt and support of a variety of formats and standards:

> *The Open University, particularly around the OpenLearn project, has been really quite innovative. We dropped back to a very rich XML format and we used that as our underlying standard to move content around, allow content to be transformed. It's not a simple end user type of process but it is one that works very well I think on a, for a large-scale organisation like The Open University... Once we've got it into an XML format and we can then do quite a range of different things with it, so for instance right in the early days of the Open Learn project we were able to push out content in half a dozen different formats RS*

The lead technical developer for OpenLearn also highlighted that any content given to the project in their XML structure can equally be transformed in as many different download formats as possible. This is a flexible way of importing and exporting content in and out of the system in a integral and systematic manner as well as extending the opportunities for the effective reuse of that learning content as demonstrated in the following quote:

> *Reuse opportunities... something that's really key to the OpenLearn project, that supporting reuse has been something that we've really worked on right from the start and ensuring that people can reuse our materials and take them away in whatever format they wanted them in. JE*

Other key advantages of using the XML structure were given through several other project examples. Firstly, much transformational work can be achieved automatically, for instance, as illustrated in the use of an audio book format:

> *About XML format wonderful things can happen further downstream, you can automatically get an audio book format, you can get a very portable format that you can push into other learning platforms. ... One of the challenges of always working with the academic course teams is to get the content into XML as early as possible in the process; once it's in XML we can do a lot of transformational work with it. RS*

Secondly a straightforward authoring process is very important, for instance, self-assessment questions can be produced and embedded very easily and at relatively low cost, again assuming the use of the XML structure as described in the following quote:

> *(The) XML authoring regime that we have at The Open University makes it very straightforward for individual academics to find simple self-assessment questions to embed in the material as they're putting it together, that makes it very easy for students to test what they're doing as they're going along, and simply by keeping the structure of the activities quite formalised up-front it gives you a mechanism of being able to put*

in a fairly rich activity at relatively low cost without getting into you need to be able to author in Flash or indeed any of the more sophisticated programming languages. RS

Thirdly it appeared that by adopting more complex interoperability standards (e.g. OAI-PMH services) several international partnerships and alliances were able to be forged with other projects, for example, between ASPECT and ICOPER. Although these projects implemented and extended their own metadata inside an OAI format they can also extract exactly the information that they want from other projects, such as OpenLearn, too. The following quotes indicate how significant a role that standards can play in the learning content scenario:

Using standards has been very important for us on OpenLearn. We quickly had to implement lists of courses in an RSS format including that kind of metadata, and later projects have us asked for more complex metadata output and so we started to release OAI-PMH services so that a content can be harvested in that way as well... (for example) ICOPER and another is ASPECT, which is an EU-funded project... they've actually asked us to implement their own metadata structure inside the OAI service so that they can get exactly the information that they require. JE

Fourthly, it was revealed that by adopting a variety of standards early on projects, such as OpenLearn, have acknowledged the importance of these interoperable standards and, therefore, striven to implement a variety of newer formats too such as e-books and audio:

We're also starting to do e-books and MP3 formats. But the other part of it is to get the metadata out there and so we've used standards with that as well, Dublin Core and LOM specifically, and again, it just makes the language of exchange of information so much easier. JE

In relation to the ePub format, in particular, a Development adviser from the Learning & Teaching Solutions department of the OU-UK, remarked that this seemed to be one of the most successful formats for many University projects in addition to it being the most open of all the e-book formats. The following comment was made in respect of this idea:

We knew that in producing ePub we were already opening, well keeping all the doors and options open for delivery later on in Kindle based devices and indeed the MOBI format in general. Right now it would seem that we ought to concentrate our effort on HTML, JavaScript and HTML5, it seems to make sense, it seems to be where the industry is converging and it seems to be what the players will be most likely to support, so Kindle on iPad and iBooks on iPad today will play HTML5 video and HTML5 audio. GE

Thus by adopting the increasingly fast technology advances and through the provision of an automatic format conversion has proven to be very important for large-scale institutions in Higher Education. Again this is evident from another quote:

... this is really technology that's been moving quite quickly but in an organised way and in a predictable way, which has meant that we've been able to really look at this platform and say well how can we push our own materials through these, and again tie together... with the XML based workflow ... we can now use (it) in exactly the same way at a push of a single button or indeed fully automated without any user interaction... (thus)... anything that we create in the VLE automatically gets the e-book (formatting) as well. GE

The organisations and institutes participating in this survey acknowledge that there are important benefits coming from reusing educational material rather than creating it all over again. These benefits lie mainly in saving valuable time and costs. The following example confirms this assertion.

The truly amazing thing about any workflow like this for e-pub is really that it's more like LEGO now (so rather) than developing anything amazingly complex from scratch... (one can start) a (building) process (that) really becomes very much like assembling a car... we bring the production line to the production of course materials, and get that approach and try to sort of make those efficiency savings, looking at those things that we can automate such as image conversions that are automated, and that will sort of enable us to push this through at scale and at minimum cost. GE

Other interviewees also remarked upon several factors from their practice that also represent important strengths for reusing OERs. An Assistant Professor at the Open Universiteit Nederland, for example, indicated the importance of offering an efficient searching interface as demonstrated by the description from the MAZE project that follows:

This user interface aspect of searching complex information spaces has been one of the key issues of the MAZE project where we have been involved previously… many user interfaces have been developed on the one hand, to enable complex search processes with easy to handle user interfaces. And on the other hand, to simplify the process of metadata generation with also very nice user interfaces that are easy to understand and easy to use and that offer easy ways to generate metadata without having endless forms to fill. This is just as a side remark so it might be interesting to also look in the results from the MAZE project as a starting point for further activities on the reuse side and on the user interface side. RO

http://www.linkedin.com/companies/open-universiteit

Another interviewee, a Research Fellow in the OLNET project and also an Educational Technologist at British Columbia University, remarked upon other significant issues for the promotion of reusability. Firstly that it is very important to develop easy ways that make sense for any end user who wants to reuse open content to/from the Web. An example described below shows that reusing content can be very simple by embedding codes for integrating resources in other environments such as Media Wiki, blogs or VLEs. The key aspect that the interviewee highlighted is that when users realise that reusing resources can be simple and easy, they are more committed in reusing resources. He stated that:

> *It was a great example that really tapped into a current use pattern we see very much on the open web about embed codes, I mean, it seems to be commonplace now that people understand if you're looking at a YouTube video that there's a little code beside it, that if you copy and paste it you'll get that YouTube video appearing. And they're basically replicating that use pattern but in this case around learning content on a Media Wiki server that can then flow to a VLE, could flow to a public web page, could load up a blog site. SC*

http://www.bccampus.ca

Secondly another key topic to emerge is the importance of supporting educators to develop their personal workflow. For that to occur, the metaphor of an Open Educator as DJ is very useful to inspire users to develop their way to recreate content for reuse as similar as DJs recreate music suggests the interviewee:

> *Because individual instructors aren't always interested in using the centralised processes, there's a lot of wisdom in focusing on helping instructors develop a personal workflow around content discovery and reuse. And, so, this is where my own work around network learning, personal learning environments and specifically this notion of a workflow around open educator as DJ has come, in the belief that not only is it a good thing but, in fact, a necessity that people who work and teach in an online environment need to develop personal workflows, and competencies around multi media developments and, reuse and delivery… (examples) of which are search, sample, sequence, record, perform and share, and I, the metaphor I is used to organise that is around the notion of a DJ, that this is how DJs interact with music in terms of finding and chopping it up, re-sequencing it and then performing it for people, but it introduces an element of creativity and fun which I think is key to learning. SC*

In addition another interviewee, a Senior Research Fellow and Managing Director, also suggested other key requirements for extending effective reuse based on his practice. Initially, he suggested, that the key issue is to make the process of authoring structured content very easy for end users. The example that follows illustrates the idea of creating a tool for producing structured content that works in different spaces and can, therefore, be supported by different OER initiatives:

> *I'll start with just a little bit about the other project I'm working on, which is around contributing to solving the problem of making authoring of structured content easy. It is gaining support across different OER initiatives and the objective is to create a tool that will make it easier for people to produce structured content in a harmonised format that will work in different spaces. AY*

A second key issue to emerge is the importance of engaging communities of practice to share reviews and references for discovering and promoting reusable resources. The following example illustrates this idea:

> *A good example of something like that would be what's going on in MERLOT, which is a referatory not a repository but they put a lot of effort into including metadata of that content but then also reviews of content in the form of metadata, recommendations, including references to the kinds of playlists that people create around the content and*

*all these things become reference points that help people discover the kind of content
that they want to use. AY*

A1.2 Best Practice network in competency-driven HE

A number of partners from the ICOPER community, who have been coordinating and
developing applications for reuse educational content, mentioned how important it
was to adhere to standards when considering the reusability aspect. They also
presented examples of key issues that both highlighted and emphasized intrinsic
ICOPER strengths: wide adoption and coverage of key educational concepts that lead
to meaningful reusability with opportunities to carry out evaluation workshops to
ensure the reuse quality performance.

As described by an assistant professor and a member of ICOPER there are two levels
of standards that are very important in reusability that were adopted in their ICOPER
application: a LOM interconnected to OAI-PMH systems and a WebService standard
for direct interaction between different systems:

> *In our ICOPER application, we use, as metadata standard, LOM, Learning Object
> Metadata and we use as the interconnection standard between repository and the
> systems OAI-PMH, which is the Open Archives Initiative Protocol for Metadata
> Harvesting, so a repository-connecting standard. And we use a WebService standard
> for direct interaction between different systems, for instance, to be able to launch the
> search services from OICS out of Author42. RO*

Other important standards for reusing and adapting content were also referenced by a
postdoctoral research fellow and member of the OpenScout project namely the
ISO/IEC JTC1 SC36, CEN/ISSS TC 353 standards:

> *The analysis, use and dissemination of standards are crucial aspects of OpenScout. The
> OpenScout work on Open Content repositories will be closely relevant to current
> standardization activities, including ISO/IEC JTC1 SC36 and, on the EU level,
> CEN/ISSS TC 353. Specifically, we have involved the CEN/ISSS Workshop Learning
> Technologies, responsible for the transition of project results into the European
> standardisation process. AM*

There are a range of issues relevant to potential standardization in the area of
competence-related information and these are presented in the document Concepts
and Standardization in Areas Relating to Competence (Grant and Young, 2010)
http://blogs.cetis.ac.uk/rowin/files/2010/08/grantyoungwp_final.pdf

The main standards described from the CETIS website are:

> *IMS RDCEO AND IEEE RCD The IMS Reusable Definition of Competency or
> Educational Objective (RDCEO) (IMS, 2002) specification "defines an information
> model for describing, referencing, and exchanging definitions of competencies.*

> *IMS LEARNING DESIGN IMS Learning Design (IMS LD) (IMS, 2003) is a specification for modelling and designing learning processes, consisting of three levels of which the third, most extensive (and least implemented) is Competency Based Learning*

> *XCRI The eXchanging Course-Related Information (XCRI) project (XCRI, 2010) has developed an XML schema to enable learning providers and information services to easily share information on learning opportunities, increasing access to and potential participation in education and training*

> *LEAP2A The Leap2A (Grant, 2010) specification supports interoperability between e-portfolio tools and similar systems and the exchange of information between them*

Regarding this diversity of standards, another important aspect, described below, was presented from the CETIS project, namely that:

> *Any standardization effort should start by looking at related efforts that have been made in the past, and current initiatives that may have related objectives, to try to ensure that standards do not multiply and diverge. (Grant and Young, 2010)*

The following sections address this issue. It appears that a key aspect of these case studies is creating a strategy to ensure effective reuse by combining the opportunity of evaluated workshops following on from training sessions. Providing support and training for end users is indeed a crucial requirement for promoting reusability, ensuring improvement, as well as disseminating benefits in adopting standards and specifications in the learning content community. An example of this important issue is given in the following quote:

> *The participants of our workshops were asked to use Author42 and its connection to the ICOPER content space, to find and reuse information available within the ICOPER content space including those that they have previously organised, in order to generate didactical, useful, meaningful course materials out of these. These are the main tasks performed at the evaluation workshops and basically, participants, I think we had ten participants organised in teams of two each, and basically, each team was successful in the completion of the tasks. RO*

The ICOPER Project coordinator gave a remarkable strength of competency-driven HE projects. He referred to the comprehensive and meaningful coverage of educational key concepts which constitute a common language that facilitate reusability in several ways:

> *I think one of the strengths of ICOPER is that we are very precisely covering the whole educational context in higher education when it comes to teaching courses at the university level, these things, I think we cover quite nicely in a quite comprehensive way… Current aspects like learning opportunities, learning outcomes, learning profiles, personal achievement records, learning designs, teaching methods, content, course delivery and then, finally, also, of course, assessment and course evaluations, so these are some of the key words that we are concerned about. So I think… of course, (most items can be) reusable... And I think what we did successfully, in this project: we found a common language for us (all of this). We have something like an ICOPER*

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anthology or a set of key concepts that we agree on and (it has become) the subject of our investigations. BE

Other key features emerging from these case studies are described by the following examples: i.e. developing context specification and collaborations for the global standardization efforts. These are highlighted in the following quote:

The project will contribute to this work with the developed context specification, as well as with novel application profiles and metadata extensions, and seek collaborations with these groups, in order to advance the global standardization efforts. AX

In terms of key benefits of extending effective reuse, the following example from OpenScout research indicated that time reduction; improved quality, fostering expertise and collaborations with open content communities were of the utmost importance:

Among the benefits listed by organisations and institutes who participated in the OpenScout research about the adaptation strategy were: savings in time and resources, expertise gained improved quality in the adapted content, as well as reaching out to the open content community and forming collaborations. AX

In addition, the Managing Director of Learn'ilities' identified another benefit in the competency-driven Higher Education projects in that users can establish connections among profiles, competencies and achievements. It was suggested that the advantage is, in fact, the easy way of reassembling these elements, such that:

Thinking differently about confidence profiles and around the way that you would join competency and the need to achieve a particular level of competence, joining that to the kind of learning materials that you would make available to people so they can easily reassemble things to facilitate that particular model. AY

A1.3 Educational Podcasting in the HE

The importance of adopting specifications and standards, particularly for exchanging new media content, was described by a number of survey participants. One of the key benefits to emerge was that of standardization and the ability of creating meaningful aggregation of RSS and Atom feeds. A Senior Research Associate at Cambridge University, UK and a member of the Steeple project who presented more detailed information gave the following example:

With the Steeple Project what we found interesting and important is to be able to exchange content in bulk and the way this is done in the word of audio and video and podcasting is through RSS and Atom feeds…

If you are publishing media to iTunes U, then you already have your Atom and RSS feeds that you can use with iTunes U and so we made very good progress with that. The kinds of things that we thought about is what are the important things that are missing from the RSS and Atom specifications, so what are the fields that exist, what are the elements that exist in those fields but aren't necessarily used in a standard way. So we looked at Yahoo Media. RSS incorporates a lot of elements from Yahoo Media. RSS has a recommendation for institutions to adopt this. So for instance we recommend the inclusion of an institution label in this, so that when somebody harvests your RSS feed they do know which institutions it has come from. And we looked at standardisation around subject categories and so forth, so that we can you know create meaningful aggregation of those feeds. BJ

Important benefits and the biggest issues related to standardisation were also highlighted in this particular case study. The following quotes are also from Steeple Projects and describe other strengths. The example below, for instance, indicated that searching on the metadata is a richer experience than just harvesting it:

In STEEPLE, It gives a much richer experience than just harvesting the metadata and allowing people to search on the metadata. What you can do when we exchange our information is you can actually build portals that allow users to bookmark, play, (and) combine the videos across you know a large number of UK institutions. So their standardisation is important for us becomes it just simply allows us to do more. BJ

Another example highlighted the benefits of the RSS specification for exchanging audio and visual material and how do content then get found by other users:

STEEPLE it's about generating content, publishing content to iTunes U and You Tube EDU and so forth and looking at what, what things need to come into place for that to happen. The project started from the premise that if you have content, then how does that content get published ...into the public, so you know with the rights... with the kind of constraints in place regarding rights and so forth. So having said that, the main areas that we looked at is this RSS specification because we were interested in the exchange of audio and visual material. So once you have audio and visual materials, how do they then get found by other people and I think that's perhaps, for us, the biggest issue that we looked at in terms of renewals. BJ

A1.4 Best practice network for school scenario

With regard to other best practice network projects the following example, from the ASPECT community, presented the most used specifications in practice for the school scenario: i.e. Standards and formats such as SCORM 2004, the Common Cartridge and QTI:

ASPECT use and test things on the Learning Resource Exchange. I'm also chairing... a working group at IMS called Learning Object Discovery and Exchange, that is also involving this idea of making possible the exchange and reuse of learning resources... The following specifications SCORM 2004, Common Cartridge and QTI have been

selected since they are the ones which are currently most used in practice. The ability of these specifications to support European content use and exchange will be evaluated in the further work of the ASPECT Project. (AspectD3p1, 2009)

Subsequently a senior software architect and member of ASPECT and IMS gave a number of examples. These outlined three special qualities of this case study.

Firstly it is important to produce and test specifications to extend effective reuse. Feedback from content providers, teachers and standards experts are, indeed, crucial for improving the practice and further disseminating those standards. New specifications can also take into account what really matters for end users or for regular standards users. The following example illustrates this idea:

If you speak of ASPECT, you have (examples of) Best Practices that are produced … (and) used by content providers, applied by content providers who produce content and then this content is tested by teachers… the teacher can provide feedback, it can be sent to the content provider, they can also provide some feedback to the standards expert and this way we have a possibility to not only improve the practice of using the standards but also… to inform the development of specifications themselves. DA

Secondly, another key issue highlighted by the interviewee is to refrain from exposing end users directly to standards at all. End users may not be particularly interested in or aware of the role of standards, but probably would appreciate and want the benefits of using standards. In order to realize what those are, well-elaborated training and activities that make sense for them must be prepared and provided. The following example outlines this issue:

We had some interesting experience in ASPECT. We use an instance of Moodle connected to this Learning Resource Exchange, (a) Federation and we asked the teachers to look for content in different formats and import this content into Moodle and work with it... Some of them have compared using a PowerPoint presentation in Moodle with a resource using the IMS Command Cartridge specification. And one of the interesting things they said by comparison is that one of the perceived advantages of Common Cartridge over PowerPoint, when used in Moodle is that… in the Common Cartridge there's a possibility to disassemble it, to repurpose it, so for the teacher it's important that we're able to keep the part we're interested in the Cartridge and get rid of all the other we're less interested in and possibly add also other external elements. It's a typical example of functionalities, enabled by the standard and that makes sense for the end users. DA

The interviewee also indicated that the key is to provide functionalities for searching and reuse content is absolutely necessary, especially in their own teacher's environment in order to facilitate the process and make them more engaged in sharing resources and feedback. This suggests that users, then, do not need necessarily to have search resources in one educational portal or go to other environments, they can use their own favourite work space.

The idea is to consider that each user, each teacher has its own environment, some are using the national portal, some are using a particular VLE. So the idea is really to provide a surf functionality in this environment, so to provide some widgets or some tool that can be used in any device or any application used by the end user so that searching for the content can be done in your environment, you don't have to go in another environment, a specialised search portal to find content and then try to incorporate that. I think that's also what in ASPECT we have tried to do this with this Moodle bridge where teachers that are used to work with Moodle can simply find content from within Moodle. DA

A1.5 Multi-cultural OERS for school teacher's training

Learning content has covered a vast range of subject areas across the Higher Education sector including the development of specialized training materials for teaching used in the context of continuing professional development. The case study materials gathered from the TESSA project clearly indicates the importance of developing multi-cultural materials, through multi-organisational, multi-country, and multi-lingual OERs. It emerged that in order to promote widening participation (Lane, 2008) around OERs across different countries in Africa, reusability attributes of the TESSA materials must highlight: accessibility, institutional commitment, support for end-users (e.g. teachers and learners) and active learning styles. This was illustrated by the following quote:

TESSA (takes a) focus from college to school based approach to teacher training. TESSA resources (are presented) as a means to an end to create new mind-sets. TESSA is multi-organisational, multi-country, multi-lingual... (There is a) vital role for collaboration (that includes) vice-chancellors and ministries. Three common issues (occur): access to materials (low bandwidth), institutional capacity for change at different levels, the need to ensure support for teachers as they develop more active learning styles (i.e. head teachers are vital). JO

More details can be accessed in this URL http://webcache.googleusercontent.com/search?q=cache:OScVcxBTG6kJ:cloudworks. ac.uk/cloud/view/882+TESSA+AFRICA+OER+specification&cd=2&hl=pt-BR&ct=clnk

Several strengths were emphasised in this case study, particularly regarding the wide range of context for reusability that includes translation, versioning, adaptation, integration, localisation and contextualisation. The example below from a key member of the TESSA project illustrates this significant feature. The Senior Lecturer and Director of the project indicated that these adapted resources have been integrated into either new courses or existing courses' programmes that are used by the participating institutions. She also highlighted that once the original generic set of materials are developed using a template then they are adapted or localised for each of the different country contexts. The following example illustrates this issue:

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The way in which the TESSA partners, the institutions and the consortium have tackled the issue of a lack of training for teachers in primary schools is to develop our highly structured bank of resources, which could be used across all the different country contexts of the institutions who are involved in the project. The materials are used within the project across nine countries but they've also been used in some other countries outside the project, so these range from Ghana, Nigeria and West Africa, through Sudan, and then the whole group of countries in East Africa: Tanzania, Rwanda, Kenya, Uganda, and down to Zambia and South Africa. The materials have been created in four different languages, (although) English (is used) for the majority of those country contexts, Arabic is used in Sudan and French is used in Rwanda. FR

Another key issue for the increased use of OERs in multi-cultural scenario, also highlighted from the TESSA project, is a focus on valuing authorship in order to help end-users (in this case: teachers) to feel confident to create, reuse and adapt OERs in their own contexts.

One of the strengths is actually that we think TESSA has helped to ensure that there was much greater use of the materials within that institution, because the materials they would have would be unique to them, even if only in a very small way. They didn't necessarily feel that they were taking something that had come from outside and they were being told by someone senior to use, they had a say in shaping what it (the OER material) was like. FR

A.2 Significant barriers for reusing learning content

Evidence from this survey indicates that problems around the development of reusable content and around the process of making this reuse effective have many different aspects. Whilst the common denominator for all surveyed experts' barriers focussed on a '*culture of reuse*', it is important to acknowledge that there was a wide variation of examples related to this term. Several experts in the current survey considered the lack of a culture of reuse one of the most significant barriers for CDR. Interviewees, however, gave different interpretations and examples to describe the meaning of "culture of reuse". In order to integrate these different perspectives and understand this concept from the perspective of our interviewees, several examples were analysed and are illustrated in the text below.

Initially a number of experts emphasised that the culture of reuse includes several technical key issues such as tooling, metadata, standards and open formats that must be coherent, integrated and implemented together. Here is one example of this issue:

What we need is like a culture of reuse, of creating reusable content and this culture, if we have the correct mindset for generating reusable content, then we can have the tooling, the metadata, the standards, the open formats and all of this has to play together to make reusable content development happen. And as long as only one of these aspects is missing, then the whole thing will fail. RO

In relation to other technical issues, further interviewees added that the culture of reuse should present efficient tools for facilitating and simplifying reusability, for example:

> *Content could be much more reused if we had better tools to produce it and to find this content. DA*

> *We still need to make it much simpler for people to do those things. We should not be expecting them to acquire a whole set of technology skills to be able to re-use somebody else's content. It needs to be seamless and it needs to be simple. AY*

Additionally the culture of reuse also appears to comprise of some social aspects, described in detail by the examples given below, but summarised here as: people interested and engaged in sharing reusable resources; communication among different stakeholders; communities of practice and the social collaboration for discoverability and credibility around the content. Again the detailed quotes that follow are summarised in the chosen headings highlighting these issues :

- Engaging people in sharing reusable resources and share interests

> *There are issues around people (who) traditionally haven't been very keen to share their materials with other people… it has been quite difficult for people to be aware of colleagues' work. FR*

> *The main challenge is to make university lecturers to realise that it's in their interest, and in their students' interest, for them to reuse good material rather than to try every year to create material from scratch. PH*

> *I've been very actively involved with the Open Source Community and I've spent a lot of time in it and I find it tremendously exciting... (yet) somehow, so far, I don't think we've managed to recreate that buzz, recreate that creative sense of urgency in OER. GE*

- Fostering Communities of Practice of people around CDfR

> *I think what's also important is being able to build community of practice around the content. DA*

- Promoting collaborations among communities for working together on the same key issues

> *All of the people who are engaged and have an interest in OER should work together and that they do, it is quite a good community for that but we need to make sure that we're not all working on the same problems independently without talking to each other PH*

- Encouraging communities to share reviews and feedback collaboratively around CDfR

> *So along the way we have to solve the issues around discovery of that content,*
> *providing some kind of attribution of credibility around the content. Most of those*
> *things are better done at a community level rather than from an external proclaimed*
> *authority, they're better coming from the community. AY*

In addition to social aspects, examples described by the interviewed experts also indicated the lack of interest from universities and publishing houses in developing open reusable content, whilst continuing to value the role of high quality content in Higher Education as well as envisioning business and marketing benefits for extending effective reuse. In summary the following quotes show that there are a number of issues to resolve:

- Open Reusable Content is not part of the goals of some HE Institutions

> *The university does not want to have a lot of content out there, so content development*
> *for reuse is actually a non-goal or it's something that they don't really want to make*
> *happen. BE*

- Open Reusable Content is not valued by some HE Institutions:

> *Compared to other eContent Plus projects, with exception of the Open Universities…*
> *content in Higher Education plays a less important role than, for example, in the*
> *school sector or in other domains (in my country). BE*

- Open Reusable Content is not considered as a big business by publishing houses

> *Publishing houses don't see the big business in Higher Education, at least not in*
> *Central Europe where a lot of these publishing houses are focusing on the school*
> *sector. And as a result of that, for example, we are kind of struggling also to get good*
> *answers for content development for reuse in this particular domain. BE*

The culture of reuse should also reinforce the importance of disseminating the key benefits around CDfR in order to convince more and more people to reuse eContent and develop reusable resources. The example below describes this phenomenon:

> *People have to be convicted that reusing objects is meaningful, because otherwise they*
> *won't do it. They have to prepare their staff with a purpose and with a mind for reusing*
> *stuff, to make it available for other teachers and university professors to have the*
> *conviction that it is helpful. BI*

These benefits should also include strategies for reducing time and skill barrier as demonstrated by the following quote:

> *People feel that reuse isn't worth it because the energy it takes to meet these other*
> *requirements is greater than the energy needed to produce something new from scratch*
> *yourself… Whatever arrangements we put in place for reuse, they've got to continually*
> *reduce the time and the skill barriers against that reuse, otherwise they will always*
> *tend to put people (e.g. teachers in universities) off. MA*

It appears that these strategies should also include multi-disciplinary teams and specialised staff for providing support and materials for facilitating this process of reusing, adapting and versioning resources. The next quote illustrates this issue:

> *A recent survey carried out within the OpenScout consortium revealed that developing content for reuse requires multi-disciplinary teams. These teams typically consist of experts both in pedagogy and technology. AX*

> *For support staff who may be supporting those staff… they may have time to learn the skills and to use repositories and to provide this material for other people to then adapt for teaching. MA.*

Thus the specific support and tailored materials offered by multi-disciplinary teams and specialised staff should include concepts that may be unfamiliar to end-users such as versioning and adapting resources. Again this idea emerged from one of the interviewees:

> *I think versioning is a concept that educators are unfamiliar with unless, perhaps, they're IT and computer programming educators… Versioning is very difficult, once someone has downloaded v1.0, how do they know if we improve and extend the material on OpenLearn, that they are out of date and they might want to come and get a newer version. Or even worse, what if we need to change the material, remove something because of rights risks or something along those lines, the unit becomes out of date, how do we keep the people that have taken away the content, informed…? JE*

Accordingly these guidelines for end-users should, therefore, also comprise of easy ways to facilitate the versioning and adaptation process, including searching in order to promote sufficient confidence. Some other participants in the survey suggested that:

> *The adaptation process: we've found that people haven't really unpicked that at all, except that they have, at times, used part of the materials… I mean people don't, in our experience, don't find it easy to adapt the materials, partly because they don't have sufficient confidence in order to be able to do that, or that changing other academics' work is perceived to be quite critical. FR*

> *… it would be useful to produce guidelines, both for people who are producing the material and for people who are going to reuse that material and one of the areas that I've touched on, which sometimes people forget, would be guidelines about, if you like, the pedagogy and the way that material has been used with learners, with students. Quite often, people that are involved in teaching want to know more about who this was for in the first place and what was their reaction to it, was it successful? And quite often, if it's not a distance teaching institution, it's a face-to-face teaching institution, people want to know how this material was used with students, because there's quite often details about the kinds of seminars and how many hours were given to students for using material. MA*

Another important key issue that should be promoted among end-users is the benefits for adopting standards. This was highlighted by the following extract:

*People who create teaching materials are often very bored and uninterested by things
like metadata... Specification itself takes time and energy for educators to understand
and if you want them to use it, then you're going to have to convince them that it's
worth it. MA*

Apart from disseminating benefits, a further key issue that should be disseminated
among end-users is the importance of providing requirements such as the clear
description of resources. This was stressed by the same interviewee:

*You may think you've written a very clear specification, but then some other people
either don't understand it or use in a different way from others, so then that causes
problems. MA*

Regarding standards and specifications, the experts also highlighted that users should
be aware of changes in technology and that there is no optimal way of looking at
reuse for content. This was underlined by the following quote:

*What I look at now is things like the IMS content packaging and the SCORM standards
reference model (that) were specified and were done roughly about ten years ago and
solving the problems that we had ten years ago. Now with all the changes in technology
I don't think that they're the optimal way of looking at reuse for content. AY*

In addition, experts also complemented that there is neither a successful solution for
reusability across many different platforms because the tendency is to simplify the
process to make it easier as demonstrated by a different participant who stated that:

*There have been some big projects around over the years such as SCORM or the IMS
Common Cartridge activities. They've come quite a long way developing reusable
content, reusable across many different platforms... That's not always been that
successful, largely because within cross possible platforms you tend to drop into a
lowest common denominator problem and you simplify stuff to make it easy to move
things around, and really it's not always the best way forward RS*

Interviewees explained that the difficulty increases around complex resources and
even with simplifying strategies, processes such as packaging, reusing, editing and
modifying resources, should be easy for end users like educators, for example:

*More complex resources like a complete course that you need to package, actually
most of the tools for packaging resources or plain standards like SCORM or Common
Cartridge are relatively complex to use and if you want to reuse these resources, to edit
them, to modify them, it can be relatively tricky. Well, certainly not something that an
end user or someone like a teacher would like to do. DA*

The process of reusing complex resources and adopting specific standards and
specifications, particularly those developed outside an organisation, is even harder for
end users as demonstrated in the following quote:

*I don't really see how we can make our XML based workflow with all it's intricacies
and hundreds of elements in there that one could possibly put in a document, I think*

that would be quite difficult to put to somebody completely outside the organisation. GE

Apart from technical and social aspects, the culture of reuse also contains a number of intrinsic pedagogic issues. An interviewee mentioned that one of the big shifts is to move away from contextualised narratives to meaningful, granular and clearly structured content, for example:

Good teaching material has a very good structure with a very closely integrated narrative where you're constantly referring back to things that you've been teaching and pointing forward to the new things that you're going to teach. And that's very difficult, because every time you want to change that material, you've got to read through it from start to finish and make lots of small and subtle changes and so the big shift for us was moving away from that very tightly integrated, very good narrative approach, to something much more in chunks and clearly structured. MA

Regarding further pedagogic issues, interviewees also remarked upon the importance of understanding and meeting the changing learners' needs by designing reusable resources from their requirements and, consequently, embracing more diverse yet subtly appropriate formats. A summary of these ideas follows:

Understanding and satisfying the changing needs of learners. AX

Think about how the content will be used and derived from their requirements. BE

I think perhaps for us one of the things that we didn't do… right at the beginning, in terms of thinking about the content, was to think sufficiently widely about different modes, formats of use, so (for example) our materials aren't particularly appropriate for using on mobile devices. FR

Sometimes it had been saved in a format that was not easy for an academic to change, it required conversion back into Word or some such form that an academic could easily get hold of and change. MA

The culture of reuse also incorporates legal issues. Experts highlighted several examples. An interviewee reminded us that although users might be interested in sharing, they should be aware of copyright issues and the drawbacks of releasing content that cannot be reused. He stated that:

I think really something problematic is for reuse, it's all these copyright things and we need really... And I think that's a problem of education, there's a lot of people ready to share content but that don't care of these issues and are releasing content that is not as reusable as they would like DA

Another interviewee added that rights are not a very clear issue even around OER (e.g. OpenLearn), especially regarding different formats (e.g. ePub). This is particularly applied to specific scenarios, e.g. commercial purposes, which differ from

the original context that was created, say, in open repositories. This issue was highlighted through the next quote:

> *The trouble with rights is it's very rarely a very clear cut issue, even with a project like OpenLearn, there are many things in OpenLearn that aren't Creative Commons, strange though that may seem because of the very nature and the heritage of OpenLearn and where these documents are coming from, so often we've been able to negotiate very favourable agreements with content owners who may say that this is actually absolutely fine to release as, under the umbrella of OpenLearn but they wouldn't want it to sort of be used as an eBook afterwards… (because) eBooks might have a potentially commercial purpose, that (we) might be able to monetise on those sort of kinds of outputs, (so) we have to be quite careful. GE*

Another example illustrated by different expert highlighted the importance of understanding composite rights particularly for those involved in the production of audio and video based content namely that:

> *With audio and video based content can be quite tricky, because the rights of films are very much composite rights, where actors have a stake in this, producers have stakes in this and so forth, the institution has got a stake in it, so you need to be quite careful about having the right kinds of forms and understanding the process so that at the end of the day the person who you intend to own the output, i.e. say the University of Cambridge in this case, actually does own the output, i.e. everybody along the line has signed the right forms and has understood what's going to happen with the piece of media, so that the university ends up owning the content or at least ends up with the ability to publish under a Creative Commons license. BJ*

In summary, the culture of reuse should be in a position, therefore, to disseminate clear issues with respect to copyright not only around OERs but also related to academic broadcasting. The following example illustrates these issues quite succinctly. The interviewee highlighted the importance of being aware of different models of licensing and rights as well as the sensitive handling of all concerned in order to be able to make the best use of it, such that:

> *In terms of commercial broadcasting we tend to look at total ownership of a piece of media and with that I mean that the publishing house actually ends up owning all the rights to a particular piece of media. In academia that's not really going to be the case… What they might be willing to do is to give you a Creative Commons license that allows you to re-publish under a Creative Commons license. So you know within academia one needs to look at a range of different models that gets you what you want and but not might necessarily mean that you own the whole piece of media. In fact what we've seen with some things is that you can turn people away by requiring all rights being assigned to the university., BJ*

A.3   Benefits for adopting standards and specifications

The following examples highlight the key benefits of adopting standards and specifications for developing reusable resources. These positive aspects were considered from the perspective of content developers as well as capturing the views of technology providers. Raising awareness about the advantages of using standards amongst producers, developers and trainers can encourage them to develop their content or tools further in such a way that future users can more easily use and reuse those resources.

In terms of **institutional benefits**, several key benefits were depicted by the survey participants, for example:

- **Opening up reusable content increases student numbers**

    Open content areas are very good means of advertising what the university is all about… Some of them are aware of these figures that we've just referred to… that open content increases student numbers and I strongly believe that this is the case here. BE

- **Reusing resources reduces content development costs**

    … *to lower your costs, you have to reuse resources according to certain specifications, you have highly individualised learning scenarios as ICOPER is researching at the moment, it becomes even more important. BI*

- **Content development for reuse allows new distribution channels for cross-selling**

    I feel that the faculty, they should be concerned about content development for reuse in the sense that they use these new technologies, these new distribution channels to get their names out, which is basically the business of a faculty member and use these new distribution channels for cross-selling maybe… books and support materials. BE

- **Being able to move content around different platforms promotes international partnerships**

    Within the university our ability to participate in international projects or international partnerships is very much based on the ability to move content around from our learning platform into other people's learning platforms. RS

In terms of the general benefits for developers, providers and users, several key advantages of adopting standards were also described by participants who provided the following examples as evidence:

- **Educators can not only reuse learning content but also can further develop their teaching methods from reusable resources**

People have learnt from other people a way of teaching… a lecturer in Science may learn something about how to teach a certain skill or area, that's what they reuse. They reuse that teaching idea not the actual material itself, so there is always that, people learn from each other in diverse ways and repositories can be useful for that as well as for taking material and changing it. MA

- **Content Providers can transform the format of learning content on a relatively large scale**

  … getting something into a machine readable format, machine transformable format, then you can do some of the interesting stuff on a relatively large scale. And even large scale doesn't need to mean very much, kind of just ten or twenty documents that need to be processed manually becomes pretty tedious, whereas if you can write scripts to process those documents to do the transformation that's when life becomes easy. RS

- **Content can be described in different contexts as well as being integrated and handled from different repositories, authoring and runtime systems.**

  Standards, from my point of view, are important on at least two different levels, one is the description standard so the metadata standard that allows you to describe those different contents. And the second level is a technical level like standards on integration of different repository systems, different authoring systems, different runtime systems, that describe how different contents can be accessed and how different contents have to be handled. RO

- **Learning content can also run on different environments, platforms and learning management systems.**

  To make sure that the content can run on these different learning management systems and that you don't have to produce these objects for single platforms over and over again, because this doesn't make sense, you can't reuse them then. BI

- **Updating resources to follow new technology changes or to avoid proprietary software that might be discontinued**

  To avoid proprietary software that might be discontinued or suddenly is available in a cut down version… systems move on, we move on to different software, different hardware, things aren't set up quite in the way they were, and that's really brought home to us the absolute need to use standards wherever we can. GE

- **A self-describing OER approach**

  To some extent the OER approach is becoming self-describing, you've no need to, for example, create a catalogue record and worry about how you're going to encode the name of authors, if you put the name of the author on the web page in some way that's easily recognisable, you might want to think about using something like micro formats or RDFA so that name becomes associated as the resource author but the idea of creating catalogue records I think is one that's going away PH

A.4   Current Challenges for Extending Effective Reuse

The most reported challenge to emerge in this survey was the need to identify appropriate and efficient tools that facilitate the process of developing reusable content and, therefore, extend effective reuse of learning content. Again there is a strong expectation on behalf of the educator or content developer, that great tools are, indeed, one of the biggest needs for facilitating the reusability of that learning content. The following examples describe the importance of having appropriate tools for a variety of scenarios in this environment:

- **Developing content**

  Good tools, tools that allow your author or creator to focus on the content itself, make good quality content. Tools obviously for supporting in a transparent way standards to make the content easily reused and reusable and to repurpose in some cases. DA

  I think one of the challenges for The Open University in developing our structured content authoring, our XML based authoring, is developing enough sophisticated rich interactivity to engage the learners as they're reading through the material. RS

- **Managing content**

  Tools and resources that help you to manage big amounts of content that are available. RO

  Tools for tailoring content that you produce for different usage scenarios and usage contexts. RO

- **Searching content**

  Good tools that are well designed and allow you to refine, to search by criteria like the type of learning resource and to filter by language. DA

  Tools for filtering content in a transparent way. DA

  Tools smart enough to compose the appropriate query to bring, that will know enough the end users to assist them and letting them simply entering a very simple queries like the way Google does with just a few key words. DA

- **Simplifying the process**

  The technology needs to be smarter about the content production and then the people who are on the educator side should simply focus on the educational aspects so the production of content should be as simple as doing anything else. AY

  We still need to provide a much simpler interface for people to be able to do that so that they don't know and don't even care that they're creating structured content, what they're doing is simply producing something that's going to help somebody learn and perform in better ways through that learning that takes place. AY

> *Tools which help people perhaps to somehow scan through resources and make more informed judgements about whether the resource is better put into changing that particular resource or whether it's better actually to create something from scratch themselves FR*

Another key challenge highlighted in this survey for ensuring quality production of reusable resources, particularly new media, was getting key stakeholders working together. The example below described this issue in details.

> *Key people include firstly your academics, because if you look at academic content… it involves the academics, it's the business of the university. So those are one of the key groups of stakeholders in this process. It's also the students. Often students come up with creative ideas; students may be publishing content already, so your students can help with creating content… Then there's the sort of formal media technicians… that go round producing content for you at the university. And then there are the technical stakeholders, your computing service, for instance, or the people that have the content, transpose the content, publish the content to RSS feeds. Then there's also your kind of communication's people, the office of communications or public relations, press office and support... So that's an overview of the stakeholders that are involved in producing audio visual content really your success in publishing audio visual content to your own website, to iTunes U, YouTubeEDU, will depend on the degree to which you can get those people to work together. BJ*

Again highlighting another key issue for extending reusability, the following example identified the importance of seeing all assets fully described with the same metadata. This idea leads to another great challenge of developing resources fully associated with the same metadata and generated automatically by the machine which holds all information as demonstrated by the following quote:

> *I'd love to see all of the assets, each and every one of the images in that book, website, e-book, whatever it may be, to be fully associated with that same Metadata and for it to be ideally produced by the machine that holds all that information. GE*

A.5 Key trends for extending effective reuse

The survey also revealed a variety of key trends related to reusability. Several interviewees mentioned new issues, which are their current theme of interests and a possible candidate, therefore, for extending effective reuse.

An example, given by one of the experts belwo, highlighted the importance of understanding an in depth user's needs and requirements particularly during the process of discovering, accessing and sharing educational resources:

> *I think we should now be at the stage where in order to find out what users' requirements are for finding educational resources we can look at their actual behaviour, we can look at how they access the existing systems and share that data. PH*

In addition to user needs, another topic of interest emerging from this survey was the need for visual and practical user guides to improve users' experience as well as improving skills for remix and reuse resources. This was demonstrated by the following extract:

> *One of the related OpenLearn projects: SCORE, who want to create videocasts of doing this kind of thing in LabSpace to help their users in the UK OER movement so that they can make it a lot clearer and give better user information on how to remix and reuse information. So it's clear that we're not meeting the needs clearly enough and I'm really looking forward to seeing those videocasts and improving the user experience and the user guides that we've got available. JE*

A further example related to the importance of understanding user's current practices was given by another expert who highlighted innovative strategies for encouraging users to develop their own different CDFR workflows, he stated that:

> *This is the way to address this problem actually asking people to come up and demonstrate the different workflows and models they had for managing learning content across the organisation, and for promoting its reusability. SC*

Regarding new issues related to learning content development, an innovative strategy mentioned by another interviewee was the idea of extending effective reuse at a very fine granular level through freeing different OER assets to be reused independently. The following example given describes this trend in both the OpenLearn and ASPECT projects:

> *There are very few projects that are really allowing reuse at that very fine granular level. And in OpenLearn, we're certainly investigating ways that we can improve that and one of the projects that I'm working on at the moment, which is funded by ASPECT, is in connection with a company called Icodeon and they have a URL language for accessing different parts of an IMS Content Package. And what we're doing is freeing the different pages of an OpenLearn unit or the different files that are embedded in that page so that they can be reused, remixed, restructured, embedded in other places as a single piece rather than as part of the entire unit. JE*

Another key theme of interest for promoting the effective reuse of learning content that emerged from this survey was content tracking. One of the interviewees highlighted the importance of understanding key features of reusable content in order to provide good recommendations for content providers. The following example was given in relation to the ASPECT project:

> *One of the things we try to do in the Learning Resource Exchange actually is looking at content tracking, seeing that happen and trying to see what content is actually reused in different context then try to understand why, so that we can provide recommendation to content providers saying, okay, this is the criteria for content that travels well and so if you want to distribute it across Europe it's probably better to focus on producing this type of content. DA*

In addition to new tendencies for extending effective reuse, the example below described the need of looking at being able to deploy content by dynamic transformation for engaging users with environments of their interest (which might not be necessarily LMS)

> *We need to be looking at being able to deploy content by dynamic transformation, whether you put it out to an ePub, to a PDF, to a book, whether you take parts of it and use it just in a browser or in some other application that's not a Learning Management System, all of these things need to be possible because that's the tool set that the learners are wanting to use and it gives us more of a capability to engage with them and with learning on their terms, rather than to force them into an environment which probably is not the optimal environment for learning anyway. AY*

It appears that one of the key needs emerging for new business models is to distribute content and label it for reuse, and these needs relate particularly to the new media content scenario. The next example was a description related to iTunes:

> *Content providers who would like to have their content reused, they don't have a clear business model for distributing their content or making it have labelled for reuse… I think for educational content at the moment there is nothing like this iTunes for learning content and that's something probably that is needed because it's only when we'll have a possibility for exchanging content and allow content providers to really earn money for the content they produce that we'll see also a lot of progress in this area. DA*

In order to maximise future reuse, several interviewees highlighted as a key trend the use of open standards. The following example was selected from the OpenLearn related ePub project:

> *In a way the best thing we can achieve is use open standards at all times and try to have assets in a quality that's good enough for people to pick up and use, and internally really that comes down to our own content management system, it comes down to having those high resolution files, those high resolution videos and images, completely compression free, no artefacts, high quality, which will ensure future reuse. GE*

New requirements for ensuring effective reuse were also described by other experts. The following example highlights the necessity of merging XML structures and making a new standard:

> *There are a couple of projects working on merging XML structures that describe content and making a new standard out of them, and I think that's something that would really enhance reusability of content in the future. JE*

New requirements also appear to include the necessity of developing new concepts for promoting reusability, such as the concept of "travels-well-content", and the concepts of "legal freedom", "technical freedom" and "cultural freedom" These examples were highlighted by different experts who emphasized the importance of link theory and

opportunities for users to improve their practice. They also highlighted the importance of realising that all these concepts potentially build on each other. The following quotes reinforce these ideas:

> *We are trying also to develop another concept, a concept of content that travels well, meaning that regardless of language or the cultural differences, we think that some content has the potential to be reused, it's some sort of universal content that makes sense of this useful... we'll have to focus on content that has this potential to be reused rather than trying to apply these interoperability layers systematically to all content. DA*

> *There is a few other elements that we need to look at and we called those the OER Freedoms. That is to say they give you freedom to access and do things with open educational resources. So the most basic of this one in some ways is the legal freedom...Does that freedom include the freedom to make profit? ...BJ*

> *The second freedom is a kind of technical freedom. ...What can I do with that content...? .Can I actually download the content? Can I just aggregate the content? Can I move this OER around? Is it easy to cross publish it? Are there low bandwidths versions? Is the content formatted for different devices? BJ*

> *The third one… is the cultural freedom. What is the educational freedom associated with this content? Does the resource travel well? Is it written a way that it conforms to human rights and human needs? Does it encourage people to take on, you know education? Does it encourage engagement and participation? BJ*

Experts also provided critical comments in relation to some of the issues that stakeholders need to consider. The first example highlighted in the following quote conveys that standards alone may not be enough to ensure effective reuse of educational resources:

> *There are the standards around content and I would actually say that standards themselves are probably becoming somewhat less important and less relevant. Things can be standardised after the fact, people are interested in being able to reuse content now. For instance, I can go to Connexions and use their XML format and I can start using content from all sorts of other providers who are using the Connexions repository and that particular XML format and that's not a standard but it enables the kinds of reuse at a granular level that are really important to people in educational environments. The problem with a lot of these things is that they require people to know too much about the standard and about the way that it operates and those things need to be pushed into the background. AY*

Several arguments were given by another interviewee to clarify some of the key issues around learning through reusable resources. In relation to this issue, one of the first topics highlighted in the interviews was framing the actual problem yet focussing on the technical reusability thus really missing the point. The following extract illustrates this idea:

> *Content is not the most important, but that when you live in a world where the content is increasingly freely available and available from many different sources that, not only is the content lower in its intrinsic value but… to realise that the learning isn't simply in the content it's in the engagement around the content, and increasingly not just in engagement with a specific piece of content but an engagement with a network. SC*

Secondly another topic that was highlighted by interviewees was the importance of scaffolding early learners rather than simply focussing primarily on experts and autodidacts i.e. the self-learner or teacher. Again this is illustrated in the following quote:

> *I do think we need to be cautious about focusing too much on experts and autodidacts and not appreciating the requirements for scaffolding of early learners, and the usefulness of that. But, in terms of how, as a instructor, one relates to learners in this network learning world and in this open educational world, I do think we're looking at a process in which one's own process as an instructor for engaging with content and with ubiquitous information and how one copes with that, is one of the primary things that you need to model for your students. SC*

A third topic to emerge was that learning is not simply within the content it is, in fact, implicit in the engagement around the content and the ubiquitous social networks. The next extract gives a perspective on this issue:

> *Framing the problem as being about the technical reusability of materials between different learning environments I think is to really miss the point. The approaches that emphasise openness and choice are not, they're not simply ideological, but they are ideological, they're recognising that in the form of basic http and html we've been given an open canvas on which to reconstruct how we construct and share knowledge, teach and learn, and that, that all of the other things that we've then imposed on top of that are simply manifestations of older models of scarcity, of artificial scarcity, that are linked to earlier ways of understanding how to create economies and, and how to create transactions and that, so, to not disregard simply as ideological these approaches that promote openness and freedom. SC*

Another key issue that was also highlighted by this interviewee were the importance of recognising the direction in which the disruptions are headed and finding new ways that we can work in this new open virtual world. He stated that:

> *Models that are clearly being disrupted are not (necessarily) a long term sustainable approach… instead (it is important) to recognise the direction in which the disruptions are headed and try to organise yourselves in processes that take advantage of that. So… specific recommendations for content development and reuse… is really to argue that the nature of the disruption that we're experiencing is large and we're at the very start of it and, a lot of these problems we're trying to solve are simply problems of trying to fit this disruption into older models, that (they) won't ultimately fit because it is a disruption, so to urge us to look past that towards a place where, that we can work in this new open way (is a credible goal). SC*

APPENDIX B - Interview Questions

B1. ABOUT THE INTERVIEWER
- Name
- Current Projects:
- Brief biography
- Homepage & other links
- Photo URL

B2. ABOUT THE CASE STUDY THAT RELATES TO CDFR
- **Practice**
  Are you involved in a project, research, or practice related to CDfR? What is
  your role?
- **Brief Description**
  Could you give more details of your practice: duration, aims, content, format,
  pedagogic approach, methodology or framework, environment & tools, target
  audience, specifications, maintenance, training & support, URLs…
  How long have you been work with OERs?
  What are your main interests?
  What kind of target audience are you interested in ?
  Do you have any particular approach related to CDfR?
  Any recommended tools for developing content fore reuse?
  Could you tell us about your experience in developing services to bring
  benefits to OER users and also workshops for engage people to develop
  content for reuse?
- **End Users**
  Apart from the target audience, were any other groups of end users identified
  during this project that were not expected?
- **Contexts/Scenarios**
  Are there any different contexts or scenarios identified in your experience?
- **Team involved**
  Are there other teams involved in this CDfR practice? Who are they? What are
  their role and key skills?
- **Strength**
  What do you consider as strength in this practice? e.g. quantity of content
  developed, different formats, different kinds of users, number of users
  registered, number of access, …

B3. STRATEGIES FOR CDFR

Underlying question:
Based on your practice, what are the key aspects related in developing content to be reused?
(e.g. Requirements, difficulties, benefits…)
You may wish to reply to this question in different ways taking into consideration the different stakeholders (e.g. the institution, educators, developers, learners, web users, communities…)
Prompt questions relating to this topic are:

- **Pedagogic aspects**
  What pedagogic issues should be considered for developing reusable learning content?

- **Technical aspects**
  What technical issues should be considered for developing reusable learning content?

- **Content Features**
  What are the key features of reusable content?
    o different formats, interactive, multimedia…
    o any particular issue related to Interoperability, Granularity, Accessibility

- **Meeting User/Stakeholders expectations:** please describe:
    o Searching / Adapting / Sharing
    o Addressing different kinds of environment / context / scenarios
    o Adding Accessible training materials
    o Adopting specifications {IEEE RCD, LOM, MLO, IMS CP, SCORM}

- **Any other recommendations,** such as:
    o A Methodology for CDfR?
    o Tools for CDfR?
    o University edicts insisting that you must reuse materials?
    o Personal/colleague encouragement to change or enhance learning & teaching opportunities

- **Anything else you'd like to add about CDFR:**
    o References that you would like to suggest
    o Papers
    o CDfR training materials
    o Other relevant URLs

APPENDIX C – SIG Special Interest Group Experts

ID	Interviewee	Projects	Role
BE	Bernd Simon	ICOPER	Senior Researcher at the Institute for Information Systems and New Media of WU, Vienna. Managing director of Knowledge Markets and Project coordinator of ICOPER .
JE	Jenny Gray,	OPENLEARN	Lead Technical Developer for OpenLearn at the Open University, UK
SC	Scott Leslie	OLNET	Research Fellow in OLNET and Educational technologist at BCcampus, Canada
RO	Roland Klemke	OpenER ICOPER	Assistant Professor at Open Universiteit Nederland And Member of ICOPER
MA	Mary Thorpe	CURVE	Professor of Educational Technology in the Institute of Educational Technology at the Open University, UK
BJ	Bjorn Hassler	STEEPLE	Senior Research Associate at Cambridge University UK NS member of Steeple.
FR	Freda Wolfenden	TESSA	Senior Lecturer at the Faculty of Education and Language Studies at the Open University, UK and the director of the TESSA Project
PH	Phil Barker	CETIS	Learning Technology Adviser at the Institute for Computer Based Learning, Heriot-Watt University, Edinburgh
DA	David Massart	ASPECT	Senior Software Architect at the European Schoolnet. Programme Manager of the Learning Resource Exchange. Member of the technical board of the IMS global learning consortium and co-chair of the SIG on 'Federated Architectures'
BI	Birgit Schmitz	Humance AG. ICOPER	Head of the department "knowledge and eLearning at Humance AG. Member of ICOPER.
AY	Allyn Radford	Learnilities Connexions	Senior Managing Director at Learnilities, Research Fellow at RMIT University and member of Connexions.
GE	Gerald Schimdt	E-PUB & Daisy book	Development Adviser in Learning & Teaching Solutions at the Open University, UK
RS	Ross McKenzie	VLEs	Strategic Development Manager in Learning and Teaching Solutions and the lead of the VLE Development Team at The Open University.
AX	Alex Mikroyannidis	OpenScout	Postdoctoral research fellow at the OU UK, the lead of the workpackage: Improvement and adaptation services for OpenScout.

APPENDIX D – SIG Special Interest Group Institutions

Examples (& URL)	Short description	Audience, Target group	Partner
Adaptive search engine	Personalisation: searching for learning resources (tool)	Students	University of Leicester (UK)
Author 42 & Media library	Authoring software & digital library (tool)	5 author roles, from producers to users	Humance (Germany)
SIMAR	Using Competitive simulation scenario software to teach marketing (tool & content)	Masters/MBA students	HEC (France)
EMERGO	Methodology & generic toolkit for games (tool & content)	Education providers using game based learning	Open Universieit Nederland (Netherlands)
Lecturnity	Recording Tool for Lectures, e-Lectures Portal (tool & content)	Lecturers as authors; students as end users	IMC (Germany)
OpenER	Open content repository (content)	Open Content Community, students	Open Universieit Nederland (Netherlands)
OpenLearn	Open content repository (content & tools)	Open Content Community, web users, learners, educators, educational institutions, professional agencies & institutions, commercial companies	The Open University (UK)
PHAIDRA	Digital asset management system (tool)	All University members, all University students & guests.	Universitt Wien (Austria)
PowerTrainer	Authoring technology for interactive content (tool & content)	HR Professionals in company training departments	IMC (Germany)
Widget integration	Extended reusability of contents by means of widget integration (tool)	Media specialists, Teachers, Learners, Tutors, Learning advisors, Bloggers & social networkers	Giunti Labs (Italy)