Open eLearning Content Observatory Services

Open Educational Practices and Resources

OLCOS Roadmap 2012

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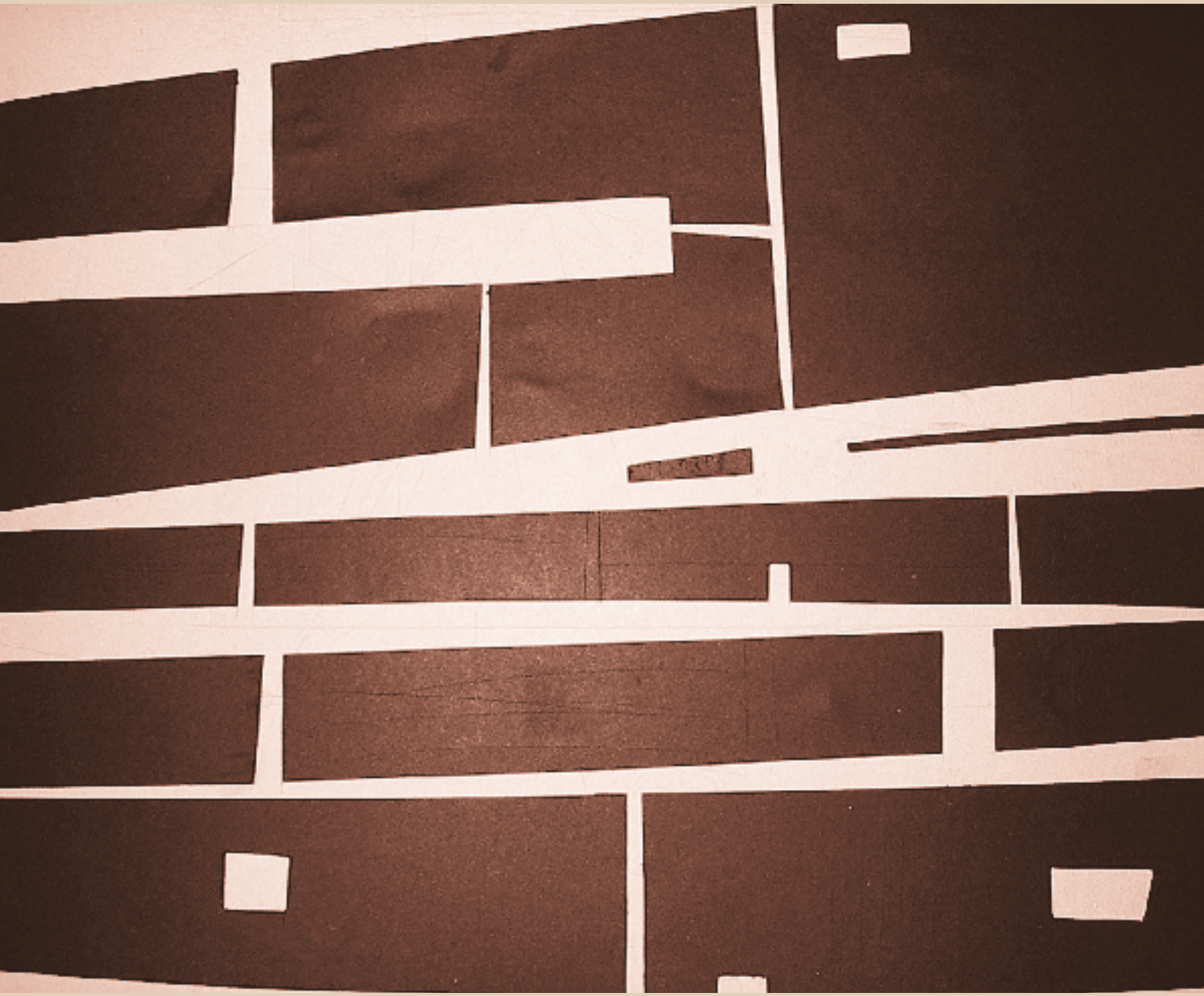

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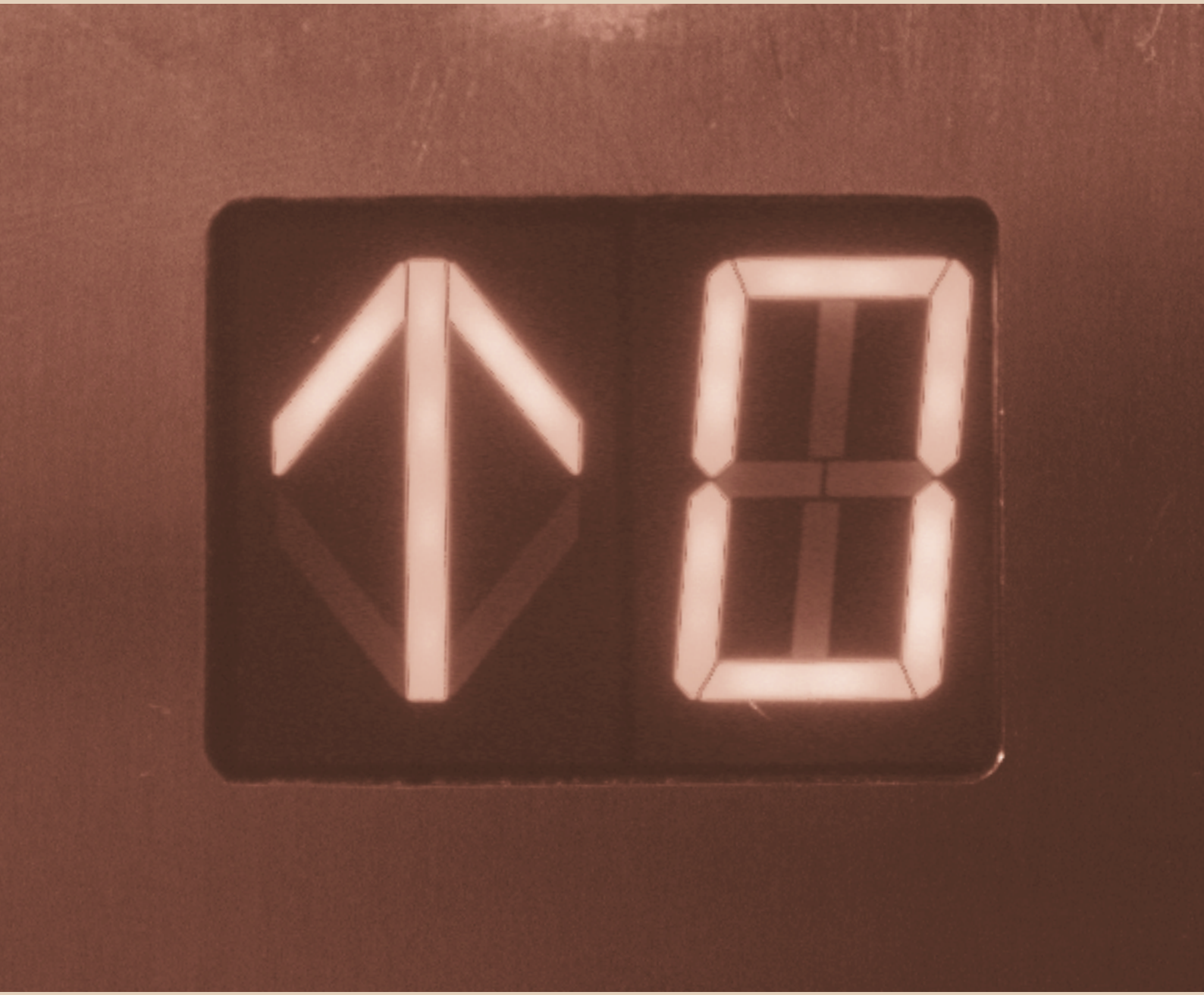


1 Executive Summary

As a Transversal Action under the European *e*Learning Programme, the Open e-Learning Content Observatory Services (OLCOS) project carries out a set of activities that aim at fostering the creation, sharing and re-use of Open Educational Resources (OER) in Europe and beyond.

OER are understood to comprise content for teaching and learning, software-based tools and services, and licenses that allow for open development and re-use of content, tools and services.

The OLCOS road mapping work was conducted to provide decision makers with an overview of current and likely future developments in OER and recommendations on how various challenges in OER could be addressed.

While the results of the road mapping will provide some basis for policy and institutional planning, strategic leadership and decision making is needed for implementing measures that are likely to promote a further uptake of open educational practices and resources.

OER are understood to be an important element of policies that want to leverage education and lifelong learning for the knowledge economy and society. However, OLCOS emphasises that it is crucial to also promote innovation and change in educational practices.

In particular, OLCOS warns that delivering OER to the still dominant model of teacher-centred knowledge transfer will have little effect on equipping teachers, students and workers with the competences, knowledge and skills to participate successfully in the knowledge economy and society.

This report emphasises the need to foster open practices of teaching and learning that are informed by a competency-based educational framework. However, it is understood that a shift towards such practices will only happen in the longer term in a step-by-step process. Bringing about this shift will require targeted and sustained efforts by educational leaders at all levels.

The road mapping work covers the following areas:

- Policies, institutional frameworks and business models;
- Open Access and open content repositories;
- Laboratories of open educational practices and resources.

For each of these areas, drivers/enablers and inhibitors of OER and open educational practices are identified and described in detail. The results are summarised in Roadmap Briefs, which may be used as starting points for discussing initiatives in OER and open educational practices on a strategic level.

Among the critical inhibitors that have been identified the following three should receive particular attention:

- In order to see researchers and educators excel in OER, academic and educational institutions will need to implement appropriate mechanisms of recognition and reward.
- Business models in OER will remain tricky. The right mix of income streams must be found, and there will be growing competition for scarce funding resources.
- Regarding educational repositories at present there exists little experience in how to effectively support communities of practice, which is of critical importance if OER initiatives want to grow based on user contributions.

With respect to potential drivers/enablers, the following three are among those of general importance:

- The urgency of the lifelong learning agenda in Europe and beyond makes OER initiatives targeted at driving participation particularly welcome.
- Whereas current OER initiatives focus mainly on providing access to static course material, a new generation of easy-to-use Web-based tools and services provides opportunities to offer potentially more effective OER.
- For authors and institutions who wish to provide OER while retaining some copyrights, the set of Creative Commons licenses allows for doing so in an internationally standardised way.

However, these points are only a limited selection of observations from OLCOS' much broader assessment of issues and developments in OER and open educational practices.

Based on the road mapping results the OLCOS report provides a more comprehensive set of recommendations for the following decision makers and stakeholders:

- Educational policy makers and funding bodies;
- Boards, directors and supervisors of educational institutions;
- Teachers;
- Students;
- Educational repositories;
- Developers and implementers of e-learning tools and environments.

The OLCOS Project Consortium invites decision makers and stakeholders in OER to consult the project website, www.olcos.org, for further information on ongoing activities and other products.

We welcome comments and suggestions on our products as well as the opportunity to establish cooperation with other ongoing projects and new initiatives in OER and open educational practices.

2 Introduction: Context, objectives and direction of the OLCOS road mapping work

"If I give you a penny, you will be one penny richer and I'll be one penny poorer. But if I give you an idea, you will have a new idea, but I shall still have it, too." Albert Einstein

2.1 Context and objectives

As a Transversal Action under the European *e*Learning Programme, the Open e-Learning Content Observatory Services (OLCOS) Project carries out a set of activities that aim at fostering the creation, sharing and re-use of Open Educational Resources (OER) in Europe and beyond. One of those activities is to develop a roadmap to provide orientation and help in decision making on various issues related to OER.

The OLCOS project is conducted in the context of other ongoing international activities. With respect to research and discussion, for example, the OECD's Centre for Educational Research and Innovation (CERI) is currently carrying out an international survey on OER (with an expected completion date at the beginning of 2007), and UNESCO's International Institute for Educational Planning (IIEP) facilitates a Community of Interest in OER. This community has been active since October 2005 and has more than 600 members from 94 countries.

With regard to the many ongoing initiatives that develop and promote OER a few illustrative examples are AVOIR – African Virtual Open Initiatives and Resources, the Commonwealth of Learning's Learning Object Repository, the Open Courseware Consortium, Schoolforge and Wikibooks (a list of 40 selected projects and resources are included in the annex of this report).

The OLCOS Roadmap has been produced to provide educational decision makers – politicians, directors of institutions, managers of educational networks, teacher organisations and other stakeholders – with orientation and recommendations to help them make informed decisions with respect to Open Educational Resources (OER). Such resources are understood to be important means for leveraging educational practices that help equip teachers, students and workers with the competences, knowledge and skills to participate successfully in the knowledge society and economy.

The Roadmap is understood to be a tool for understanding the relevance of OER and identifying required actions. Other OLCOS products such as tutorials and best practice use cases will provide information and advice for the creation, sharing and re-use of OER for user groups such as educational managers, tools developers and implementers, teachers/trainers and students.

The Roadmap provides an overview of current and likely future developments in OER through presenting and assessing drivers/enablers and inhibitors for open educational practices and resources. The objective is to identify possible achievements in a time-horizon set for 2012, and to specify how the related challenges could be addressed (recommendations).

Furthermore, the OLCOS Roadmap may help in defining and prioritising some key areas on which activities should be focused (e.g. some major inhibitors), and in conceiving mechanisms to monitor progress along the way.

2.2 How can Open Educational Resources make a difference in teaching and learning?

At present a world-wide movement is developing which promotes unencumbered open access to digital resources such as content and software-based tools to be used as a means of promoting education and lifelong learning. This movement forms part of a broader wave of initiatives that actively promote the "Commons" such as natural resources, public spaces, cultural heritage and access to knowledge that are understood to be part of, and to be preserved for, the common good of society. (cf. Tomales Bay Institute, 2006)

With reference to the Open Educational Resources (OER) movement, the William and Flora Hewlett Foundation justifies their investment in OER as follows: "At the heart of the movement toward Open Educational Resources is the simple and powerful idea that the world's knowledge is a public good and that technology in general and the Worldwide Web in particular provide an extraordinary opportunity for everyone to share, use, and re-use knowledge. OER are the parts of that knowledge that comprise the fundamental components of education – content and tools for teaching, learning and research."

Since the beginning of 2006, the Open e-Learning Content Observatory Services (OLCOS) Project has explored how Open Educational Resources (OER) can make a difference in teaching and learning. Our initial findings show that OER do play an important role in teaching and learning, but that it is crucial to also promote innovation and change in educational practices. The resources we are talking about are seen only as a means to an end, and are utilised to help people acquire the competences, knowledge and skills needed to participate successfully within the political, economic, social and cultural realms of society.

It is important to note that current educational practices are decisive in determining whether – and how – digital educational content, tools and services will be deployed and utilised. If the prevailing practice of teacher-centred knowledge transfer remains intact, then OER will have little effect on making a difference in teaching and learning. However, as C. Sidney Burrus from the Connexions project said in OLCOS' expert consultation process: "Delivering modern OER to the traditional teachers may not be as effective as delivering it to modern teachers, but it is better than nothing. (…) important change occurs in two phases: first, you do the old job better, then you redefine the job. Some of the traditional teachers will change, just slowly and partially. I strongly recommend involving EVERYONE if they will cooperate at all."

OLCOS understands that the key issue with respect to OER is whether or not they are useful and effectively used in equipping students with the competences and skills for personal and professional achievement in the current and emerging knowledge-based societies and economies (among the extensive literature available, see, in particular, Burton-Jones 1999; Lesser / Prusak 2003; Neef 1998; and Nonaka / Takeuchi 1995).

It is widely accepted that certain core competences are essential for individuals to participate successfully within a knowledge-based society. These core competences, which learners' should strive to acquire, are: self-direction and creativity, critical thinking and problem-solving skills, collaborative team-work and communication skills. These competences are not always fostered and encouraged when educational institutions and teachers base their instruction on a model in which the teachers are perceived as dispensers of knowledge.

This model of teaching has been criticised by many educational experts and practitioners, and it has often been discussed that an educational revolution is needed and could be stimulated through the use of e-learning methods, new educational tools and Web-accessible media-rich content. Such a revolution has not occurred so far because the educational innovations hoped for require a new educational culture and mind-set as well as overcoming considerable

organisational barriers within the established educational institutions.

In fact, OLCOS expects that within those institutions a shift towards competency-based and learner-centred education will be slow to occur. Open educational resources (OER) are among the potential enablers of such a shift, but only if educational policies and organisational frameworks empower teachers and learners to make good use of such resources.

2.3 Towards learning experiences which are real, rich and relevant

In a policy paper published by the European Open and Distance Learning Liaison Committee, it was noted that "a new vision of ICT [Information Communication Technology] for learning is needed at policy, management and grass roots practice level if a new window of opportunity is to be found for ICT to become really interesting to innovators in the learning system". Furthermore, a new policy paper published in May 2006 identified "the knowledge gap on learning innovation" as a major problem. (European ODL LC 2004 and 2006)

From the perspective of ICT a new vision and a wide-open window of opportunity can be found in the current development and usage of "social software" based tools and services that are highly supportive of open learning practices and processes. Social software, such as Weblogs, Wikis, RSS-based content syndication, social book-marking, podcasting, etc., is increasingly being used outside the commercial domain and shows the first spill-over effects within the realm of education. Wider adoption for educational and lifelong learning purposes could have an enormous innovative impact as these tools and services are ideally suited to learner-centred as well as collaborative approaches in developing competences required in our knowledge society.

OLCOS advocates open educational practices that are most likely to allow for learning experiences that are real, rich and relevant. As the knowledge society is built to a large degree on digital environments of work and social communication, such practices must (among other goals) foster a creative and collaborative engagement of learners with digital content, tools and services in the learning process.

Again, open access to resources is an important element in educational innovation, but not the only solution per se. The decisive factor is that open educational practices are fostered by the appropriate institutional culture and mindset and supportive environment, including easily accessible and shareable tools, services and content.

The importance of digital resources stems from the fact that these resources are seen as fundamental to the knowledge society and economy. Therefore it is essential that teachers and students become proficient with digital tools and services and are aware of the various content licenses. This proficiency is vital because within the digital realm content cannot be created, re-used and shared without employing tools and services. Moreover, content licenses are important because they define what uses the authors who hold IPR/copyright are willing to grant others who wish to benefit from the investment already made in developing the content.

On the other hand, software-based tools, services and multimedia allow for the emergence of innovative educational practices when used in didactically sound ways. For example, much educational potential is likely to be found in a digitally enhanced collaboration of teachers and learners. There really exists a knowledge gap in how to use digital resources intelligently in learning innovation, but this gap will be best closed by teachers with the right professional attitudes through sharing within communities of practice experiences and lessons learned.

Towards a new face of learning

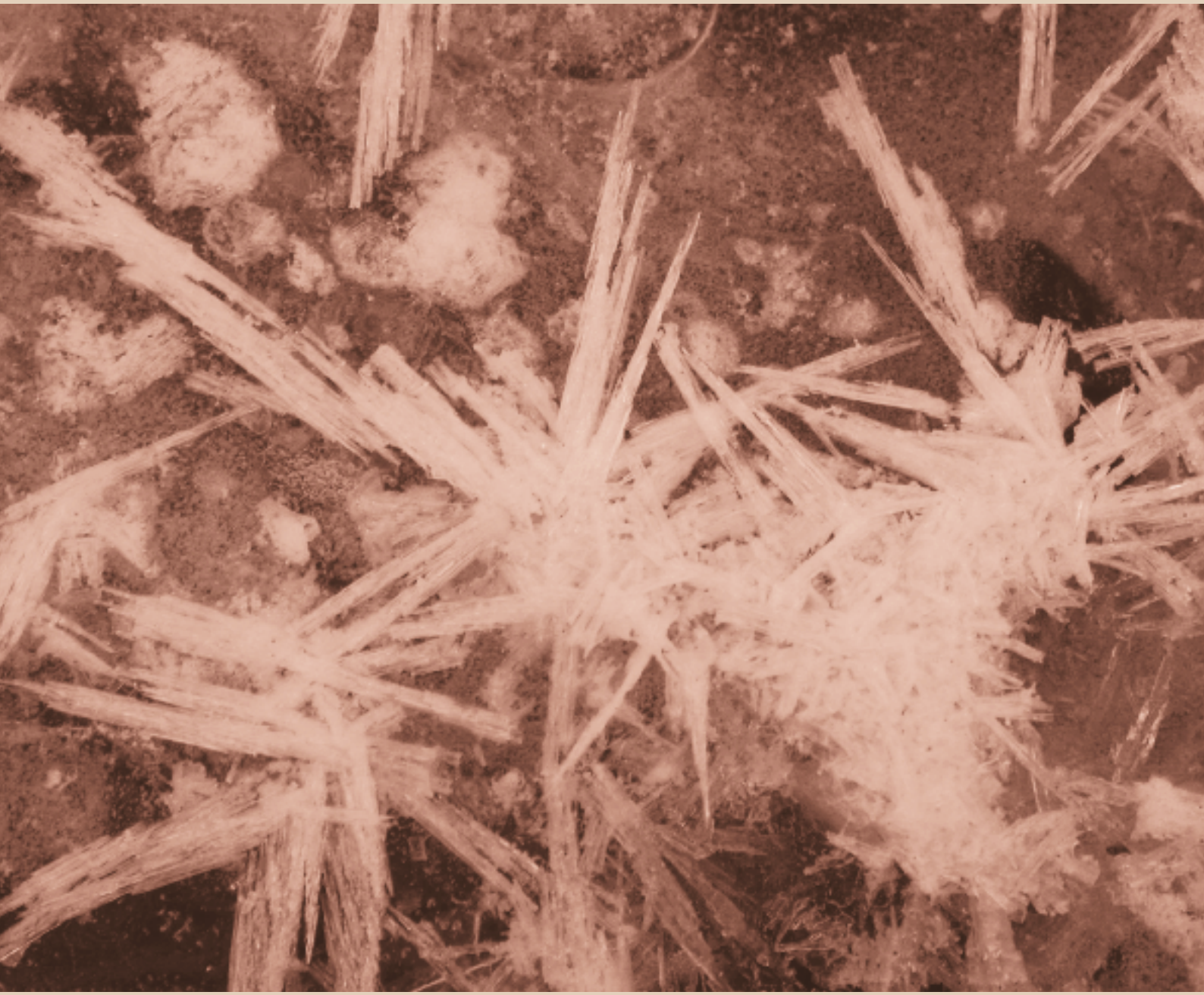
Will Richardson, author of "Blogs, Wikis, Podcasts and Other Powerful Web Tools for Classrooms"(Corwin Press, 2006), in an article published in the George Lucas Educational Foundation's "Edutopia Magazine", writes:

"The good news for all of us is that today, anyone can become a lifelong learner. (Yes, even you.) These technologies are user friendly in a way that technologies have not been in the past. You can be up and blogging in minutes, editing wikis in seconds, making podcasts in, well, less time than you'd think. It's not difficult at all to be an active contributor in this society of authorship we are building. As usual, many of our students already know this. (…)

In an environment where it's easy to publish to the globe, it feels more and more hollow to ask students to 'hand in' their homework to an audience of one. When we're faced with a flattening world where collaboration is becoming the norm, forcing students to work alone seems to miss the point. And when many of our students are already building networks far beyond our classroom walls, forming communities around their passions and their talents, it's not hard to understand why rows of desks and time-constrained schedules and standardized tests are feeling more and more limiting and ineffective." (Richardson 2006b)

Similarly, in a Futurelab (UK) interview on "Education for 14-19 year-olds", Mary Curnock Cook from the Qualifications and Curriculum Authority thought: "Technology is key to their environment, even to their sense of self and, when they come to school, it's as if they are being powered down. No wonder they lose interest." In the same edition of Futurelab's "Vision" magazine key messages from a conference on "14-19: Transitions, Technology and Learning – lessons learnt" were "the importance of forging better links across formal and informal learning environments, the need for assessment that meets young people's personal aspirations and needs, and the centrality of creativity and collaboration to the entire process of learning". (Futurelab 2005, 6 and 7)

One promise of "social software" such as Weblogs and Wikis is to help close to some degree the obvious gap between current educational practices and what a younger generation of students uses almost naturally to communicate and form communities of interest outside "the classroom". For example, Wikis are understood to be a useful tool to bridge the different learning cultures of teachers and students. (cf. Ferris / Wilder 2006)



3 The quest for Open Educational Resources

This chapter provides an introduction to the ongoing discussion of the concept of Open Educational Resources. Related to this we address different viewpoints on who is considered to create and provide educational content, with a particular focus on the role different actors such as publishers and educational repositories attach to teachers. Furthermore, we provide an overview of the current situation and new developments in open digital learning resources from a European perspective.

3.1 Attributes and expected benefits of Open Educational Resources

When defining Open Educational Resources (OER) one discovers that an authoritatively accredited definition does not yet exist (cf. the discussion in the next section). However, experts who understand OER as a means of leveraging educational practices and outcomes will propose definitions of OER based on the following core attributes:

- that access to open content (including metadata) is provided free of charge for educational institutions, content services, and the end-users such as teachers, students and lifelong learners;
- that the content is liberally licensed for re-use in educational activities, favourably free from restrictions to modify, combine and repurpose the content; consequently, that the content should ideally be designed for easy re-use in that open content standards and formats are being employed;
- that for educational systems/tools software is used for which the source code is available (i.e. Open Source software) and that there are open Application Programming Interfaces (open APIs) and authorisations to re-use Web-based services as well as resources (e.g. for educational content RSS feeds).

These are rather demanding principles and, in fact, repositories of educationally relevant resources often do not fully abide by them. Hence, readers should be aware that when in the following chapters we refer to "open" resources or refer to interesting projects, there may be several criteria that these do not meet while still being developed in the spirit of the current Open Access movement in research and education.

It is expected that adherence to the principles outlined above can bring about tremendous benefits for education and lifelong learning in a knowledge society, not least of which is to eliminate many inefficiencies and bottlenecks in the current provision of e-learning opportunities. More specifically, among the expected benefits of Open Educational Resources as seen from the viewpoints of educational networks, teachers and students are the following:

From the viewpoint of educational networks (European, national, regional) and institutions, OER can:

- Provide a long-term conceptual framework for alliances in the creation, sharing and provision of educational resources based on a strong emphasis of reusability;
- Allow for a higher return on investment of taxpayers' money (public funds) through better cost-effectiveness when reusing resources (e.g. sharing development costs among institutions or professional communities);

- Promote digital competence for the knowledge society beyond basic ICT skills through making available tools and content that allow learners to develop their critical thinking and creativity;
- Enrich the pool of resources (content and tools) for innovating curricula and teaching & learning practices, including resources from public sector information agencies, libraries, museums and other cultural organisations;
- Lead to a leverage in the educational quality of content through quality control, feedback and improvements within content alliances, communities and networks who share content (quality control through networks of developers and users has often been shown to bring good results);
- Foster lifelong learning and social inclusion through easy access to resources that may otherwise not be accessible by potential user groups.

From the viewpoint of teachers and students, OER can:

- Offer a broader range of subjects and topics to choose from and allow for more flexibility in choosing material for teaching and learning (i.e. content that can be easily modified and integrated in course material);
- Save time and effort through reusing resources for which IPR/copyright issues have already been resolved;
- Allow for engaging teachers in leveraging the educational value of resources through providing their own personal assessments, lessons learned and suggestions for improvements;
- Provide learning communities such as groups of teachers and learners with easy-to-use tools to set up collaborative learning environments (e.g. group Wikis or Weblogs, social networking, content feeds, etc.);
- Promote user-centred approaches in education and lifelong learning; users not only consume educational content but develop their own ePortfolios, and share study results and experiences with peers.

This overview of possible benefits of Open Educational Resources may seem overly optimistic. In fact, there are many unfavourable conditions that constrain a much stronger move towards open educational practices and resources. However, there are also various supportive trends and enablers for achieving real breakthroughs in teaching and learning, and we hope that the OLCOS roadmap and recommendations are supportive in making informed decisions on how to gain the greatest benefit from open educational practices and resources.

3.2 Ongoing discussion for a comprehensive definition of Open Educational Resources

The term Open Educational Resources (OER) has been introduced and promoted in the context of UNESCO's aim to provide free access to educational resources on a global scale. The term was first adopted by UNESCO in 2002 in the final report of the Forum on the Impact of Open Courseware for Higher Education in Developing Countries, to refer to "the open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes". (UNESCO 2002)

With regard to this working definition, it is important to note that "resources" are not limited to content, but comprise "three major areas of activity: the creation of open source

software and development tools, the creation and provision of open course content, and the development of standards and licensing tools. The outputs of all three may be grouped together under the term Open Educational Resources (OER)." (UNESCO – IIEP / Albright 2005, 1)

There are also much broader interpretations of Open Educational Resources (OER). For example, the OECD's Centre for Educational Research and Innovation (CERI) states on the webpage of their OER survey that this would comprise "Open courseware and content; Open software tools; Open material for e-learning capacity building of faculty staff; Repositories of learning objects; Free educational courses" (see also Hylén 2006, 49-51).

In short, an authoritatively accredited definition of Open Educational Resources does not exist at present. Rather, the term provides a reference point for the ongoing discussion and clarification of different notions of "open provision of educational resources". This may be understood from a financial point of view, i.e. free of charge for non-commercial purposes such as research, teaching and learning, or even free of ownership in the sense of "public domain" or "commons"; and also with regard to technical considerations such as a possible mandatory provision of content in open formats and availability of the source code of software.

Further, there may be different concepts of "educational". For example, does this imply only formal, institutionally framed educational opportunities or also informal, self-managed lifelong learning? Must content undergo some special treatment which makes it "educational", or is it a sufficient condition that educators find some content potentially useful in teaching and learning activities?

Open educational content – suggestions from an OLCOS expert workshop

An OLCOS workshop held in Vienna on 14 June 2006 explored the question of what are the important issues that should be considered in the development of a comprehensive definition of open educational content. Some suggestions were:

- That a specification of "educational content" should be detailed enough to allow for clearly identifying and categorising such content (and that this may require a taxonomy of such content with in-depth explanations);
- Regarding the new generation of Web-based tools and services ("social software", Web 2.0) it may be difficult to isolate pieces of content from their rich interlinkage;
- The importance of metadata must be fully acknowledged; if, for open content, metadata are not available the content is undiscoverable, not linked to context, non-manageable, etc.; further, metadata are often highly valuable content in themselves;
- Yet, experts pointed in different directions with respect to the type of metadata: some suggested using simple metadata standards (such as those used in typical RSS-based services); others suggested taking the route towards "formalised" metadata (i.e. use of Semantic Web specifications such as RDF);
- To strongly emphasise the aspect of open formats which is crucial for easy modifiability and re-use;
- That a flourishing of open content will not be achieved if there are no strong incentives (reward mechanisms) for producing, sharing and (re-)using such content; and that communities of interest in certain subjects will have an important role;
- Derived, combined or mixed material should be clearly marked as such. In technical terms, for new versions or material that builds considerably on work by others, metadata must be created that provide information about the re-use made.

Formats should be used that have metadata "embedded" and carry them with them;
- Quality criteria and assurance will also, and perhaps particularly, play an important role in the provision of open educational content; mechanisms like automatic provenance detection and quality assurance would be highly beneficial;
- The meaning of "open provision" should be clarified in detail: for example, is the content meant to be accessible by anybody without registration or restricted to teachers and learners in an educational network?
- Which restrictions can be accepted? What about potential commercial re-uses of the content, is it possible or strictly excluded?
- That "open educational content" should be content for which IPR/copyright issues have been resolved;
- It should be considered whether it is possible to customise existing licenses that are already in wider use (such as the Creative Commons licenses) for educational content, and to make content with such licenses detectable by search engines;
- Also, a clarification of moral rights should be considered, for example, if the work of an author of open content is placed in a context he or she does not find appropriate, or if an author wants to recall published works due to a reconsideration of opinion.

OLCOS expert workshop, Vienna, 16 June 2006: For the list of participants and further results, see the workshop minutes that are available on www.olcos.org

OLCOS has gathered expert opinions and suggestions on open digital educational content (see information box), but does not attempt to provide its own fully-fledged definition of Open Educational Resources. There are two reasons for this:

First, we find the current discussion on such resources in the educational communities extremely productive, and leave it to UNESCO's International Institute for Educational Planning (IIEP) and the OECD's Centre for Educational Research and Innovation (CERI) to summarise in their final project reports the main conclusions and clarify the concept of OER much further than is currently the case.

Secondly, OLCOS' approach is different in that it does not primarily emphasise open educational resources but open educational practices, which, however, can benefit much from open access to resources such as content and tools. From a perspective of innovative open educational practices (which will be clarified in later sections of this report), much of the current discussion on OER will appear to be dominated by a traditional understanding of education as well as relevant content and tools.

For example, in the UNESCO forum and OECD survey there is an emphasis on the sharing among educational institutions of "courses" or "course content" (such as syllabi, teachers' guides, lecture notes and material, reading lists, etc.). Furthermore, an understanding of content as "static" information entities seems to dominate. This is understandable, if, as in the case of the UNESCO and OECD activities, the focus is more on understanding the current situation in the educational sector than on developing a longer-term perspective in Open Educational Resources.

Such a perspective will, for example, also take into account the current boom in the use of "social software" tools and services. Although this has not so far had a stronger impact in the educational sector, it is evident that such tools suit open educational practices admirably. This is because they are supportive of a high flexibility of learning processes and allow for easy publication, sharing and re-use of study content, commentaries, links to relevant resources, etc. in information environments that are managed by the teachers and learners themselves.

Also, from the perspective of Open Educational Resources, "openness" is the core paradigm of content, tools and services in the so-called "Web 2.0" digital environments. Hence, in the future the much sought after OER will more likely be found in these "social" environments and contexts of learning than in typical "courses" that are today supported by the Virtual Learning Environments of schools/colleges and universities.

Web 2.0 e-learning – Some features

The notion of a Web 2.0, which can be distinguished from the Web 1.0 version with respect to several technological as well as behavioural features (cf. O'Reilly 2005), has also inspired parts of the education community among others. The following are some elements that are more widely understood to form part of the Web 2.0 and to be of interest for an "e-learning 2.0":

- Social Software for easy publishing and sharing of ideas, content and links: In particular Weblogs, Wikis, Social Bookmarking, and content sharing websites such as Flickr. Increasingly also collaborative authoring and other interactions in real time: For example, Writeboard, Writely, SynchroEdit and others;
- Collaborative filtering: Discovery of "most interesting" resources through filtering techniques, but also ongoing conversations, recommendations and cross-linking of resources in social networks;
- Open APIs of Web service applications (e.g. Google Maps API, Flickr API) for creative re-use (e.g. mashups) of services and content;
- Many services based on RSS [Really Simple Syndication] feeds, which are used to continually update websites as well as the personal libraries of end-users with information about, and a link to, available thematically relevant content (which can also be pod- or videocasts);
- The content on Web 2.0 websites will also often be licensed as open content (e.g. Creative Commons).

Sources with educational perspectives: Alexander 2006; Cych 2006; Downes 2005; O'Hear 2006; Wilson 2005; see also the thoughtful Weblog elearning 2.0 [putting the "oh!" back into learning] authored by Mike Malloch, http://www.knownet.com/writing/elearning2.0

3.3 Who should create and provide educational content?

Different points of view abound on who should create and make available educational content. Of particular interest in this discussion is the role the different parties think educators could play in content creation and provision, because they are the ones who are expected to organise, steer, support and evaluate learning processes.

Therefore, it makes a huge difference if educators are understood to make use of prefabricated content or create teaching and learning resources themselves, for example through taking material from different sources, adapting it to their particular educational context, and combining it with their own products such as lesson plans and worksheets.

The point of view of educational publishers

The point of view of the publishers concentrates on the fact that the current educational framework (policy, curricula, classroom settings, assessment and certification schemes, etc.) leaves little room for the educational institutions, teachers and learners themselves to create and share teaching and learning content.

For example, the European eLearning Industry Group (eLIG) writes: "Educators have long been presented by some as substitutes for publishers. Content created and exchanged by educators may sometimes fit the required quality standards but it should be obvious to everyone that a teacher's job is different from that of a publisher. (…) Against all evidence and facts, some public authorities are still firmly convinced that a few motivated and skilled teachers can provide a great deal of free educational material to many or that each teacher is best placed to design the editorial content he really needs. Experience in EU-wide PPP such as the Innovative Teachers' Network indicates that teachers attach particular value to being able to share experiences in the selection and use of existing high-quality content, linked to a curriculum as much commercial content is."(eLIG 2005, 16-17)

Actually, if one takes as reference point current textbooks, modular courses or state-of-the art software-based products, the observation of the eLIG is correct. Most educators lack incentives, time and skills to create such learning material. However, what OLCOS stresses is not that educators should be enabled to develop and freely share such types of content on a large scale, and thereby compete with educational publishers.

Rather, the key points are, first, whether and where exactly usage of "high-quality content, linked to a curriculum as much commercial content is" is the best approach in fostering the development of competences, knowledge and skills. Secondly, if other practices are more suitable, how to enable educational institutions, teachers and learners to nourish such practices by providing them with the right environment, which includes making such practices mandatory in curricula, teaching guidelines, etc.

The point of view of open access educational repositories

This point of view is the one that informs the work of ever more repositories of learning and teaching resources that are accessible freely by anybody. Their philosophy includes the belief that sharing and re-use of content is good for leveraging educational practices, and that educators are able to create content that is useful also for others. This implies the notion that teachers and learners are interested and are themselves able to find, assess the quality of, and re-use some of the content that can be drawn from their repositories.

Such repositories are often project based with some initial funding from a public agency or a foundation, and maintained through the work of volunteering educators and 'in kind' support of IT personnel and technical resources of an academic or educational institution. Besides the issue of sustainability, another major problem of such repositories is that the amount and diversity of resources made available tends to be limited and, hence, the level of usage is often rather low.

Arguably, the key problem of current open access educational repositories may be that, despite their philosophy of sharing, they see teachers and learners as consumers of content who primarily want to download useful material. A better approach would be to support communities of interest around certain subjects (for example, in history or biology) by providing, alongside the content, mechanisms for adding comments on how best to use some

content, for documenting one's own project results, creating links to related content, and discussing new issues in certain subject areas.

Open learning communities: How much active contribution can be expected, and how can the level of participation be raised?

Learning content repositories who want to establish a community around the content they hold will ask how many active contributors they may expect. One observer suggests: "It's an emerging rule of thumb that suggests that if you get a group of 100 people online then one will create content, 10 will 'interact' with it (commenting or offering improvements) and the other 89 will just view it." (Arthur 2006)

For this pattern he cites available data for community content generation projects such as Wikipedia and discussion lists on Yahoo. For example, on the Yahoo Groups, 1% of the user population might start a group and 10% participate actively by starting a thread of a group or responding to a thread-in-progress.

The initial idea of a "1% Rule", i.e. that about one per cent of the total number of visitors to an "online democratized forum" (such as a Wiki, bulletin board or community that invites visitors to create content), was promoted by the marketing consultants Ben McConnell and Jackie Huba (2006).

The ratio of creators to consumers is also important with respect to learning communities who, among other activities, create content. But what really is important is not the "1% Rule", but the question of how to achieve at least 10% of people who add something to the initial activity and content.

In an OLCOS expert workshop, Graham Attwell from Pontydysgu (Bridge to Learning) proposed what may be called the "Searching–Lurking–Contributing" theory of learning processes: (1.) First, persons interested in a topic will "Google" some links; (2.) then they will find denser places of content, such as a website of a community of interest, a thematic Wiki, Weblogs of experts on the topic, etc.; (3.) then they will become "lurkers", i.e. come back to find new information, discussions, commentaries, links, etc. If the community has a newsletter or an RSS feed they may also subscribe to such services. Finally, (4.) if they feel "familiar" with the community they may also become contributors.

So, a strategy for educational communities who want to raise the number of active participants and content contributors is first of all not to shut out learners who just want to observe what is going on. Furthermore, it is important to actively "grow" the community through direct information channels (e.g. a regular e-mail newsletter or RSS feed) and opportunities to participate (for other options that help in "familiarising" interested people, see the practical suggestions by Ross 2002 and SitePoint Community 2003).

But how large could the active core of group members become? According to anthropological insights, a useful benchmark could be 150 individuals. (cf. Dunbar 1996) This is confirmed by findings about the size of tribes, the growth of firms (which above 150 people will acquire a more rigid, bureaucratic structure), or the number of scientists who cooperate and form a network around a specific research problem.

The point of view of educational repositories commissioned by Ministries of Education

In contrast to the open access repositories discussed above, these repositories represent a major long-term investment based on a national educational strategy and dedicated funding programmes. A larger part of the course material, learning objects and other content will be licensed from educational publishers, which often demands that such repositories (or parts thereof) are accessible only by registered teachers and students. But also content from various other sources (e.g. public agencies, academic institutions, libraries or archives) may be present as well as a limited amount of material provided by teachers, which is often created in the framework of some special projects. Most often national educational repositories represent a "top-down" approach for delivering available teaching and learning content that is aligned to the curriculum, though some portals also want to stimulate innovative projects of teachers and students.

Important to mention here is the European SchoolNet (EUN), which is a collaboration of ministry departments and national educational networks throughout Europe. The initial idea of the EUN, which was started in 1996, was a "bottom-up" process with the EUN as a central access point to educational resources from the national and regional networks. This included the idea that in the emerging digital environment educators would themselves increasingly create and provide content to a common pool of teaching and learning materials.

Over the following years the EUN, and the national educational networks, learned that there are considerable barriers to an effective participation of educators in pooling educational resources. Consequently, the approach shifted towards a more "top-down" approach, which over the years has been massively supported through project-based EU funding.

Today, the core longer-term initiative of the EUN is the European Learning Resource Exchange (LRE), which will be accessible to all interested Ministries of Education participating in the EUN and other public and private sector owners of educational content repositories. The development of the LRE builds on the results of several larger projects such as CELEBRATE (06/2002–11/2004) and CALIBRATE (10/2005–03/2008). Important ongoing work is the creation of the LRE Application Profile, which provides a set of metadata elements and vocabularies that are to be used by all participating learning object repositories.

Although the European Learning Resource Exchange clearly represents the EUN's "top-down" approach, the EUN never fully abandoned the notion of an active role of teachers in educational resources. For example, one of the assumptions the CELEBRATE project wanted to test was that teachers can potentially be more active if they are provided with the opportunity to select and combine learning objects from different suppliers and modify and re-use them using next-generation, user-friendly tools and learning environments. (cf. McCluskey 2004, 10)

CELBRATE explored the potential of the learning objects approach for primary and secondary schools. The project set up a content brokerage system and demonstration portal, and around 1,350 learning objects developed within the project were evaluated by 319 schools and 775 teachers in six countries. CELEBRATE also carried out a larger teacher survey, some of the results of which are summarised in the information box below.

Learning objects sharing and re-use – results from a teacher survey

In the framework of the CELEBRATE project (06/2002–12/2004), which was co-ordinated by the European SchoolNet (EUN), a large survey was carried out to investigate teachers' attitudes towards learning objects (LOs). Favourable attitudes towards sharing and re-using LOs were thought to be among the key factors for a learning object economy to become established and flourish.

The survey was conducted using an online questionnaire translated into the different languages of the respondents from Finland, France, Hungary, Norway and the UK. The sample of educational institutions was made up of primary and secondary schools that were known to have a better than average ICT infrastructure and experience in using ICT in teaching. The number of valid questionnaires returned was 508, of which nearly 70% were from Finland and Norway.

Of the many interesting survey results only a few can be summarised here. For example, the survey found that the teachers expected that learning objects could "support student-centred discovery", "convey information effectively to students" and "facilitate discussion between students". At the same time most disagreement was found for the statement "complex, large content packages are unsuitable" and "LOs are best used as teachers' presentation tools". (cf. CELEBRATE / Nurmi 2003, 60-62) This could suggest that teachers would welcome repositories of learning objects as an additional learning pool for students, rather than as a resource for direct use in the classroom.

Of core interest here are the survey results regarding the readiness of teachers to produce LOs, share them with others, and to re-use materials produced by others. Actually, roughly a half of the respondents said they were interested in producing LOs themselves, whereas 25% of the teachers were not. The possibility of getting some financial reward did not seem to be a strong motivator. In fact, considerably more agreed to be "ready to share my own LOs with others without a reward" than to consider having them sold by a commercial company. Finally, the vast majority (approximately 83%) of the teachers were willing to use available LOs produced by others. (cf. CELEBRATE / Nurmi 2003, 72-73)

To put these results in perspective, the following are some results of the survey regarding the use of ICT by the teachers: 96.7% had a computer at home, and 73.6% in the classroom. 92% reported that they use ICT for planning and preparing their teaching at least every week. Two thirds of the respondents said that they use ICT weekly or even more often during lessons in the classroom or computer lab. Most teachers did not feel restricted in their use of ICT by a lack of network access (82.3%), but by "not enough educationally meaningful programs" (27.6% "a lot", 47.2 "a little").

Not surprisingly, most teachers considered themselves as very good or quite good at text processing, e-mailing and searching the Internet, while skills such as programming or multimedia production featured low. (The survey did not ask for know-how regarding the use of software such as a Weblog, Wiki or other social software.)

Regarding the assignments teachers give to their students those that involve writing texts and searching the Web clearly dominate, while creating web pages or using an online forum or collaborative platform were shown to be low. However, about 75% of the teachers agreed that it is "very important that students' work becomes more independent with the help of ICT".

OLCOS' point of view

OLCOS sees a critical lack of educational innovation for learner-centred and collaborative learning practices and processes in which it is more likely that competences and skills for a knowledge society will be built up and proven. In such practices and processes, individual and groups of learners (including teachers) will actively use tools and content to understand problems, discuss approaches and methods in problem solving, and share study resources and results. We also acknowledge that it should be the teachers and learners who identify and decide upon which tools and content are most useful for certain study purposes. For example, whether or not a commercial content product better serves certain purposes than some open access content that may be available.

OLCOS' main concern regarding commercial educational content is that, due to the commercial considerations of the publishers, such content will usually – technically as well as with regard to licenses – not allow for learning activities such as re-use, modification, and open sharing of new content that contains parts from the publishers' original content. Hence, commercial educational content will most likely not foster open learning processes that allow for acquiring key competences and skills for the knowledge-based society. However, publishers are currently a major part of the educational "content pipeline", and will in the foreseeable future continue to play an important role in the educational sector.

Regarding large-scale educational repositories commissioned by ministries of education, we observe that they represent a "top-down" approach that wants to make available centrally and also as easily as possible educational resources relevant to the curriculum, including much content that is licensed from educational publishers.

This approach does not depart definitively from the notion of teachers as mediators of prefabricated educational content and, hence, perpetuates traditional practices of teaching and learning. It is an attempt to "upgrade" the delivery of educational content to the digital era (e.g. electronic instead of physical material), but does not fully take advantage of the opportunities opened up by new digital tools and services for innovative approaches to teaching and learning.

Yet, the fact should also be stressed that, despite policies and initiatives to bring about a change in educational practices (e.g. from teacher to learner centred and from subject to competency based), such change only happens slowly. While outside the settings of formal education electronic tools and services are becoming the natural environment of students, the educational institutions and teachers find it difficult to introduce innovative educational practices under the many constraints they face, such as the typical classroom environment and teaching schemes.

This may seem to be an overly negative picture and to ignore considerable developments both in the technical infrastructure of schools and colleges and in the use of electronic material by teachers. In actual fact the roll-out of infrastructure in the classroom (e.g. data points and projectors) is proceeding reasonably quickly, and many teachers have mastered the basics and are capable of using a "blended learning" approach.

Most current repository-based content supports this approach, in which the teacher uses some material in his or her presentations and points students to relevant content for further study. However, these are incremental changes in teaching and learning that benefit from new presentation technologies and easier ("at your fingertips") access to information than using a bricks-and-mortar library.

Rather than expecting a radical change or a "re-invention" of education from within the educational institutions, we think it is more likely that a diffusion of new forms of online

communication and collaboration into the institutions will slowly change educational practices. Educators and students already use the Web to a large extent to find information not only for personal but also for professional purposes such as preparing classes.

But the Web is currently changing dramatically due to new information standards, tools and services, and educators and students will increasingly make use of such resources. They will find information in project Wikis (of which Wikipedia is the largest and ever more frequently used and linked resource); will read Weblogs of professionals (who address interesting topics and provide comments on up-to-date information and discussions), and realise that ever more RSS-based and other services can be used to obtain thematically filtered information or audio and video casts on certain subjects and topics.

In a first step they will do so as information users. But, if learner-driven and collaborative educational approaches are emphasised and supported by directors, head teachers and IT managers of educational institutions, the first choice of teachers and students would certainly be to use such tools and services in meaningful teaching and learning practices.

Therefore, we expect that by 2012 a stronger shift towards e-learning will take place that will build on tools and services for collaboratively creating and sharing content while also drawing on many larger and smaller publicly funded educational and other e-content repositories, including offerings of private–public partnerships.

Increasing experimentation with Social Software tools and services

We are already observing much experimentation with "social software" tools and services at universities, colleges and schools. Wikis probably take the lead because of the ease of collaborative Web-based authoring and publishing they provide (for example, with respect to the German-speaking school community, see Doebeli-Honegger 2005). Even using Wikis in primary schools has been explored, for example as a tool for collaborative story telling. (Désilets / Paquet 2005) One often cited example is WikiVille, a project started in February 2006 in Bolton, England. WikiVille invites young people to write and reflect on topics such as life in their home town. It has become a global project through the participation of students from many countries around the world.

Also Weblogging sees interesting uses and reports on the educational impact are favourable. For example, the project "Escoles en Xarxa" (Schools on the Net) has created a community based on the Catalan language in secondary schools. In the first half of 2006, 53 schools were already connected to the project in the Catalan-speaking Community (Andorra, Balearic Islands, French Eastern Pyrenees, Catalonia and Valencia). In particular, the ongoing project also helps spread social values. Students use the blogs to report on developments in the social environment of their school and to debate social problems, for example experiences of people arriving in Spain from third world countries. (cf. EUN / Insight 2006) Another example of stimulating community and media creativity through Weblogging and RSS channels is the Canadian Campus Commons project. (Hemphill 2005)

An "Innovation Brief" of the European SchoolNet's Insight service suggests that online community, content sharing and social networking services like 360°Yahoo!, ConnectViaBooks, Del.icio.us, Flickr and Furl could be used to enhance learning. It also outlines possible educational implementations of such services. The Brief highlights the fact that "through sharing one's digital knowledge artefacts with other learners one not

only brings on-line learning in a social context that it is sometimes missing, but also allows new paths of learning with peers to emerge". (EUN / Vuorikari 2005)

The UK-based educational think-tank and development centre Futurelab in their "Opening Education" series recently published a study on the potential of a variety of social software based tools and services for education. They find the potential to be clear and that in schools "we are already witnessing small-scale experiments". However, they urge, "the use of social software in education is still in its infancy and many actions will be required across policy, practice and developer communities before it becomes widespread and effective". (Futurelab / Owen *et al.* 2006, 4)

3.4 Open e-learning resources in a European perspective

The current focus in open resources for education and lifelong learning is mainly on providing access to more content in digital formats. There is little consideration of whether this will promote real innovation in teaching and learning. If the goal is innovation, access alone is certainly not enough. The same can be observed in related areas such as cultural heritage where ever more resources are digitised, while the question of how to enable engaging cultural experiences and learning with these resources is often neglected. (cf. Geser 2004 for some suggestions)

However, we expect that with increasing resources made accessible over the coming years the question of actual usage and impact will come to the fore, and the focus of interest will become how to enable novel forms of study and creative use.

In the following we provide an overview of the current situation and new developments in open digital learning resources from a European perspective.

A slow growth in a situation of fragmentation

In recent years, significant conceptual and technical progress has been made with respect to interoperable, accessible and re-usable digital learning resources. However, the growth in volume of European *open* e-learning resources has been rather slow. There are many reasons for this, though of particular note should be the situation of educational fragmentation within Europe due to the many different languages, different educational frameworks and various aspects of cultural diversity.

Unfortunately, there is a lack of detailed quantitative overviews on the availability of educationally relevant open resources in Europe. This is due to the fact that such resources are often not specifically addressed and, hence, not documented and monitored in the existing national e-learning strategies. However, generally speaking, there is a predominance of material in English, due to the considerable and sustained efforts of countries such as the USA (e.g. MERLOT – Multimedia Educational Resource for Learning and On-Line Teaching), Canada (EduSource – Canadian Network of Learning Object Repositories), Australia (EdNA Online) and, on the European side, the United Kingdom.

The United Kingdom also stands out within Europe because a lot of funding has been made available from lottery money for "good causes", such as digitising and making accessible on the Web material for education and lifelong learning. In particular, this also includes learning resources from cultural institutions such as archives and museums. To provide but

one illustrative example: The National Archives, which may seem to be an unlikely candidate as e-learning content provider, has created inspiring free offerings such as "Learning Curve" (Bringing history to life), which follows the History National Curriculum from Key Stages 2 to 5, or "Moving Here", a huge resource for lifelong learners interested in their community's history of migration to, and life in, the UK.

Overall, a much stronger creation, exchange and localisation of open e-learning content in and among the European member states is required to achieve key educational goals set by the eEurope initiative. In particular, smaller countries and language families could benefit from repositories of shared open e-learning content, as costs for the creation of the original media objects (e.g. texts, images, video, animations, 3D objects, simulations, etc.) can be saved and instead invested in the translation of texts and audio material.

Also the lack of economic impact due to the slow increase in open e-learning resources should not be underestimated. It is often not considered that a broader uptake of the open content model must not necessarily be seen as a threat to European companies who develop and market e-learning technologies and content. Rather, it may considerably raise the demand for content authoring, publishing and management tools, as well as interest in high-value digital educational products for which complementary open content is made available.

International collaborative efforts will need to be strengthened

It will be important also to further strengthen cooperative efforts in Open Educational Resources beyond Europe. International sharing of teaching and learning resources on the level of dynamic individual projects already exists. For example, the US-based Connexions platform is also used by university professors and high school teachers from Europe for creating, managing and sharing course material. The Connexions website has about 200,000 unique visitors per month who come from over 150 countries.

On a global level an encouraging example is the recent establishment of the Global Learning Objects Brokered Exchange (GLOBE) initiative, which is a collaboration of ARIADNE (Europe), Education.au (Australia), eduSource Canada, MERLOT (USA) and NIME (Japan). The work of the ARIADNE Foundation concentrates on e-learning standardisation and development of systems and tools for managing educational material. The most important Europe-wide (and potential global) player in e-learning content may become the European SchoolNet (EUN) through their European Learning Resource Exchange which is currently under development.

With respect to Higher Education, the Open Courseware Consortium could become an interesting player; at least universities and colleges are becoming more aware that sharing of content may be an approach to broaden their portfolio of teaching and learning resources. The Consortium has about 100 members; besides 11 universities and colleges from the USA there are many European members who participate under umbrella initiatives such as the ParisTech "Graduate School" (France) and the Universia OCW (Spain).

However, it should be noted that, for transferring educational content to "non-Western countries", localisation of the content according to differences in cultures and educational systems is required, i.e. elements such as images may not be used due to cultural sensitivities and even the didactical aspects of some course material may not match up with the expectations and needs of teachers and learners in other countries.

Regarding localisation of Higher Education courseware for "non-Western countries", the summary of an OECD–CERI workshop on Open Educational Resources notes: "There are also some rather large scale translation activities going on, particularly to Spanish, Portuguese,

Simplified and Traditional Chinese and to some extent to Korean and Thai. This exemplifies the need to 'localise' content, meaning to adapt the resources according to the needs, preferences and cultural preferences of the local user." (OECD–CERI 2006, 3) Most of the content that has been translated so far is from the M.I.T. Open Courseware initiative.

Valorisation of public sector information hampered by a lack of open access

There is also the question of how services making use of interesting public sector information could become a more relevant resource for education and lifelong learning. It is a well-known fact that Europe is not particularly good at stimulating the valorisation of content that is created or collected by public bodies. Starting from the European Commission's Green Paper on Public Sector Information (1999) there has been wide discussion of how the valorisation could be leveraged. In 2000, a comprehensive study provided clear evidence of how much Europe lagged behind the United States in effective valorisation. (Pira 2000)

The study showed that public sector information (PSI) is a major, but so far under-exploited economic factor. It distinguishes between the investment value, i.e. what governments invest in the acquisition of PSI, and its economic value, i.e. that part of national income attributable to industries and activities built on the exploitation of PSI. The study estimated that, across the European Union as a whole, governments invest around EUR 9.5 billion each year in PSI, with the largest investments being in geographical, cultural and statistical information. The economic value of this PSI was estimated at EUR 68 billion, while the USA with an investment of EUR 19 billion achieved a more than ten times larger economic value of EUR 750 billion.

Among the most important factors for this are the strong US freedom of information law, no government copyright, no restrictions set on re-use, and fees limited to recouping the cost of dissemination. The Pira study recommended learning from this approach, and even pointed out that, in terms of costs, charging could be counter-productive to fostering a stronger valorisation of PSI (though, not wanting to be too radical, the authors suggested a goal of marginal cost recovery).

The study also identified shortcomings in Europe with respect to resource standardisation and access, which over recent years may have been overcome. Perhaps today is the right time to promote the creation of educational & professional and cultural services based on open access policies for public sector information.

Little impact of projects-based digital repository development

Many efforts in digital repositories, libraries or archives of educationally relevant material have been funded in Europe. On the European level, for example, are the European eLearning programmes such as Leonardo and Minerva as well as the eContent Programme. From the perspective of stimulating educational innovation, many funded projects set out to develop and promote repositories of teaching and learning material. Also a multitude of projects in the Information Society Technology priority of the Fifth and Sixth Framework Programmes in Research and Technological Development (125 projects in the area of Technology-enhanced Learning alone) had a learning content repository component.

However, these projects were characterised more by exploring, piloting and demonstrating feasible approaches. They have helped in gaining a better understanding of technical and organisational challenges and possible solutions, and allowed for developing and sharing

knowledge among the project partners and clusters of related projects across Europe. However, most of the repositories did not achieve sustainability and growth in volume and usage. A reason for this was that projects often made use of parts of digital collections of participating institutions and/or commercial companies based on the understanding that this was for purposes of trialling and demonstration only.

The European Digital Library as a flagship venture

At present, the most significant European venture in open access is the European Digital Library initiative, which was proposed in April 2005 by the Heads of State and of Government of France, Germany, Italy, Hungary, Poland and Spain. This was understood by many observers to be in reaction to the Google Print Library Project which has the ambitious aim of digitally scanning millions of books from the collections of major American libraries and making them searchable online via Google's search engine.

This raised concerns about the ever-increasing dominance of the English language on the Internet and in global culture. Consequently, 19 national libraries of EU Member States immediately after the proposal announced their support of the European Digital Library venture. The aim is to digitise on a large scale and make accessible on the Internet works that belong to the European intellectual and cultural heritage.

As currently only a fraction of the cultural collections in the Member States is digitised, the European Commission in August 2006 adopted a recommendation that calls on the EU Member States to set up large-scale digitisation facilities to speed up the digitisation and online accessibility of the material. It is considered that by 2008 two million books, films, photographs, manuscripts and other cultural works will be accessible through the European Digital Library, and by 2010 the volume should have grown to at least six million. But, in 2010 the volume is expected to be much higher as, by then, potentially every library, archive and museum in Europe will be able to link its digital content to the European Digital Library. (cf. Europa.eu 2006; Commission of the European Communities 2006)

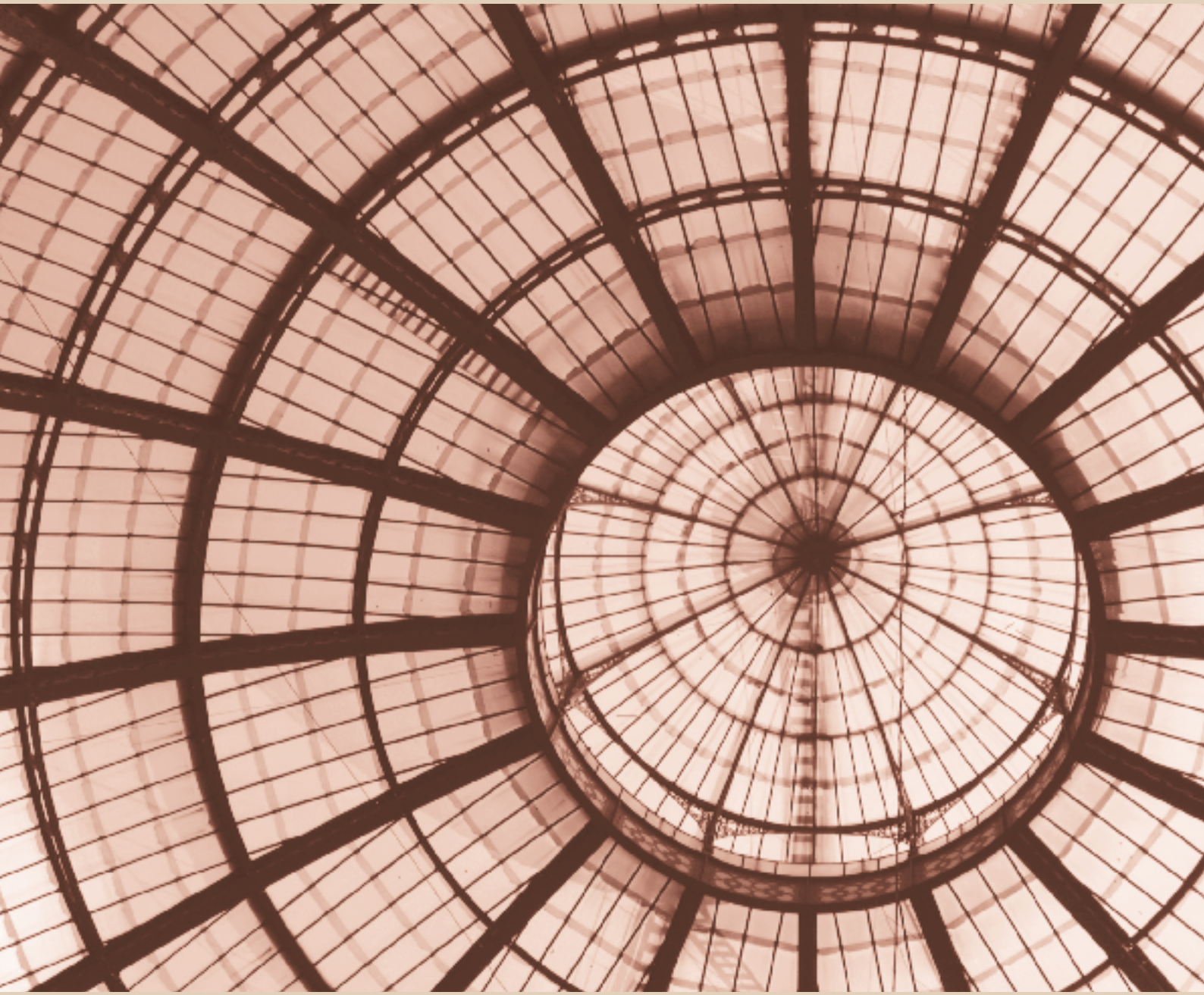
Communities of interest and practice and knowledge technologies as critical success factors

A European Digital Library could also form a massive resource for educational purposes, particularly if advanced technologies are being implemented that allow for exploring relationships between ideas and understanding cultural concepts that are exemplified in different works. In fact, the important point to emphasise is that providing access to digital material is not sufficient for digital libraries to become dynamic virtual places of learning and knowledge development.

Digitising and providing online access to collection objects is only a first step. Valorisation of the resources can only be achieved if there are also online tools for individual and collaborative work of scholars and students, contexts for learners such as concepts and narratives that embed cultural objects in history and society, and platforms where people can relate objects to how they understand their cultural history, identity and community.

OLCOS' observation is that too often this has been neglected in the development of online collections that were meant to be of interest to e-learning. In particular, communities of interest in certain subjects and opportunities for collaborative e-learning practices have not

been supported appropriately. Often this has been due to a lack of easy to implement and use tools and services, but also to a lack of understanding of how to best support self-organising learning communities. Today, useful tools and services are available as well as more know-how and experience in how to set up environments for learning communities.



4 Competences for the knowledge society

Educational policies increasingly emphasise innovation and organisational change of educational institutions that are considered necessary to better align education and lifelong learning with the requirements of the knowledge society. However, new educational approaches are not easily found and their implementation will be difficult if they require considerable transformations of current educational frameworks and practices.

What has been achieved so far is a better definition of key competences that are considered to be of importance for successful participation in the knowledge society. Much less consolidated is the understanding of how such competences should preferably be developed in learning processes.

OLCOS thinks that priority must be given to open educational practices that involve students in active, constructive engagement with content, tools and services in the learning process, and promote learners' self-management, creativity and working in teams.

Furthermore, this chapter introduces the idea of value chains of open educational content which emerge when teachers and students re-use available content and make enriched and/or additional material (e.g. use cases, experiences, lessons learned, etc.) available again to a larger community of practice.

Such an understanding of educational content differs considerably from the currently still dominant concept of educational content as "canned products" that are to be delivered by a few educational providers (e.g. educational publishers or repositories) to teachers and learners. However, we think that particularly in the context of Open Educational Resources it is essential to explore other models of content creation, sharing and re-use.

4.1 An urgent need for a transformation of educational practices

Educational institutions from primary schools to universities and on to lifelong learning providers exist to help people acquire the competences, knowledge and skills they need as individuals in the political, economic, social and cultural life of a society.

Yet, increasingly we acknowledge that traditional ways of providing learning opportunities are no longer adequate to equip teachers, students and workers with the competences required to participate successfully in the emerging knowledge-based society. It is becoming ever more evident that the societal frameworks and conditions are changing at a pace that is not being met by what most educational institutions today offer as learning opportunities.

Many in the educational sector such as university deans, school directors, managers of adult and lifelong learning centres, educational programme managers and teachers/tutors are aware that they cannot keep conducting "business as usual". However, new approaches are not easily found, evaluated and implemented. This is because the established educational practices are informed by complex regimes that include educational policies, curricula, teacher education, student assessment and certification schemes, and many other aspects such as limited budgets. These impede the required changes in educational institutions that would need to be systematic rather than piece-meal, sustained rather than based on some pilot projects with little tangible impact.

The OLCOS Roadmap wants to contribute to a transformation in educational practices that brings learning processes and their outcomes closer to what individuals will need to participate successfully in a dynamic knowledge-based society.

The ability to have easy access to and re-use Open Educational Resources is important in this, but is not the key point. Open content, tools, licenses are only means to an end, which is to foster the acquisition of certain competences needed by teachers and learners. Therefore, OLCOS stresses the importance of open educational practices within and across educational institutions, as the actual practices are decisive in whether, which and how digital educational content, tools and services will be employed.

Basically this is about people who have the right know-how and skills and are provided with the appropriate institutional framework (goals, values, guiding principles) and environment (for example, technical infrastructure) to make use of these means in open educational practices that are key to innovations in teaching and learning.

Such practices we understand to follow a competency-focused, collaborative paradigm of learning and knowledge acquisition. In other words, priority is given to learning communities instead of teacher-centred education, and development of knowledge and skills required for tackling and solving problems instead of subject-centred knowledge transfer. Generally, this will demand an active, constructive engagement with content, tools and services in the learning process (as is widely known, students recall as little as 5 per cent of a lecture or 10 per cent of what they read, but remember more than 75 per cent if they "practise by doing").

Though we have not emphasised the role of e-learning so far, this provides a key to making education and lifelong learning more effective, efficient and pervasive. However, e-learning can take very different forms such as "click & learn" offerings, some online multimedia used in school or university-level teaching, or learning communities that use electronic tools and services to develop and share knowledge.

Again, it is the practices that decide what kind of e-learning is employed and whether this makes a real difference in education and lifelong learning. As with any new media technology, there has been a tendency to imitate previous educational paradigms, such as the "electronic classroom", for example. Perhaps today is the time to shift decisively from the old paradigms to new ones that make a difference.

4.2 Defining and developing key competences

Formal education, training and lifelong learning providers face a rapidly changing societal and economic environment. In particular, there is an increasing demand to find new ways to equip teachers, students and workers with the competences and skills they need for the knowledge-based society and economy. For example, large parts of the existing workforce need re-skilling to ensure employability due to rapid technological change and an increasingly service-oriented economy.

Developing the required competences and skills at all educational levels, from basic education to ongoing lifelong learning, is a key element of the European Union's strategic goal of becoming "the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion". (European Council, Lisbon, 2000, paragraph 5) The "Lisbon Agenda" also called upon the Member States, the Council and the Commission to establish a European framework defining "the new basic skills to be provided through lifelong learning", which were considered to be "IT skills, foreign languages, technological culture, entrepreneurship and social skills". (European Council, Lisbon, 2000, paragraph 26)

The Stockholm European Council adopted the report "The Concrete Future Objectives of Education and Training systems" (European Council 2001), which identified three strategic

objectives (quality, access and openness of education and training systems) and associated objectives of which one was "Updating of the definition of basic skills for the knowledge society". The Barcelona European Council adopted a detailed work programme for achieving the common goals and objectives by 2010. (European Council 2002/C 142/01)

The task of defining basic skills or key competences for the knowledge society has in recent years occupied many working groups at global, European and national levels. The need for citizens and workers to be "competency-rich" has been acknowledged by several efforts among which are the OECD's DeSeCo project "Definition and Selection of Competences", which considered a general categorisation of key competences in "Acting autonomously", "Using tools interactively" and "Functioning in socially heterogeneous groups" (OECD 2002); the Eurydice survey on "Key Competencies in Compulsory Education", which revealed a heightened interest in key competences throughout Europe (Eurydice 2002), and the PISA activity, which elaborated a new "Definition and Selection of Key Competencies" (PISA 2005).

We believe that, to acquire the competences and skills for personal and professional achievement in the knowledge-based society, the learner's autonomy, personal mastery and self-direction must be acknowledged and innovative approaches implemented that foster self-management, communication and team skills, and analytical, conceptual, creative and problem solving skills. However, there is of course a huge difference between identifying required competences and operationalising them for inclusion in the concrete practices of teaching and learning at different educational levels.

With respect to such operationalisation, an important step is the reference framework "Key Competences for Lifelong Learning" (November 2004), which was outlined by the working group on key competences under the Education and Training 2010 work programme (European Commission 2004). This framework defines the key competences from the perspective of lifelong learning, i.e. the competences should be acquired by the end of compulsory schooling but also learned, updated and maintained throughout life.

The framework understands "competence" to mean a combination of knowledge, skills and attitudes, and distinguishes eight domains of competences that are deemed necessary for personal fulfilment and development throughout life, active citizenship and inclusion, and employability. The domains of competences are: Communication in the mother tongue, Communication in a foreign language, Mathematical literacy and basic competences in science and technology, Digital competence, Learning-to-learn, Interpersonal and civic competences, Entrepreneurship, and Cultural expression.

The detailed framework consists of a tabular overview, which for each domain contains the definition of the competence and its elements with respect to knowledge, skills and attitudes. For example, for Digital Competence (the term that is preferred by the working group to "digital literacy"), the required skills should comprise:

- "Ability to search, collect and process (create, organise, distinguish relevant from irrelevant, subjective from objective, real from virtual) electronic information, data and concepts and to use them in a systematic way;
- Ability to use appropriate aids (presentations, graphs, charts, maps) to produce, present or understand complex information;
- Ability to access and search a website and to use internet-based services such as discussion fora and e-mail;
- Ability to use ICT to support critical thinking, creativity and innovation in different contexts at home, leisure and work."

It is important to note that the framework does not describe in terms of pedagogy or didactics how the knowledge, skills and attitudes should preferably be developed in learning processes.

However, we think that in open educational practices, based on learners' own activities such as collaborative study projects, explorations and experiments (which also include documentation and communication of results), the much sought after proven competences and skills for a knowledge-based society are more likely to be developed than in "closed", predominantly teacher- and subject-centred education.

To provide but one example, which is enabled by a new generation of easy-to-use Web-based tools: If students have their own Weblog they engage in a self-directed, constructive practice. As authors of postings they must make their minds up about a topic, gather, evaluate and interpret information, take a position, come up with convincing arguments and evidence, and find the right means and style of expression. And this practice is inherently social and conversational, because the students themselves experience being part of a distributed community of interest and refer to ideas and writings of others. The same is true if students work collaboratively on a thematic Wiki, where each of them can add information, edit and rework texts of others, etc. They engage in collaborative knowledge creation, which will include discussing certain assumptions, statements, information sources, etc.

However, to incorporate such innovative learning practices in their teaching regime, educational institutions and teachers/tutors must change their role from dispensers of knowledge to facilitators of individual and collaborative learning and knowledge development. This will include providing students with advice on how to identify and address real world problems rather than textbook-based exercises, how to search, select and assess sources of information, and how to document and communicate their results to others for easy access and re-use.

Yet, educational practices are informed and framed by complex regimes that include educational policies, institutional goals, values and rules, curricula, assessment and certification

Being informed vs acquiring one's own experiences: Re-defining good teaching

Vicky Davis, a pioneering teacher who introduced Wikis in a college preparatory school, said in an online conversation that teachers are afraid to abandon their role as "the sage on the stage" (instead of the guide at the side), and are challenged by the Internet-based tools students are increasingly making use of:

"I think the traditional view of teachers is being challenged by these tools. After all, they think, the teacher is supposed to be the expert – in this rapidly changing world, the students can access new, relevant information that was once only accessible to the experts. (…) I think we TELL them too much and deny them the EXPERIENCE. By using wikis to share and aggregate their information we focus on the EXPERIENCE and not just dictating notes.

Why not do a wiki and aggregate the results of experiments. The teacher guides but does not tell the students the outcome. Let them aggregate and learn what the outcome is and draw the conclusion on their own. Then, they have learned. Then, we have truly taught. (…).

This is not about proving how much we know and feeding our own egos because society has marginalized teaching as a profession. This is about using methods that really TEACH. I think that is where the fear comes in. If teachers no longer 'teach' are they needed? It is a redefinition of good teaching."

From: Vicky Davis, Using Wiki in Education (conversation with S. Mader), 28 April 2006, http://www.ikiw.org/?p=79

schemes, educational settings such as classrooms and laboratories and their equipment, legitimate educational content (such as textbooks that are approved by some agency) and, of growing importance, digital information and communication technologies.

Innovation regarding teaching and learning practices that requires some change in the educational frameworks is not easily achievable, as is also the case with innovative forms of e-learning in schools and higher education institutions. Rather, the established regimes will strongly influence which learning practices are being developed, which technologies are considered, how they are implemented, how they are supposed to be used, and which results can be expected from this.

4.3 Priority of open educational approaches

Many promoters of Open Educational Resources (OER) do not take into account the legacy of traditional institutional frameworks and pedagogical models. They seem to assume implicitly that easy and free access to a "critical mass of high-value content" (which appears as a standard formula), and tools to make use of such content interactively, would somehow also lead to a change in such frameworks and models.

Pedagogical models are often not even considered in the discussion of OER. The reasons for this are manifold: For example, given UNESCO's goal of fostering free availability of teaching and learning content and tools for developing countries, the educational paradigm must seem of only secondary importance. (cf. the recent report "The State of the Right to Education Worldwide", Tomasevski 2006)

Another reason is that the discussion of OER has often been dominated by technical and management considerations rather than the perspectives of educational practitioners. And still another reason for a narrow understanding of OER is the focus of many discussions on issues of appropriate licensing schemes (for example, see the entry on Open Content on Wikipedia).

OLCOS promotes the understanding that, before addressing useful open content, tools and licenses, one must consider the pedagogical approaches in which these resources could make a difference, i.e. by being used in innovative forms of teaching and learning. This is because, if the dominant model is teacher-centred education – a teacher mediates authoritative textbook or course content and learners digest and reproduce it – the Open Educational Resources will not make for a difference in education. In such a model teachers may download Web-accessible open teaching material to prepare classes, and students may use some content to prepare material for lessons, but this will remain a one-way channel of content provision, in which physical textbook or course content is replaced by digital material.

Teachers and students will remain consumers of prefabricated content, not themselves becoming creative and collaborative, and they will not "pay back" with their own content. Hence, there will be no proliferation of value added content, i.e. content that contains results derived from learning processes such as enriched material, use cases, novel methods put into practice, lessons learned, etc. that other teachers and students may want to re-use and develop further. For example, the OpenCourse.org project invites teachers to openly share their course material for re-use and improvement under an obligation for users to contribute back to the community. The guiding idea is "Open Content + Community = Open Course" (Robert Stephenson).

In fact, as described in the following sections, the open e-learning practices and processes OLCOS promotes are basically about sharing and adding value. But for such processes to flourish, educational institutions themselves must become "learning organisations" (Senge

1990, Senge *et al.* 1994) seeking to develop and maintain an environment that favours innovation and change of established educational frameworks and practices. A key problem with becoming such "learning organisations" is the internal organisation of most educational institutions. This follows a model of "professional bureaucracy" (Mintzberg 1983), in which an administrative and collegial apparatus ensures that the individual professionals (the teachers) can do their job, but does not require much collaboration between them. Collegiate democracy and consensus prevail, and established professionals have discretion to conduct their work as long as they do not violate established principles and practices. Yet, it is well known that professional bureaucracies (like all bureaucracies) become performance structures rather than structures for innovation. The development of solutions for needs never encountered before is a difficult process, and radical change is more likely to be resisted.

David C. Forman from Sage Learning Systems observes that educators and trainers usually "have focused their efforts on learning in individuals, not organizations". But, he urges, "The economy, world situation and avenues for value creation have changed dramatically. The competitive strength of companies and even countries is now tied not to physical resources but to the knowledge and skills of people. And these people do not work in isolation within companies; they work in teams, informal groups and in multiple roles." (Forman 2004)

Yet, we would add, today teaching and learning within educational institutions does not usually build on teams of teachers, and teachers and learners, and there are but two basic roles, "teacher" and "student". There is a considerable mismatch between teaching and learning as framed and maintained by typical educational institutions and the fabric of work in a knowledge-based economy "out there".

4.4 Open educational content value chains

In the knowledge society we are increasingly becoming aware that there is something wrong with the notion of learning content as products that only need to be digested "as-is" by a learner to achieve a certain testable learning outcome. In fact, this is an "industrialist" notion of the process of learning that would make use of what has been termed "learning objects".

According to this notion, ideally a large repository of "learning objects" is provided from which an instructor can easily choose, aggregate and package some into larger chunks (courses), to be sequenced and transmitted to the learners for consumption and preparation for a series of tests that lead to a certification of some knowledge that has been acquired. To assist this, of course, a Learning Management System (LMS) would also be provided to manage learners, courses and tests results.

In fact, this is the model of learning that has been nurtured by developers and providers of LMS and publishers of course material for vocational training. Although the notion of "learning objects" has been widely discussed also by educators, the "industrialist" model did not succeed with schools, colleges and universities. The main reason for this is the core role they attach to the teacher in mediating a body of knowledge to the students. However, this knowledge transfer model of education has also been put into question. It is widely understood today that this model does not work particularly well in promoting competences and skills.

Rather than being the "sage on the stage", teachers would need to stimulate and moderate active, constructive and collaborative learning processes. A possible productive role of learning objects (LOs) in such processes has been summarised by researchers who carried out a survey on teachers' needs with respect to LOs: "Constructivism highlights the value of context-dependent, situated nature of learning, which is seen as an active process where knowledge and meaning

are constructed in an interaction with other people and environment with all of its tools, cultures and settings. Therefore, the LOs should be in a first place tools and means that engage learners with knowledge construction processes, provide ways to interact with the content and other people, and facilitate discussion about the issues being learned." (CELEBRATE / Nurmi 2003, 42, with reference to Jonassen / Peck / Wilson 1999)

In such a constructivist paradigm learners and teachers will explore, discuss, and solve problems collaboratively. This will include active searching for relevant information, re-use and enrichment of content, and sharing of study results with other learning communities. Actually, we think that a stronger momentum in open educational content can be achieved by fostering the development of educational content "value chains" or "value webs", in which value is defined in educational terms such as enhancements and outcomes of teaching and learning.

Collaborative learning practices are most likely to allow for such value chains to emerge and progress, because the learning community will:

- use some existing digital content or courseware as a starting point;
- consult other available content from e-learning repositories or other relevant sources of information;
- document their own study process and results, such as use cases, experiences, lessons learned, guidelines, etc. (note: documentation also includes metadata);
- make this enriched content available again to other learners, e.g. via repository and/or syndication services, and
- thereby share the results for re-use, and enrichment, by other learners.

Of course, for such value-added, freely exchangeable and re-usable content to proliferate several requirements must be fulfilled, particularly a change in the professional role, self-understanding, attitudes and skills of teachers, based on attaching a greater importance to education in a knowledge-based society. It is also important that content providers such as repositories should promote the improvement of content that is drawn from their pool of resources. For example, the AEShareNet (Australia) has among its "instant licenses" a "share and return" license. This permits free use, distribution and adaptations, but requires enhancements to be returned to the original copyright holder. The aim is to stimulate a continuous improvement cycle but having a single licensor who can aggregate and integrate improvements for new releases.

It is important to note that OLCOS does not expect teachers and learners to compete with educational publishers in the creation of what they see as "high value content", i.e. highly edited, multimedia-based, instructional content. Such content belongs to a completely different paradigm of learning. Also the engagement of teachers in the described value chains is not a form of "business incompatible and hidden-cost models of Open Content production, called 'free' but often made possible only through the institutionally untracked use of public funds (e.g. to pay the salary of teachers or professors who author 'free' content…)". (European eLearning Industry Group [eLIG] 2005, 10)

Engaging in educational content value chains as described above is exactly what one would expect paid teachers to do together with students in the collaborative development of useful competences and skills. The value chain emerges from an active, constructive and often project-based approach "where the process of content creation takes precedence over product. In this context content is ephemeral and apart from a personal project portfolio/archive, what is produced may be of little or no archival value. We should not lose sight of this and the focus on 're-use' should not extinguish opportunities to support this most active form of learning." (Devine 2004)

However, given a broader base of engaged and skilled teachers we expect many of the results to be of high educational value that is worth sharing with others. What is clear, however, is that today much of the content that is made available by lecturers, teachers and tutors on institutional Virtual Learning Environments (VLEs) does not stimulate and inform effective learning processes. "The current dominance of the content/VLE model is in need of questioning with its heavy emphasis on a presentational, knowledge transfer approach and, not surprisingly, a fundamentally conservative approach to design and interactivity. Done badly, this can be pretty dull stuff for our students, given the sophistication they typically expect in the digital worlds they frequently inhabit." (Devine 2005)

In fact, the students of the "digital generation" increasingly mediate their daily activities through Web-based and mobile communications and are skilful producers and brokers of information. Why not challenge them to address coursework and carry out study projects using digital tools and media such as creative software, digital (video) cameras, Weblogs, social networking, etc.?

Among the main reasons for ducking out of this opportunity are that the currently dominant educational paradigm emphasises knowledge transfer, teachers are expected to work with too many students, they are not equipped with the right didactics for moderating learner-centred processes (hence, are afraid of losing control), and there exists little experience in assessing and crediting the results of such study work. But, can the educational systems continue to repeat such excuses over and over again? Is it not time for a change, time to adapt educational settings, and to develop the required competences and assessment criteria?

4.5 Canned products vs open practices

What partly hampers a stronger uptake of the open content philosophy is the notion that this is about content as products, whereas, basically, it is about learning practices and processes that among other things need openly shared content to thrive.

A product-centric view is a barrier to innovation in the development of content services that can be used in constructive and collaborative forms of learning and knowledge creation. Currently, service in the domain of education and learning mainly means being able to search in a database, select some interesting material, and download the canned products on the desktop.

That there is something wrong with the current development of content and services for e-learning by commercial publishers and educational institutions was also a conclusion of the European Commission's eLearning Conference "Towards a Learning Society" (2005): "One of the important conclusions of the discussion was that there is currently insufficient innovation in the production and use of educational content. Too much of existing digital content has simply been transposed from other forms, prepared for traditional models of learning based on knowledge transfer. More needs to be done to embrace learner-centred approaches, based on constructivism, collaboration and co-operation. The feeling was that content may be important, but it is not necessarily king when it comes to effective learning." (Holmes 2005)

This dominance of the content-centric view was also observed in the first rounds of discussions on Open Educational Resources (OER) that were facilitated by UNESCO's International Institute for Educational Planning (IIEP). Summarising these discussions, Peter Bateman and Kim Tucker write: "A 'product' mind set seemed prevalent in the earlier discussions. But the two [product/practice] are, of course, linked: quality products result from

quality OER development practices. There is therefore a need to define quality OER practices." Furthermore, with respect to the issue of quality assessment they write: "There was also a slight tension between those advocating formal quality assessment of OER (as products), and those intent on maximising the learning opportunities and using OER to enhance learning (process/practice)." (UNESCO–IIEP / Bateman/Tucker 2006, 37)

In addition, many promoters of the open content philosophy still foster a notion of digital content that does not take into account new Web-based tools and services for creating, sharing and re-using content. Content is seen as fixed products such as articles or presentations in PDF format or high-professional software-based products. Yet, this is mostly "canned" content, which means that instead of sharing the data sources a visualisation of texts and images is provided (a PDF document of a PowerPoint presentation, for example). Such content cannot be easily re-used, edited, repurposed and enriched, which alongside clear licenses (e.g. authorisation for derivative works or remixing) is a major requirement of open content practices.

Yet, currently a new generation of tools and services allows non-professional authors to create, update and interlink content (e.g. Weblogs and Wikis) easily and collaboratively, to syndicate, aggregate and automatically receive information according to specific thematic interests (e.g. RSS feeders & aggregators, not only for text-based information but also audio and video), and to combine and integrate content from different information services (e.g. a "mashup" of maps, images and various information).

This development is highly supportive of collaborative educational practices and content production and sharing based on rich interlinking, easy updating, re-combination and delivery of information entities. It provides opportunities for creating educational value webs in which many teachers and students can participate and add value through their own contributions of open content.

The following table compares the two content paradigms of "canned" versus "open" content:

	Canned content	Open content
Basic notion	Courseware, textbook, supplementary material, etc.	Web of various kinds of information resources (including open courseware, etc.)
Role of teacher	Instructor, dispenser of knowledge	Facilitator of learning processes, coach/mentor; learning context manager
Role of learner	Receive, digest and reproduce knowledge	Active learner who develops competences, knowledge and skills
Status of content	Certified educational material, aligned to curriculum	Content as deemed useful by teachers and learners in a certain learning context
Creation/authors	A few professional authors ("high value products")	Many authors, including professional authors, teachers and learners
Copyright	Rigid ("all rights reserved", exceptions for educational purposes)	Open content licenses (e.g. Creative Commons, "some rights reserved")
Content process model	Create, assemble, package and deliver (one to many)	Create, share, re-use, improve and enrich (collaborative)
Context	Removed from learning process (educational content industry; often mono-disciplinary perspective)	Part of enquiry-based learning process, learners engage with real world, "inter-disciplinary" content, and contribute own ideas and study results
Quality control	By subject and instructional experts	By learners and teachers in the learning process (study group, community of practice)
Access	Restricted, registration and authentication	Open access, but some parts of a project may be for "members only"

Services	Database search and download for preparing courses/classes	RSS feeds for thematically relevant content (text, audio, video), peer-to-peer content services, bookmark sharing, discussion fora, social networking, etc.
Learning objects	Static units, low granularity, seldom updated	Evolving units, various granularity of interlinked material, much "micro content" from content feeds, frequent updates
Metadata	IMS Learning Resource Meta-data, LOM (often with lacking educational categories) and others	Traces of use by other learners, recommendations, shared content categories (e.g. on Weblogs) and keywords (e.g. in social bookmarking), RSS summary metadata and others
Tools	Typical desktop tools and presentational "electronic classroom" applications	Wikis, Weblogs, RSS feeders & aggregators, etc., plus content acquisition and creativity tools (e.g. digital camera, sound recording in field work, graphics, etc.)
Content management	Institutional Learning Content Management System	Self-managed by individual and groups of learners; e-portfolios to document, reflect, and present learning progress and results

4.6 Activities in the open digital educational content life cycle

Besides understanding open educational content from the perspective of an evolving "value web", it may also be useful to distinguish in more detail the different activities that will usually be involved in the production, provision and use of such content.

These activities show important differences from the traditional life cycle of educational content. In particular, this cycle is characterised by a strict separation of tasks in which specialised educational authors and publishers produce the content and teachers and learners are only considered as users of the content such as textbook or course material. Updates, changes and additions to the content are carried out by the authors and publishers, who hold the copyrights and IPR.

In open educational practices we not only expect to find that the teachers and students themselves increasingly become producers of content; there are also many other activities they

will carry out as part of active, constructive learning processes. Such activities include:

Create

In collaborative open e-learning practices content is created not by one or a few but by many and often distributed groups of authors. These authors are educational and subject experts, teachers and learners who form learning communities (or communities of practice) and share an evolving corpus of content that is relevant for certain open learning practices. This collaborative approach has been made possible through the availability of tools and services that make it easy for many authors to create and publish richly interlinked content. An example of such a tool is a Wiki, which is already often used for projects of university- or school-based groups of teachers and students.

Re-use / modify

Open content should allow for easy re-use and modification based on open content formats and clear licensing agreements. In open educational practices content will often be drawn from different sources for re-use according to different learning goals, designs, contexts, etc., and such re-use should not only be easy to carry out, but should also be allowed for. For example, RSS aggregators make it possible to aggregate content that is relevant for certain topics, and make this continuously updated resource available to a group of learners.

Re-use will also require disaggregating the original content and including parts such as texts, images, diagrams, a java applet, etc. in a new product. Often this will require modification of some parts to adapt them for the envisaged learning design, for instance by choosing other examples, or to update them with new figures, images or links to fresh content.

But re-use can also mean making use of the structure of some type of content, for example a template of a lesson plan or a suggested common structure of a learning resource which is populated with a person's own content from a different subject area.

Of course, all this work can be done more easily if the original content is provided in an open content format; otherwise a lot of work would need to be invested on re-doing the same content, for example a diagram that should be updated with new statistical figures.

License

Licensing must be considered throughout the open content life cycle. Authors who have created new content must consider what they want to allow others to do with the content and provide appropriate information on the copyrights (e.g. by attaching a Creative Commons Attribution–NonCommercial–ShareAlike license).

If authors in the production process re-use content created by others, they must check what uses they may legitimately make of the content, and adhere to these when incorporating the content into their product. As a consequence, for the content they make available the authors must choose a license that does not violate the licenses of the content they have integrated into their product.

Further, digital repositories should also make users aware in their terms and conditions of the implications of the different licenses of the content they hold (preferably, this should be one license with very few restrictions regarding re-use).

Share

In the open content life cycle, content that has been adapted to a specific learning design and context, and further developed through contributions in the learning process, is (again) made available to others who could benefit from such value added learning material. This will

often be done by uploading the content (plus some descriptive metadata) to an open access content repository, where others can find it by using a search service.

Search

In open e-learning practices, searching of useful content is an important part of the learning process as the content to be used is not prescribed, but depends on the goals and requirements of the study project. Hence, the learners' search activity becomes an integral part of the learning process and mechanisms that support the search process have an important role to play.

The search will not be limited to repositories of educational content, but will also include many other sources that may hold useful information. Often repositories and other sources (e.g. special interest portals) will have RSS feeds that can be subscribed to free of charge and push fresh content on certain topics of interest to the learners. Here the search will be about finding the most suitable among such content feeds.

Use

While the open digital content life cycle stresses the importance of collaborative creation and sharing of educational resources, teachers and learners will often just use available content as found and judged to be useful. However, as this content will increasingly stem from collaborative learning processes, this may stimulate them to "pay back" and also share their results with others.

Manage

In the management of open educational content, open access repositories and systems will play an important role. A large part of open digital content will reside in such repositories, the metadata of which will be exposed to harvesters and used for searching, alerting and other services.

However, in open e-learning practices content will also increasingly be managed by teachers and learners themselves (for example, their Weblog, ePortfolio or group Wiki). Therefore it is important that the users have available easy-to-use content management tools and acquire skills in effectively managing content, on their own desktop as well as in shared environments.

5 Presentation of OLCOS road mapping results

5.1 Introduction: Scope and approach

In this part we present drivers & enablers and inhibitors in different areas relevant to further progress in open educational practices and resources. These areas and particularly interesting topics have been identified in an analysis of a larger body of literature and two OLCOS expert workshops held in January and June 2006.

As Jan Hylén from the OECD's Centre for Educational Research and Innovation (CERI) said in the second OLCOS expert workshop, Open Educational Resources (OER) are "a vast area" to map and this is "a fast evolving landscape".

CERI is carrying out a survey to grasp the scope and scale of current OER initiatives with a focus on Higher Education internationally, and to identify how institutions tackle various issues related to producing and providing access to OER. (cf. OECD–CERI 2005, the final survey report is expected to be published at the beginning of 2007) Furthermore, UNESCO's International Institute for Educational Planning (IIEP) has been facilitating online fora that discussed these issues also mainly from the perspective of Higher Education. (cf. UNESCO–IIEP / Albright 2005; UNESCO–IIEP / Bateman/Tucker 2006)

For the OLCOS road mapping work we have chosen a somewhat different approach:

First, this work has a broader scope than that of CERI and IIEP, as we did not limit our research to OER for and from Higher Education. Hence, we also include secondary education institutions and emphasise the topic of lifelong learning. However, as Higher Education institutions are at present among the most active in OER, we have included relevant developments and examples from this domain.

Secondly, OLCOS' road mapping has a time horizon until 2012. This means that, besides assessing the current and likely future state of affairs with respect to OER in obviously relevant areas, other interesting developments with a potential impact on the concept of, and progress in, OER should also be taken into account. For example, the work of CERI, IIEP and others shows a particularly high interest in course material of the currently typical variety. In contrast, we also consider as very important content that is produced and shared using Wikis, Weblogs and other Social Software tools, RSS feeds (including also podcasts [audio] and videocasts); shareable, formally described Learning Designs, and even content such as controlled vocabularies, taxonomies and ontologies.

Thirdly, due to OLCOS' emphasis on educational practices rather than educational products, the discussion of some topics may have a different flavour from other publications on OER. A common aspect, however, may be an emphasis on identifying behaviours that should be changed or promoted more strongly in order to realise the expected benefits of OER.

Areas and topics covered

We have grouped the areas and topics covered in the road mapping work as follows:

| Policies, institution frameworks, and business models
| Open Access and open content repositories
| Laboratories of open educational practices and resources.

In these areas we have tried to identify the most important topics, which are described in appropriate detail and with reference to available survey results.

The topics addressed include some that have been around in the educational sector for some time now (e.g. Learning Objects) or can be expected to appear on the radar of educational institutions and networks until 2012 (e.g. Learning Design based systems, Personal Learning Environments, Semantic Web applications and others).

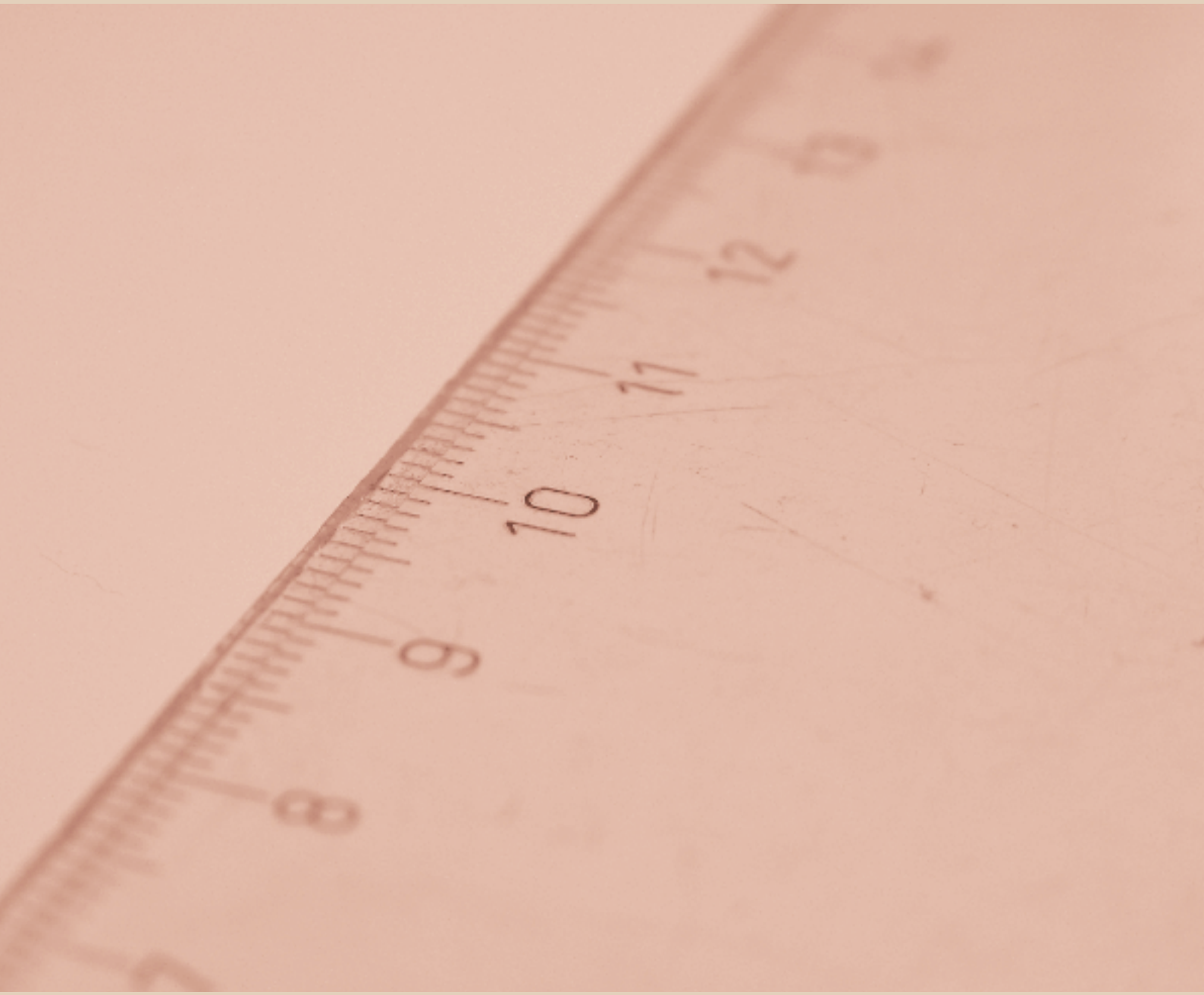
Topics of a technological nature will be discussed mainly from an educational perspective. In fact, many "technological" topics have considerable implications with regard to the understanding of what practices of teaching and learning should be supported (or not supported).

It may also be important to note that the road mapping work does not cover applications such as games, mobile technologies or new forms of human–computer interaction (e.g. multimodal interaction, augmented reality). Such applications can allow for interesting learning experiences, yet will find it difficult to reach wider use in mainstream educational settings in coming years (interesting outlooks and current examples are provided in BECTA ICT Research 2006a and NMC–NLII 2006).

In the following chapters, for each of the areas covered we first present the identified drivers and enablers and then possible inhibitors:

- Drivers and enablers are understood to be developments that provide either a favourable environment or a particular handle for bringing about changes towards open educational practices and resources.
- Inhibitors are understood to be factors that hinder a broader uptake of open educational practices and resources.

After the presentation of the detailed results of the road mapping work in the three areas covered we provide Roadmap Briefs in which the drivers/enablers and inhibitors are grouped according to their assumed short to medium (until around 2009) or longer-term influence (until 2012).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5.2 Policies, institutional frameworks and business models

Brief introduction to the main topics

In this chapter we provide an overview of developments on the level of educational policies in ICT-supported education and lifelong learning, the current international interest in Open Educational Resources (OER), issues in OER business models and the readiness of educational institutions for OER initiatives.

Of general importance will be the observation that despite massive investments in the e-learning infrastructure of educational institutions (hardware/software, connectivity, LMS, etc.) over the last ten years or so only little impact has been achieved with regard to changing educational practices.

There is growing concern that the educational institutions would not support learners effectively in acquiring the competences and skills required to participate successfully in the knowledge society. This is a pressing issue with respect to lifelong learning agendas that want to ensure economic competitiveness and employability of workers for higher value jobs (knowledge-based industries).

Hence, particularly in the area of ICT-based lifelong learning offerings, we may expect a growing understanding of the importance of OER to drive participation. A point in case are the recent experiments of some Open and Distance Teaching Universities to offer open self-learning courses with the goal of "converting" users to registered students.

At present there is a healthy level of competition among leading institutions in providing free access to educational resources. However, the larger and more widely known projects are substantially funded and business models for sustainable OER initiatives are a major point of concern. Furthermore, at the institutional level there is a critical lack of appropriate reward mechanisms for educators to excel in OER.

Regarding educational publishers we observe a situation of entrenched commercial interests that will make it difficult to find a balanced approach for open and commercial offerings. It is also unclear whether the shift towards Open Access publishing and OER will stimulate publishers to show a higher propensity to invest in innovative products and services than is currently the case.

In coming years there may also be a widening gap between traditional educational content that is protected by rigid Digital Rights Management technology and an increasing circulation of content that is openly shared (e.g. based on Creative Commons licenses).

5.2.1 Drivers and enablers

Policies emphasise educational innovation and organisational change in educational institutions

For about ten years considerable investments have been made to equip educational institutions with computers, software programs, local networks and Internet access. Recently, as highlighted by the European Commission's 2005 eLearning Conference "Towards a Learning Society", "policy emphasis has switched from infrastructure and connectivity to content, services, and practice". (eLearning Conference 2005, 3)

Moreover, policy also increasingly demands a stronger commitment of directors, managers and staff of educational institutions regarding educational innovation and organisational

change. As Brian Holmes from the European Commission's Directorate-General Education and Culture writes: "Whereas ICT remain a powerful tool for supporting learning, its real value is as a catalyst for change, fostering innovation in learning and organisational processes. Indeed, an important element coming out of the conference was the need to reinforce organisational change and innovation as facts of life for competitiveness and social development." (Holmes 2005)

Driving the demand to "change" and to "innovate" is the observation that the investments made in ICT-enabled teaching and learning has not yet brought about the profound changes in educational practices that would better align educational institutions with the requirements of the knowledge society. In fact, there are growing concerns that educational institutions do not support learners effectively in acquiring the competences and skills required to participate successfully in the knowledge society. In particular, expectations that the use of ICT would somehow bring about student-centred and collaborative approaches have not been fulfilled.

These concerns may even contribute to the current tendency in some European countries to reduce budgets for new ICT initiatives. Yet, at present leadership would be required in the promotion of a new generation of Web-based tools and services that are more likely to have an impact on teaching and learning practices.

The questioning of the ways electronic tools and content are currently used in mainstream education is certainly not a European phenomenon. For example, an American study published under the title "Thwarted Innovation" (Zemsky / Massy 2004) concludes that despite massive investments in ICT-supported education only little impact has been achieved with respect to changing teaching practices. The study found that wider use is made of systems for managing courseware (Blackboard, WebCT) and simple, mostly PowerPoint-based "e-lectures". A profound change in teaching styles did not take place, despite numerous projects that explored and showcased novel approaches. The authors conclude: "eLearning will become pervasive only when faculty change how they teach – not before."

The same pattern can be found elsewhere, in Australia for example. Ron Oliver, Dean of Teaching and Learning in the Faculty of Communications and Creative Industries at Edith Cowan University, has undertaken an analysis of the advancements that have occurred in the use of educational technologies over the years 1995-2005. (Oliver 2005) In particular, he addresses the expectation that ICTs may help in bringing about student-centred learning settings and knowledge construction among learners, which is "a common feature of many educational programs in 2005".

Oliver comments: "For teachers seeking to deliver and support student-centred learning, contemporary ICT provides many supports. In universities, for example, most teachers are very much aware now that Web-based learning can provide many supports for student centred learning settings. Web tools such as discussion boards, online chatting, Weblogs and communication portals all have direct relevance to this form of learning and their applications are not obstructed by high overheads such as the need for high level skills or equipment specifications. But still, ICTs are not mainstream in the teaching practices of many teachers in our institutions. In all sectors, large numbers of teachers prefer to deliver their courses in ways that make little or no deliberate use of ICT. And this is despite large amounts of technology infrastructure, large amounts of software and enabling factors."

Readers will find that this resonates with OLCOS' observation that a new generation of easy-to-use Web-based tools (such as Wikis, Weblogs, social networking, etc.) can enable learner-centred approaches which certainly are more "lightweight" than top-down implementation of Learning Management Systems and centralised repositories with "critical masses" of Learning Objects.

Ideas for Rethinking Schools and Schooling in the Digital Age

Increasing doubts are raised as to whether schools are able to change and help students to acquire the competences and skills required for the knowledge-based society. Rather than ignore such doubts (and often severe criticisms), it will be important for educational leaders to consider alternative models and explore aspects of such models that promise to provide real advantages. (cf. Caldwell 2004)

In the OECD Schooling for Tomorrow project three scenarios of the future of schools have been discussed: "schools maintaining the status quo", "de-schooling" and "re-schooling". The following are two interesting models of "re-schooling", which is understood to be the best direction to go.

Ambient Schooling

The European SchoolNet (EUN) with many stakeholders throughout Europe is developing the RELEASE (RE-thinking Learning for Ambient Schooling in Europe) framework, which is part of a ten-year vision of the EUN. Basically, the framework suggests that the school, rather than functioning as a container of education, should become a learning provision centre whose services "follow" and "surround" the student.

In such an "ambient schooling" scenario, teachers, mentors, co-students, learning objects, library resources, etc. form a virtual and unobtrusive environment available to the learner in a much more self-directed and self-paced learning process, yet still rooted in the school as an institution of society. But here the focus is on learning, not on the school as "container".

The EUN authors consider this to be a model of "re-schooling" rather than "de-schooling". The model would be realised through an evolutionary institutional change and the development of personalised learning in a home–school–community continuum. An EUN-led research proposal based on the RELEASE framework was submitted as a large Integrated Project in the Information Society Technologies area of the Sixth Framework Programme of the European Union, but did not receive funding. However, parts of the framework are being explored in ongoing initiatives such as the "Learning Interoperability Framework for Europe (LIFE)", an action launched by the EUN in March 2004.

Sources: Presentation by EUN Strategy Manager Frans Van Assche (2005); project background: McCluskey 2004, 9-10.

Small Schools, Loosely Joined

Harold Jarche, an independent Canadian consultant who writes about the intersection of learning, work & technology, suggests that, with the range of tools now available on the Web, one might return to the one-room school, "grounded in its community but linked to a world of learners". (Jarche 2006) He considers:

- "With access to the Internet a one-room school would have to reach out to the rest of the world and not be wrapped in the confines of the industrial school. Schools would have to seek out partnerships and not be isolated islands.
- Communities of learning online could be developed to link learners in several schools and even in different countries.
- No teacher would be able to 'master' the subject matter, so teachers would become facilitators of learning, which is what they profess to do anyway.
- Small schools would be integrated into the community and there would be a

sense of ownership by the community, not the education system.
| Most children would be able to walk to school, therefore eliminating buses, reducing greenhouse gas emissions and encouraging exercise.
| Children and parents could have more than one school to choose from.
| Sales of industrial school buildings could be used as financial capital for the transition."

Understanding that ICT-based lifelong learning needs to be promoted through easy access to educational resources

There is a strong emphasis at policy level on the role of lifelong learning in the knowledge society. Since the "Lisbon Agenda" (March 2000), lifelong learning is increasingly being promoted by funding programmes at European and national levels. In fact, following the adoption by the European Commission of the Communication on "Making a European Area of Lifelong Learning a Reality" (adopted on 21 November 2001), lifelong learning has become the guiding principle for the development of education and training policy. In 2007 all Community education and training programmes will be integrated in a single Lifelong Learning Programme, and the total resources available are expected to be double those of previous years.

A core goal in the promotion of lifelong learning by many countries is to ensure the employability of workers in a situation of global competition in knowledge-based industries. (cf. World Bank 2003) A broader framework has been elaborated by the Delors Report for UNESCO (1996), which describes "four pillars" of lifelong learning: learning to know, learning to do, learning to live together, and learning to be. (Delors 1996)

There is an established understanding that easy access to educational resources is required to promote lifelong learning by active learners of all ages. Also the role of such access in reducing social inequalities, fostering social inclusion of migrants, and supporting education in developing countries is often acknowledged. (cf. Halimi 2005)

From a pedagogical perspective, key aspects of ICT-supported lifelong learning and OER are that self-directed learning is emphasised and there is much potential for novel approaches of collaborative knowledge development. It is understood that such approaches are more likely to evolve in learning settings other than traditional forms of formal education, which still show little tendency to abandon the teacher-centred paradigm of education. However, in ICT-supported lifelong learning also the role of e-coaches and communication among peers will need to be given much more consideration. Those who most need access to lifelong learning resources may not always be best prepared for fully self-directed learning.

International interest in, and funding of, Open Educational Resources

There is a high level of recognition of the importance of collaboration in Open Educational Resources (OER) as well as many commitments by governmental agencies, private and public funding organisations and consortia of leading educational institutions to support the current wave in OER. The following are but a few examples:

A leading role in broadening the understanding of the value und benefits of OER is taken by UNESCO and the OECD. For example, the OECD's Centre for Educational Research and Innovation (CERI) is carrying out an international survey on OER (which is expected to be

completed at the beginning of 2007), and UNESCO's International Institute for Educational Planning (IIEP) is facilitating a Community of Interest in OER. This community has been active since October 2005 and has more than 600 members from 94 countries.

At the European level, the importance of OER has been recognised, among other occasions, in the conclusions of the European Commission's eLearning Conference "Towards a Learning Society" (2005), and emphasised by many experts in consultations for the European *e*Learning Programme. (cf. Holmes 2005). Recently, Ján Figel, Commissioner for Education, Training, Culture, and Multilingualism, confirmed the supportive role of OER for the European lifelong learning agenda. (cf. Figel 2006, 12) Furthermore, the European Digital Library initiative (started in 2006), which received commitments by many national libraries and other cultural institutions throughout Europe, may develop the flagship of European open digital resources.

The international agency Commonwealth of Learning (COL), which focuses exclusively on using technology to expand the scope and scale of human learning, has firmly adopted and put into practice the concept of OER, and "will remain in the forefront of these developments". (cf. the section on education of the COL website) That COL knows how to put new tools to good use is exemplified in their support of the WikiEducator project.

The World Bank, the biggest funder of education in the world, among its many activities makes available and promotes sustainable development materials for teachers and students on their Youthink! website. Other globally relevant initiatives are, for example, the Open Courseware Consortium and the Global Learning Objects Brokered Exchange (GLOBE).

Among the private funders of OER, the William and Flora Hewlett Foundation deserves to be highlighted for their pioneering efforts and continual financial and other support of OER projects. For example, in the board meetings in February and June 2006 alone, the trustees of the Foundation awarded over $13 million to such projects. (cf. Hewlett Foundation 2006, which includes links to new and ongoing funded projects)

Another prominent sponsor is the Soros Foundations Network, which makes large funds available in their programmes in the areas of Children and Youth, Education, Information and Media (though not as yet under the label of OER). For example, in the Children and Youth Programs (2005: $9.418 million) the Network funds the Reading and Writing for Critical Thinking programme which helps teachers from 28 countries change classroom practices to promote active, enquiry-based learning and cooperative problem solving.

Creative Commons licensing is firmly established and increasingly used

Today the default copyright status for creative works is "all rights reserved", which has practical impacts on the process of creativity and cultural, scientific and educational development. This impact is felt particularly in an age of inexpensive Internet-based publishing, copying and further distribution of creative works.

The default "all rights reserved" requires that authors who do not want to rigidly limit the reach and potential influence of their work perform an overt act that clarifies this and also clarifies in which ways they allow others to make creative use of their work. Otherwise nobody can legitimately re-use the work without permission, except some "fair use" which, however, is limited and has vague boundaries.

To help in this, the non-profit organisation Creative Commons (CC) provides an easy-to-use mechanism for choosing and attaching to a creative work one of six standardised CC licenses. (Note: CC also offers several other licenses such as the Sampling Licenses, the Music Sharing License and the "Developing Nations" license, which will not be addressed here).

All six CC licenses have as a basis the condition attribution, which requires giving credit to the author. The "Attribution" [only] license is the most liberal license under which a copyright owner can release a creative work; this "lets others distribute, remix, tweak, and build upon your work, even commercially, as long as they credit you for the original creation". The inclusion of the condition "ShareAlike" in the license also allows this but requires that the new creation be licensed under identical terms. The inclusion of "No Derivatives" completely reduces the permitted use of the work to redistributing it unchanged and in whole. Inclusion of "NonCommercial" in a license of course excludes using the work for commercial purposes.

It is important to note that each of the six CC licenses implies some baseline rights and restrictions, which, among others, include that the license applies worldwide, lasts for the duration of the work's copyright, and is not revocable. Further, with respect to basic uses, each license allows licensees to copy the work, to distribute it, to display or perform it publicly, to make digital public performances of it (e.g. webcasting) and to shift the work into another format as a verbatim copy.

The CC licenses are expressed in three ways: The Commons Deed, a simple, plain-language summary of the license, complete with the relevant icons; the Legal Code, which is the "fine print" an author and the users of his or her work need to be sure the license will stand up in court; and the Digital Code, a machine-readable translation of the license that helps search engines and other applications identify the work by its terms of use.

Part of the Creative Commons initiative has always been the goal of making it easier for potential re-users of content to identify works that they may safely use, i.e. without worrying about the intricacies of "fair use". The machine-readable translations (metadata) of the CC licenses already allow users to discover Web-accessible material that has a link to a CC license through using the Yahoo! CC search interface (http://search.yahoo.com/cc) or Google's advanced search (section "Usage Rights").

OpenBusiness.cc has developed a CC statistics generator that queries the Yahoo! search index for back-links to a CC license URI (http://www.openbusiness.cc/cc_stat/). On 26 November 2006, the application found 27,442,937 such back-links and the distribution of the six basic CC licenses (comprising versions 1.0, 2.0 and 2.5) was as follows: "Attribution" 12.27%, "Attribution–NonCommercial" 11.03%, "Attribution–ShareAlike" 19.27%, "Attribution–NonCommercial–ShareAlike" 37.46%, "Attribution–NoDerivatives" 2.61% and "Attribution–NonCommercial–NoDerivatives" 17.46%.

These results show that there is a strong tendency to exclude commercial use. In fact, about two thirds of the content has been made available under a Creative Commons license that contains the "NonCommercial" restriction. Experts from the Commonwealth of Learning consider this to be a point of concern with respect to open educational content; this "can have the effect of closing open educational resources to just the type of use that the originators would like to see, especially in developing countries". They recommend users of CC licenses to avoid the "NonCommercial" restriction and use instead "ShareAlike" licenses. (cf. Daniel / West / Mackintosh 2006)

It is also interesting to note that a decrease in the use of the "NoDerivatives" restriction seems to have occurred. According to data from Yahoo!, in February 2005 about 32% of the back-links to over 10 million Web pages pointed to a CC license containing this restriction (cf. Creative Commons 2005a); at the end of November 2006 such licenses made up only about 20% of the back-links.

However, the OpenBusiness.cc application may not be able to access all data from the Yahoo! search index. At the beginning of August 2005, Yahoo! announced that their search index comprised 20 billion records of which 53 million showed linkbacks to CC licenses.

Earlier, in May 2005, Yahoo!'s index was at 8 billion records of which 16 million had linkbacks to CC licenses. This makes for a relative increase in CC license links of approximately one third within three months. Mike Linksvayer from Creative Commons, who reported the increase, wrote: "Take the exact numbers with a lump of salt, but the indication of growth is impressive nonetheless." (Creative Commons 2005b):

Part of the success of the Creative Commons licenses is that to date they have already been "ported" into 34 legal jurisdictions around the world and are in the process of integration into many others (http://creativecommons.org/worldwide). This work is carried out at the national level by volunteer experts from renowned institutions; in addition, there are many groups who promote the use of Creative Commons licenses by institutions and creative individuals.

OLCOS expects the Creative Commons licenses to become the leading standard for licensing creative works other than software. This will help greatly in taming the proliferation of open content licenses since the second half of the 1990s. From the many existing open content licenses – such as the Free Art License, the various Open Music Licenses, the Open Publication License, and so forth (cf. Liang 2004) – only a few may be used further by smaller groups of authors.

Creative Commons – "Some Rights Reserved": Building a Layer of Reasonable Copyright

The Creative Commons organisation writes in the "About us" section of its website:

"Too often the debate over creative control tends to the extremes. At one pole is a vision of total control – a world in which every last use of a work is regulated and in which 'all rights reserved' (and then some) is the norm. At the other end is a vision of anarchy – a world in which creators enjoy a wide range of freedom but are left vulnerable to exploitation. Balance, compromise, and moderation – once the driving forces of a copyright system that valued innovation and protection equally – have become endangered species.

Creative Commons is working to revive them. We use private rights to create public goods: creative works set free for certain uses. Like the free software and open-source movements, our ends are cooperative and community-minded, but our means are voluntary and libertarian. We work to offer creators a best-of-both-worlds way to protect their works while encouraging certain uses of them – to declare 'some rights reserved'."

Source: http://creativecommons.org/about/history

Healthy competition among leading institutions in providing free access to educational resources

Open Educational Resources have already made it to the list of priorities of some institutional decision makers. An important background and an incentive for European universities and other educational institutions to become involved is the increasing global competition in Higher Education and Europe's demographic development that is causing a decline in student numbers.

Many initiatives started after the extensive media coverage for the Open Courseware (OCW) project of Massachusetts Institute of Technology (MIT), which was announced in April 2001. As a first mover in open courseware, MIT could report survey results showing that in 2005 31% of their new students were aware of the OCW website prior to making their decision to apply

to MIT and, of those, 35% said that the website was a very significant (5%) or significant (30%) influence on their choice of school. (Carson 2006, 52)

Meanwhile the Open Courseware Consortium, which was stimulated by the MIT venture, has about 100 members, as well as 11 universities and colleges from the USA, most of them under umbrella initiatives such as the ParisTech "Graduate School" (France), the Universia OCW (Spain), the China Open Resources for Education (CORE), the Japan OCW Consortium and the Vietnam OpenCourseWare.

Some results and effects of the MIT Open Courseware initiative

In autumn 2004, the MIT OCW project surveyed 5,000 users of the OCW website, which around that time had about 400,000 unique visits per month. Although MIT initially intended the OCW project to serve educators, they found that most of the users of the OCW website were "self-learners" and students.

Almost half of the respondents were self-learners, individuals seeking to educate themselves by tapping into MIT's course materials. For students enrolled somewhere, who made up one third of the site's users, the most important reason was to complement a current course.

The 15% or so of educators who accessed OCW material wanted to "enhance personal knowledge" (25%), "develop a course" (22.8%), "prepare for a specific class (17.8%), "enhance research" (13.8%) and "develop curriculum" (9.3%).

Only 36% of the users surveyed were located in North America; the rest came from East Asia and Western Europe (16% each), South Asia and Latin America (11% each), Eastern Europe (4%), and the remainder from other regions.

Regarding internal effects of the OCW project it should be noted that faculty participation is voluntary, but in March 2006 about two thirds of MIT professors had their courses online. The OCW staff managed to limit the time that faculty members typically spend on getting materials for a course online to under five hours.

There is, of course, also considerable peer pressure at work, according to Anne H. Margulies, executive director of OCW, "not just to participate, but to bolster the look and content of their courses. 'There has been a wholesale improvement of the materials,' she says. Some of that movement is driven by faculty members' 'own competitive pride of looking at what their colleagues are doing,' she said, and some results from other sources. 'Students are asking faculty members why their courses aren't up.'" (Lederman 2005)

While many educational institutions will still ask why they should invest in Open Educational Resources (OER), there is already competition in providing free access to such resources. This is exemplified not only by the many Open Courseware initiatives but also by the experimentation of Open and Distance Teaching Universities in attracting new students through offering open self-learning courses (see below).

In a workshop of the OECD–CERI survey on OER one argument put forward was "that if we look 7-10 years back, the same question was asked by many institutions regarding websites. Today it is almost impossible for a well-established institution to be without a good website, even if very few can show that this is a sound economic investment. It was suggested that the same will be true regarding Open Educational Resources in maybe 7-10 years ahead." (OECD–CERI 2006)

Being engaged in OER raises the visibility and esteem of educational institutions. However, in the competition for recognition, educational "brands", state-of-the-art websites, quality of resources and services and, in particular, active user communities will be of key importance.

Latecomers may be well advised to develop more innovative approaches in open resources than, for example, the MIT Open Courseware project. This primarily makes available lecture notes (in pdf format), readings, and sometimes samples of student work, though there are exceptions such as a graduate course on Aircraft Systems Engineering in autumn 2005, which had many guest speakers and made video lectures available.

Open and Distance Teaching Universities make open self-learning resources accessible as a way to attract students

Competition for new students may become particularly severe for Open and Distance Teaching Universities. An interesting recent venture in this context is the European Association of Distance Teaching Universities' "Self-Learning through Open Resources" (SLOR) initiative, which seeks to bridge the gap between open lifelong learning and formal e-education as provided by the EADTU members. The participating universities provide free access to a limited set of shorter courses (entry Bachelor level) for independent learning, and thereby try to attract more students to their formal study offerings. The formal courses make use of the same learning materials but include tutoring, assessment and examination. This can be seen as a larger-scale experiment that will investigate whether or not the participating universities from several European countries see a noticeable conversion rate from informal to formal learning offerings. (cf. Mulder / Dorp 2006; Dorp 2006 on the SLOR MORIL project)

The SLOR initiative receives funding from the William and Flora Hewlett Foundation, as do new projects of the Open University of the Netherlands and the Open University UK. Also these projects explore new ground for universities who strongly depend on whether they get their online offerings right.

The OpenER project of the Open University of the Netherlands is very similar to the EADTU's SLOR initiative. It focuses on re-engaging adults in lifelong learning and, according to a summary of the Hewlett Foundation, OpenER "will offer sixteen courses suitable for independent study, with optional opportunities for formal assessment. In addition to its intrinsic value, OpenER hopes that the free courses will attract and motivate potential students to enrol in regular, formal education. Research will be conducted to analyze the project's longer-term impact on higher education participation rates in the Netherlands." For the execution phase and the measurement of effect, a subsidy is being requested from the Dutch Ministry of Education, Culture and Science.

Differing from the EADTU and the Open University NL approach, the Open University UK in its OpenLearn project will, in addition to making educational content freely accessible, also put in place an advanced environment capable of supporting different learning needs and styles. OpenLearn content will comprise learning material in 11 subjects in units that range from between 3 and 15 hours of study time and in difficulty from access level through to postgraduate level. The learning environment will offer, on the one hand, a LearningSpace that should allow the student "to learn by following a structured unit or merely dip in and out of the materials" and, on the other hand, a LabSpace that will offer to make use of some of the OU UK's tools for Knowledge Mapping, Sensemaking Communities and Social Presence, among others. Both "spaces" will be managed by an implementation of the open source Moodle learning content management and virtual learning environment system.

Of particular interest will be how the OU UK will secure the sustainability of OpenLearn and what tangible benefits they will experience from the venture. Before submitting the OpenLearn proposal, the OU UK received a planning grant "to study how to contribute to the OER movement without adversely impacting its business model". (Hewlett Foundation 2006) In the proposal, the OU UK anticipates "a positive impact on its core business" through "a mutually reinforcing set of open content and formally supported offerings which will together expand significantly the University's reach, both within the UK and globally. The funding base for open content in the longer term, therefore, lies in enhanced income levels generated through the core business of the University." The OU UK adds that "there is admittedly a degree of uncertainty about the actual impact of open content on the core business", but that it "is no stranger to this kind of uncertainty". "It is our view", the proposal states, "that the time has come for open content and, in accepting this, the University needs to adopt the same bold and pioneering approach which has characterised it throughout its history". (Open University UK 2006)

The Bologna Process could become a driver for cross-border collaborative development and sharing of study material in Europe

An important longer-term driver of Open Educational Resources in the tertiary education sector in Europe could be the Bologna Process. Although study resources are not one of the main action lines of the Bologna Process, an important element will be the collaborative development and sharing of study material across borders. This is of particular importance to Joint Programmes and Degrees as promoted by the Bologna Laboratory of the Network of Universities from the Capitals of Europe (UNICA). However, as stated in the European University Association's study on "Developing Joint Masters Programmes for Europe" (2004), "joint programmes offer a vision of integration at European level that is one step ahead of current Bologna reforms currently being implemented in their multiple national contexts".

The University of Vienna may provide a good example of the impact of the Bologna Process with respect to reorganisation that goes beyond adapting curricula to the goals and requirements of the Bologna Process. In a project called eBologna the University is also investing considerably in related e-learning and e-content development strategies, in which shareable content is also seen as an important factor to enhance international educational cooperation (cf. Projektzentrum Lehrentwicklung 2006 [in German])

Incidentally, at the University a first Joint Degree (Masters) Programme "Middle European international master programme in Cognitive Science – MEi: CogSci" started in October 2006. Consortium partners in the Joint Degree venture are: Comenius University in Bratislava (Slovakia), Eötvös Loránd University in Budapest (Hungary), Budapest University of Technology and Economics (Hungary), University of Ljubljana (Slovenia) and University of Zagreb (Croatia). For further Joint Degree ventures throughout Europe, see the Network of Universities from the Capitals of Europe (UNICA) Bologna Lab Manual on Joint Degrees from November 2005. (UNICA 2005)

5.2.2 Inhibitors

Business models in Open Educational Resources are tricky

Not surprisingly the discussion on feasible business models for initiatives in Open Educational Resources (OER), i.e. resources that are made freely available on non-commercial terms, has so far not led to the identification of a "one size fits all" model. Rather, it is widely understood that in each case the right mix of financing strategies must be found, which makes the "business" of OER particularly tricky. (cf. Downes 2006; ODEC–CERI 2006)

It should also be noted that over the last few years many OER projects have been started and we will see many others emerging. The most prestigious are receiving considerable funding from public and private funds, while others have been started based on the enthusiasm of educators and a supporting IT department of a larger academic or educational institution.

However, an issue for all is the question of long-term viability and stability of the initiated OER project. With respect to further funding of major initiatives or a grant to stabilise a smaller project, applicants will have to compete for the scarce financial resources available from public agencies and foundations as well as within universities or educational institutions.

It is unlikely that public and private funding can be the sole model for sustainability of the many OER initiatives that are currently mushrooming. Other models that can allow for additional income streams build in particular on membership fees, special services, sponsorships and donations.

In the membership model, organisations contribute a certain sum, e.g. as an annual contribution, and in turn are granted a set of privileges (e.g. the partner programme of the open source educational environment Sakai). Larger, longer-term sponsorship may also be an avenue for OER projects, but the more likely candidates for such income are projects by prestigious institutions and/or those who have a large user base. However, OER projects may try to obtain sponsorship money through mechanisms such as the following: The community software initiative Elgg at the end of July 2006 invited sponsors for their educational networking site Elgg.net on which they want to place sponsor logos directly below the login box. In the invitation they mentioned: "Sponsorship will run month to month – we will offer better rates to those who sign up for longer periods. (…) At the moment we have 8100 users and growing quickly; page views average out at around 3,100,000 per month".

Regarding income through donations, OER projects will face the same situation as larger, longer-term sponsor partnerships. Sizeable donations are more likely to go to projects that are firmly established and have proven their worth. However, projects that strike a chord with many people and show themselves capable of delivering on what they promise may receive some donations from people or organisations who want to support the initiative. The more tangible the benefits and the more vibrant the community around an initiative, the more likely are donations or sponsorships to be offered.

Services on top of a basically free product will be of particular interest to OER projects. To quote the Elgg example again, they have founded Curverider Ltd to provide services such as installations of large-scale learning community networks. Another example is that the Connexions project offers "publish on demand" among other services. Users can aggregate and customise textbooks (e.g. for a full course) not only from their own material but also from other available Creative Commons based content. A 300-page, hard-bound engineering textbook would cost $15-$20 (as opposed to $100 or more from a traditional publisher). The $15-20 final price to the student includes not only costs and profit for the on-demand press but also a small "sustainability revenue stream" for Connexions. (cf. Dholakia / King / Baraniuk 2006)

As a general rule, OER projects will need to demonstrate an in-depth understanding and rigorous support of what the users value about certain resources (content, tools, services), which essentially is what the resources allow the users to do and achieve. Tangible individual and community-level advantages are of particular importance to projects that want to engage the users not as consumers but as co-creators of a shared, commons-based resource.

OER projects that want to survive once start-up funding dries up should wholeheartedly abandon the provider model of many educational projects, in which something is done for learners (most often offering access to a content repository). Instead, OER projects are more likely to flourish if they support learners in doing something themselves, for example creating, managing and sharing some content within a community of practice. Sustainability of a community-based OER project will often be not so much a matter of financial resources as of removing barriers that hinder the community from growing and maintaining momentum. (cf. Downes 2006; Wiley 2005)

With regard to OER business models, the potential of cost-savings and of enhancing the quality of resources through cooperation among institutions should be emphasised much more. Unfortunately, at present there is little publicly available empirical knowledge of cost-savings that might be achieved through cooperation in the development, management and provision of educational content and services. One of the positive effects of the current interest in OER may well be that more exploration of potential benefits and pitfalls of sharing content and other resources will take place.

In an OLCOS expert workshop held in June 2006, it was generally acknowledged that content sharing should be promoted because a wider circulation can leverage the quality and re-use of educational content. From many Open Source Software projects it can be learned that the promise of "what you give, you receive back improved" holds true. However, rather than putting too high expectations on the working of an "invisible hand", educational institutions may be well advised also to directly establish cooperation in sharing resources. Besides the external quality control within a community of institutions, the fact that resources made available will be assessed critically by partners will certainly also have a positive effect regarding internal quality control processes.

Lack of institutional policies and incentives for educators to excel in OER

The established culture of academic and higher education institutions does not particularly foster the creation, sharing and re-use of Open Educational Resources. One observer writes: "Under the current tenure and promotion system, faculty are rarely rewarded for sharing their intellectual property outside of the traditional publishing model. Furthermore, many institutions do not have clear-cut policies detailing who owns the rights to online educational content, particularly if institutional resources were used to support development. Because of ownership, access privileges, and control concerns, faculty tend to be skittish about uploading their learning objects or any other educational content onto a central server or, even worse, a server located outside of the institution." (Metros 2005)

In universities greater value is often attached to research than to teaching, in particular when it comes to academic promotion. Hence, there is usually little incentive and support for faculty to experiment with innovative IT-enhanced forms of teaching and to excel in producing and sharing educational material. The focus on demonstrating individual achievement, as for instance exemplified in the "sole author" publication culture, will often discourage a stronger engagement in collaborative educational projects. (cf. Campbell 2003; McNaught 2003;

examples of how "faculty grapple with the familiar competition between research and teaching" are provided in Hershberger *et al.* 2005)

In a workshop on issues in federating educational repositories, one participant, with regard to the willingness of Higher Education researchers and lecturers to share their products, thought "that academics, in that sense, are a little schizophrenic. On one hand, they want to share their research as far and wide as possible, but on the other hand, they appear unwilling to share learning materials even as far as the next door down the hall. The key question, he felt, is how can you set things up so there is both an ego reward and a formal reward for learning output to be shared?" (Kraan / Mason 2005)

Tony Koppi *et al.* in an article on lessons learned in the institutional use of learning objects write: "The issue of reward for publicising teaching and learning materials is of paramount importance. (…) This necessary change in the academic culture will be a slow one." (Koppi *et al.* 2004, 461) Also, the participants of an OLCOS workshop held in Vienna in June 2006 agreed that appropriate reward mechanisms may well be "the factor that could make or break" the success of OER projects that want to pool and openly share educational resources.

Altruistic motivations or the possibility "to gain reputation", which are often mentioned in

How can one promote the proliferation of Open Educational Resources at the institutional level?

That there are institutional inhibitors for a higher participation of researchers and educators in the OER movement has also been confirmed in contributions to an Internet discussion forum on OER (24 October – 2 December 2005) facilitated by UNESCO's International Institute for Educational Planning. The following are some observations and suggestions from the final forum report's section on "Incentives for Faculty Members":

"Very few institutions have implemented incentive programmes for instructors to either produce or use OER, mainly due to institutional reticence and a deeply entrenched academic culture. In part, this may be due to mounting pressures by universities to claim ownership of staff research in order to generate profit and to enhance institutional competitiveness."

"Further staff involvement in the OER movement could be stimulated through the existing recognition and reward systems of the higher education community. Various incentives were suggested. They included:

- adding OER to portfolios that are presented for academic promotion and tenure;
- awards for outstanding development, production and dissemination of OER materials;
- integration of open content as a standard element in scholarly training and practice;
- incorporating the concept of 'open content' and production of OER into scholarly training and practice for both academics and managers;
- adoption of institutional policies that encourage opening educational content and valuing the creation of such materials (including in tenure and promotion processes)."

"The creation of OER should be viewed not as an additional burden but rather as an integrated part of the scholarly endeavour that is useful, first and foremost, to a faculty member's own teaching, scholarship and career."

Source: UNESCO IIEP / Paul Albright 2005, 9

the context of OER initiatives, may not be strong enough drivers to encourage investing the required time and effort to create OER beyond typical "courseware" such as lecture notes and reading lists. Academic and educational institutions would need to offer appropriate incentives (e.g. significant relevance in academic or other promotion) and support (e.g. technical support, training, etc.) that ensure a broader and sustained participation of researchers and educators.

Another important requirement for academic and educational institutions to participate more fully in OER is the importance of being clear about the IPR/copyrights for the material that could be made available. The material will often incorporate some content (e.g. images, diagrams, etc.) from third parties under the assumption of copyright exemptions for research and educational purposes or "fair use". Fears that such assumptions would not hold if challenged by the original IPR/copyright holders will often impede the willingness of institutions or individual educators to make such material openly accessible. Hence, OER initiatives will provide an opportunity to be clear about what is appropriate and to develop institutional regulations in support of overcoming the fears of authors and users regarding re-using and sharing of content.

Models that build on teachers in the creation and sharing of Open Educational Resources will need to invest considerable effort on training and support

If teachers are expected to make greater use of ICT and create and share digital content, much more effort needs to be invested in teacher training and support in making effective use of digital tools and services.

Yet, very often this is neglected even in projects that have set themselves the goal of enhancing teaching through e-learning. For example, a study of 149 projects funded under the European Leonardo da Vinci programme in the area of vocational education found: "Although all the projects surveyed aim at teaching new skills and abilities, and invest considerable finance and labour in developing innovative learning environments, we found few examples of pro-active teacher / trainer development programmes. This was the weakest side of many of the projects we looked at. Learning platforms and digital teaching aids are described at great lengths – mostly in technical terms, with regard to professional content – but it is hard to identify any educational philosophy that the training of future trainers could be based on." (Attwell *et al.* 2003, 32) Also, in their conclusions the study authors particularly urge: "To promote the necessary change of the teacher's role, the Leonardo projects on eLearning should never forget to train and prepare the teachers for their new role as managers of learning processes." (ibid., 35)

Managing learning processes will also require know-how and skills in how to re-use content and share repurposed content and experiences among a wider circle of peers and colleagues. Initiatives that set out to involve schools in Open Educational Resources (OER) will be well advised to reserve a considerable part of the overall budget for providing in-service teacher training on how to work effectively with such resources (a rule of thumb derived from many ICT school projects is that 30% and more will be needed for training). Also important is to ensure that the tools used in OER projects are as robust as possible to achieve lower than usual formal and user self-support costs. Such support can amount to over 60% of the total cost of ownership of ICT in secondary schools. (cf. BECTA ICT Research 2006b, 8).

Even more important in school-based OER projects will be the development of a culture of sharing and re-using content. An important aspect of teacher training in OER will be to

overcome teachers' reservations regarding re-use of content from others. While teachers often show a willingness to share their own material with colleagues, many seem to be not convinced of the easy re-usability of such material. Also, teachers are afraid that they need to invest too much time finding interesting content in educational repositories and integrating it into their existing material. (cf. CELEBRATE / Nurmi 2003, 72-73; COLIS Education Researchers' Report 2003, 57-61)

Difficulty of finding a balanced approach for open and commercial educational offerings (entrenched interests of educational publishers)

Political decision makers find it difficult to foster, on the one hand, the development of commercial (digital) educational content markets and, on the other hand, open content for equal lifelong learning opportunities and social inclusion. Yet, policies and strategies should be clear, as nothing could be more unproductive than lip service in both directions.

The European eLearning Industry Group (eLIG) considers it important "to determine whether there are models of Open Content that are compatible with for-profit and at-cost models of content creation", which is a vital issue with regard to public–private partnerships. Therefore, the eLIG asked "how the EU, as well as its Member States, plan to tackle a mixed model based on the free content developed for mass distribution on the one hand, and a model based on sound public–private partnerships, balanced licensing schemes and Digital Rights Management solutions, on the other". (cf. eLIG 2005, 10-11)

Confronted with the current strong move towards Open Access strategies, most publishers seem to take a defensive position, which, for example, is evident in the increasing reference to Digital Rights Management technology. Publishers see established commercial models being endangered by the proliferation of open, free-of-charge content and are urging governments to maintain fair competition and avoid unbalanced allocation of funding. Further, they stress that for a flourishing European digital content market their interests must be taken fully into account. A frequent suggestion also is to explore new business models based on public–private partnerships; however, it remains unclear what this could mean beyond governments funding licensing of their content. (cf. the eLIG 2005)

Little innovation by most academic and educational publishers

At present, most academic and educational publishers show little propensity to develop innovative content products and services. For example, the UK eLearning Credits (eLCs) programme, introduced in January 2003 in conjunction with Curriculum Online, made GBP 230 million available in the academic years 2002/3 to 2004/2005 to be spent by schools on digital educational resources. The Content Advisory Board, in their report to the Secretary of State for Education and Skills, found "that, although eLCs may have had a significant impact on promoting awareness and use of digital content in the classroom, they have probably not led to a step change in the level of innovation embodied in digital content used in classroom. This suggests that the availability of funding alone will not create the conditions for the development of more innovative practice and products." (CAB 2005, 14)

Understandably, publishers need incentives to invest ahead of the market, and it seems that with regard to the academic and educational sectors there is a lack of confidence that innovative products and services will be highly welcomed and used by researchers and educators.

Even regarding the more advanced STM (Science, Technology, Medicine) publishing domain there is growing dissatisfaction among market observers with the lack of innovativeness of publishers. For example, industry consultancy veteran David R. Worlock from Publishing Services Ltd critically discussed Open Access repository models, but, at the same time, urged publishers to consider what really will most change the shape of STM publishing over the coming years. He suggested that this would not be the Open Access movement but innovations such as multiple media articles, evidential database publishing, new secondary research services (e.g. beyond ISI's Web of Knowledge), advances in data mining, visualisation of relationships of retrieved content, and Semantic Web ontologies and mark-up. (Worlock 2004)

In fact, innovations in the world of academic publishing seem to be driven more by service providers such as Stanford University's HighWire Press service or ISI's Web of Knowledge (Thomson) rather than individual book and journal publishers. Michael A. Keller from Stanford University Press said at a conference on new paradigms for academic library and information services: "there is notable reluctance of book publishers to engage in digital publishing and network distribution, much less experimenting with new, mixed media genres that could only be presented on the web". And, he explains: "That reluctance is based on the desire to maintain their current levels of sales and thus of profitability, to be sure, but is as well a reflection of the difficulty of reading using existing technologies." (Keller 2006, 8)

In effect, there has been little innovation beyond hybrid publications (i.e. a book with accompanying CD-ROM or DVD); e-books and similar approaches to reproduce familiar formats from the Gutenberg Era in digital form have not yet proved successful.

Possible implementation of rigid Digital Rights Management Systems by many organisations

There is currently much debate about unfavourable conditions for customers and society at large that can result from a wide implementation of Digital Rights Management Systems (DRMS). As emphasised by Lawrence Lessig, this could lead to a "by-permission culture" that would destroy an important basis of creativity and cultural development, which he sees to be easy "re-mixing". (Lessig 2005)

In fact, not only commercial companies such as publishers consider implementing DRMS, but also foundations that capitalise on the IPR/copyright of individual creative persons and royalties-collecting societies that are considering new services for their client base. Also, public sector cultural heritage institutions (e.g. archives that hold photographic, radio, film/TV collections) want to control the usage of their content. Therefore, the discussion on DRMS must also take into account the situation regarding public sector information that is not necessarily "public domain" but is held by agencies and institutions with a special legal status.

A detailed report on DRMS and consumer interests demonstrates that the expectations of consumers of digital content are not sufficiently taken into consideration. (INDICARE / Helberger 2004) Consumer organisations are concerned about:

- limitations of functionality and portability of content (e.g. ability to use the content on different devices at home, in the car, etc.);
- full accessibility of the content (for example, to make personal compilations of content for private uses);
- transparency of conditions of use, and
- protection of privacy against invasive mechanisms and capturing of personal information that may be used for purposes that are not in the interest of the consumers.

The authors of the report are convinced that consumer acceptability is crucial for the success of business models that pin their commercial hopes on DRM technology. Ever more rigidly conceived technical protection would run against the digital content industries' own interests. They suggest that DRM approaches should be "fair and responsive" and, in particular, take into account consumer expectations regarding the use of digital content. Furthermore, they observe that the content owners' current battle against "content piracy" increases the burden for legal users while illegal users remain out of reach (the so-called "hit-the-one-you-win" paradox).

A researcher summarised a smaller survey on which DRM technologies and rights restrictions students perceive as critical obstacles as follows: "Implementing control systems like DRMS may make purchasing less attractive than copying for consumers as the legal products restrict them in their usage. (…) Our results have shown that consumers dislike encryption and the requirement for specific software and/or hardware to use the digital content, and they don't like any restrictions on playability. Overcoming these obstacles may be a way for content providers to make some consumers switch from copying to purchasing, or even to make consumers switch from not consuming any digital content to purchasing it online." (Fetscherin 2005, 86)

An industry view on future digital content business models

Timo Ruikka from Nokia Corporation expects new digital content business models to emerge that build on decreasing costs of content and high flexibility services that will provide consumers with a continuous stream of their preferred selection of content.

For these benefits, customers would accept that they are not allowed a freely copiable and transferable personal copy. "In fact, I expect the prices to go down so far that users will consume content like they consume electricity: without thinking how much a minute costs but turning it off when finished… Also, the flexibility will be in the incredible selection (…) and in the tailoring to changing needs and tastes: having a constantly updated top 100 songs in your pocket is flexibility even if you cannot transfer any of those tracks to another device". (Ruikka 2005)

It seems that such models are already feasible for learning services, yet without the limitations in reusability considered for content such as the "top 100 songs". Even today learners can subscribe to a variety of free RSS feeds selected according to themes of study interest.

5.3 Open Access and open content repositories

Brief introduction to the main topics

In this chapter we address the current uptake of Open Access publishing (including access to results of academic and educational projects) and general developments and issues related to open content repositories.

Open Access (OA) is understood to be of general importance for promoting scientific progress and innovation, educational and lifelong learning opportunities, and cultural diversity and understanding in the digital environment.

The OA movement is particularly strong in the field of academic research and publication. In this field the "academic publishing crisis" has acted as an effective icebreaker for the OA principle. In fact, available data indicate a real breakthrough and strong growth in OA publishing. For example, at the beginning of October 2006 the Directory of Open Access Journals covered 2,410 journals.

Still an issue is the fact that Open Access publishing requires overcoming concerns among researchers (particularly younger scholars) about the low recognition of such publications. However, much greater momentum of the OA movement is to be expected if increasing numbers of funding bodies require results of academic and educational projects to be made available through OA repositories.

In recent years much tried and tested know-how in distributed open content repositories has been developed, and we are seeing ever more repository content or, rather, metadata surface from the so-called "Deep Web" (e.g. using Open Archive Initiative metadata harvesting). Also, educational repositories will not remain as isolated stores of content but become active information providers and ensure that their holdings can be easily discovered and accessed by potential users.

An important issue for all repositories is the quality and consistency of available metadata. The creation of rich metadata will remain costly and OER initiatives will need to strike the right balance between the achievable richness of metadata and the costs they incur (e.g. due to the need to employ skilled personnel). However, interesting research is under way to allow for automatic capturing of data in the context of use of learning material (e.g. "attention metadata").

A further topic we will address in this chapter is the prospect of benefiting from an ontology-based "semantisation" of educational resources and Semantic Web applications. From the OER perspective it will be interesting to note that ontologies are expensive to create, but are usually freely shared within and among related domains of knowledge.

While the issues of open content repositories addressed in this chapter are of a more technical nature, in the following sections we will focus on how to "grow" repositories that are useful for communities of practice in teaching and learning.

5.3.1 Drivers and enablers

Strong breakthrough of the Open Access principle in academic publishing

Open Access (OA) is increasingly understood by many decision makers to be "the right thing to do" with regard to promoting scientific progress and innovation, educational and lifelong learning opportunities, and cultural diversity and understanding in the digital environment.

In the field of academic research and publication, the OA movement has found expression in several declarations such as the Declaration of the Budapest Open Access Initiative (2002), the Bethesda Statement on Open Access Publishing (2003), the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003) and the OECD Declaration on Access to Research Data from Public Funding (2004).

The Open Access principle is well summarised in the following statement of the Budapest Open Access Initiative (the paragraph focuses on journal literature but can also be applied to all kinds of creative works): "By 'open access' to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited." (BOAI, http://www.soros.org/openaccess/)

Although there has been considerable "buy-in" for Open Access by policy and institutional decision makers, the most effective icebreaker in the OA movement has certainly been the "academic publishing crisis", which is due to rising journal subscription prices, publishers' strategies such as "bundling" of titles, the financial difficulties of many scholarly publishers, and the associated problems for research libraries. Part of the crisis also is the recognition of an unfair distribution of costs and benefits in traditional academic publishing in which authors, peer reviewers and editors invest efforts, but the result comes with an ever increasing price tag to be paid by the research libraries that acquire the journals, series and other academic publications on behalf of the researchers and students.

A "Survey of Librarians on Factors in Journal Cancellation" commissioned by the Association of Learned and Professional Society Publishers (ALPSP), which was published in March 2006, found that availability of publications via Open Access archives "was ranked a long way behind the needs of faculty, usage and price in determining cancellations". However, the survey also found that "54 per cent say that availability via OA archives is an important, or a very important factor in determining cancellations now, and 81 per cent think it will become important or very important in the next 5 years". (ALPSP 2006)

In fact, the academic culture is increasingly adopting the Open Access principle. (cf. Willinsky 2006; Jakobs 2006) There is a growing understanding that in the digital environment effective new publishing and content access models should be used. For example, on the Directory of Open Access Journals, a service that covers free, full-text, quality-controlled scientific and scholarly journals, at the beginning of October 2006 a total of 2,410 were covered of which 708 journals were searchable at article level. One type of Open Source software for journal management that is in wider use is the Open Journal System (OJS), which has been developed by the Open Knowledge Project. In July 2006 they reported over 700 installations of OJS being deployed to operate journals around the world in 11 languages.

The fact that studies have shown that OA publications score higher with respect to citations

(see information in section 5.3.2, page 80) will encourage the adoption of the Open Access principle by researchers. This works against the resistance of academics to OA journals and repositories due to criteria of academic promotion such as the high value given to publications in the "major" or "core" journals of a discipline.

However, the majority of journal publishers, including larger commercial publishers such as Elsevier and Springer, now allow authors to "self archive" their published work in an openly accessible repository of their institution, and some publishers grant open access six months or more after the initial publication of the otherwise subscription-controlled content.

Some publishers are also shifting to what seems to be the most promising OA model for academic publications, namely that the authors pay for the publications from their budgets (institutional, project budgets, etc.), and anybody can access them immediately and free of charge. This model has gained much attention through the non-profit venture Public Library of Science (PLoS). (For a detailed discussion of the "author pays" model, see OECD 2005, 57-78)

An example of a publisher that in recent years has shifted to the author-pays model is the fast-growing Cairo-based scientific publisher Hindawi (founded in 1997), which currently has over 40 peer-reviewed journals in the fields of mathematics, engineering, materials science, chemistry, biology and medicine. For example, seven journals are published in collaboration with the European Association for Signal Processing (EURASIP). For an article in the Journal on Applied Signal Processing, authors pay $495 to see their article made freely available under a Creative Commons license. EURASIP promotes the author-pays model because they want to see "academic publishing that enables immediate, worldwide, barrier-free, open access to the full text of research articles for the best interests of the scientific community." (Theodoridis / EURASIP 2005)

Strong growth in Open Access academic publications

Heather Morrison from the British Columbia Electronic Library Network and E-LIS Canada reported a "dramatic growth of open access" in the first quarter of 2006: Over 780,000 new records were harvested by OAIster, which on 22 March 2006 held 7,040,586 records on Web-accessible products from 610 academic and other institutions. The addition represents a 12.5% increase in records in the first quarter of 2006, or the equivalent of a 50% annual increase (double the annual increase in 2005). To the Highwire Free programme 200,000 delayed free access articles were added, raising it to a total of 1,335,546 articles on 31 March 2006. This was an 18% increase in the first quarter of 2006, or the equivalent of 72% annually. Among the disciplinary archives examined, the highest growth rate of 14% in the quarter (annual equivalent of 56%) was seen at E-LIS, a smaller archive of documents in the area of Library and Information Science. Longer-established and larger disciplinary archives also showed impressive but slower growth rates. For example, Research Papers in Economics (RePEC) showed a 6.4% growth (or the equivalent of 25% annually), and the total of items available online on 31 March 2006 was over 367,000. Morrison believes: "Differences in growth rates suggest the possibility of a life-cycle factor in open access archives growth, perhaps initial slow growth, followed by very rapid growth, then a more steady growth as the archive matures." (cf. Morrison 2006)

Funding bodies require that project results be made available through Open Access repositories

High-level declarations on Open Access (OA) have often not been followed by practical measures to enforce OA at the level of research and educational institutions. However, much greater leverage in OA will be achieved if increasing numbers of funding bodies require that project results be made available on OA institutional and/or central repositories. Encouragingly, major funding bodies have started to demand that the results be made available for OA. To provide but three European examples:

The Wellcome Trust, UK's biggest non-governmental funder of biomedical research, demands that all papers from new projects be deposited in PubMed Central or UK PubMed Central within six months of publication (the Trust spends £400 million producing almost 3,500 papers each year).

The German Research Foundation, with a total amount of research funding of Euro 1469.5 million in 2005, in its new funding policy expects research results to be deposited in either discipline-specific or institutional electronic repositories following conventional publication (allowing discipline-specific delay periods of 6-12 months). Alternatively, the results should be published in a peer-reviewed OA journal.

The Austrian Science Fund (FWF), which in 2005 had available overall funds of about Euro 112 million, generally finances all peer-reviewed publications resulting from FWF-funded projects. Funding of quality-controlled Open Access publications has already been possible within FWF projects, but has depended on the initiative of the researchers. After initiating a voluntary commitment at the beginning of 2005, the FWF recently changed its policy and requires directors of funded projects to ensure that they adhere to the OA principle.

It should also be noted that the recently published "Study on the Economic and Technical Evolution of the Scientific Publication Markets in Europe", which was commissioned by the European Commission's Directorate-General for Research, recommends adoption of policies that "guarantee public access to publicly-funded research results shortly after publication". (European Commission DG Research 2006 [recommendation A.1])

OpenDOAR lists 760 quality-assured Open Access Repositories and offers helpful tools for administrators

OpenDOAR, the Directory of Open Access Repositories, recently released its first quality-assured listing of Open Access repositories. From a selection of 1,000 candidate sites the project has included 760 repositories in the listing. They hold research papers, conference contributions, theses and other academic material. Each of the repositories has been visited online by project staff in order to check general repository features, type and size of holdings and available services such as e-alerts, RSS feeds, etc. Many of the listed repositories are institutional, but there is also a wide range of subject-based and governmental sites.

An important goal of OpenDOAR is to enable search services to deliver good results by selecting repositories that are of direct interest to the user. To this end, OpenDOAR also provides tickbox tools so that repository administrators can easily clarify repository access policies and permissions in order to inform service provider about what use they can make of the repository information. (cf. OpenDOAR 2006)

Widespread tried and tested know-how in distributed open access repositories

Over the last ten years or so, solid know-how has been developed on how to make accessible, and provide for federated search of, information in distributed repositories of all kinds of resources. This includes making use of the Open Archive Initiative approach based on their Protocol for Metadata Harvesting, Peer-to-Peer repositories and/or implementations building on the Simple Query Interface (SQI) for federated search across learning object repositories.

The Open Archive Initiative's approach allows repositories to expose the metadata of their holdings to harvesters of organisations that provide services based on the collected metadata (e.g. a search portal, an alerting service, etc.). The largest OAI service is OAIster, which on 11 October 2006 had 9,617,889 metadata records from 695 institutions.

One of the strengths of OAI-based systems lies in the relative ease with which they can be implemented in support of collaborative service provision. Consequently, the OAI approach has seen a rapid uptake. For example, a survey conducted at the end of 2002 by the Open Archives Forum project found that European repositories had already strongly embraced the approach. (Dobratz / Matthaei 2003) Interestingly, the domain of cultural heritage, cultural archives, specialised libraries and museums is among the most active users of the OAI-PMH. (cf. Foulonneau 2003)

A leading example of an OAI-PMH based resource discovery network is the UK RDN, which builds on several subject gateways of the Arts & Humanities, Social Sciences, Health & Life Sciences and Science, Engineering & Technology (a total of about 140,000 information resources). The resources are selected and described by subject specialists. In July 2006, the network became Intute (a composite word derived from "Internet" and "Tutorial"), which sets out "to convey the experiences of guided learning and online resource discovery".

The OAI-PMH mandates Dublin Core metadata, which in recent years has become a de facto standard for simple cross-discipline resource discovery (however, organisations can in principle expose other metadata if the records are structured as XML data and have a corresponding XML schema for validation). As educational content repositories will often employ the Learning Object Metadata (LOM) standard, or national LOM adaptations such as CanCore [Canada] or UK LOM Core, making use of OAI-PMH requires cross-walking it to the "flatter" Dublin Core Metadata Element Set.

A survey conducted at the end of 2002 by Filip Neven and Erik Duval on repositories of educational material that make use of LOM found that, among the ten repositories that were analysed in more detail, only one, the Education Network Australia – EdNA Online, had plans to build on OAI-PMH. (cf. Neven / Duval 2002; regarding EdNA, see Millea 2003; and for an overview of LOM-based and other educational repositories, CETIS 2005)

In fact, researchers who at the end of 2004 reported on a repository of metadata cross-walks found that "the LOM - DC [Dublin Core] relationship is still experimental" (Godby / Young / Childress 2004); and a digital repository review concluded: "Issues are beginning to emerge in relation to lack of interoperability between Dublin Core and IEEE LOM metadata models. This results in complexities for data exchange and cross-searching." (Heery / Anderson 2005, 18)

Another issue is that many educational content services such as ARIADNE, EdNA Online, GEM (Gateway to Educational Materials), MERLOT and others are often understood to be repositories, but in fact are service providers that aggregate and make accessible a catalogue of educational material held elsewhere. As they do not hold deposited material they may feel that letting harvesters collect their metadata would mean giving away the treasure they build on.

This may be one of the reasons behind a stronger affinity of educational and other repository service providers to use Peer-to-Peer networks based on the Simple Query Interface (SQI) rather than build on the OAI harvesting approach.

Peer-to-Peer based systems have been explored by many projects in the educational sector such as Splash/POOL (educational file sharing) or Edutella (an RDF-based metadata infrastructure). However, making use of the Simple Query Interface (SQI) is understood to provide a particularly solid approach to connecting learning object repositories through Peer-to-Peer networks.

The Simple Query Interface (SQI) specification has been developed under the auspices of the CEN/ISSS Workshop on Learning Technologies and is understood to be "a rapidly maturing standard for federated search across learning object repositories". (Ternier / Olmedilla / Duval 2005) Basically, SQI-based federation relies on querying, and works by putting a "wrapper" around the search interfaces the constituent repositories already have.

Among the repositories that have already implemented SQI-based services are the members of the international GLOBE (Global Learning Objects Brokered Exchange) consortium: ARIADNE (Europe), Education.au / EdNA Online (Australia), LORNET (Canada), MERLOT (USA) and NIME (Japan). Other projects that have validated the SQI approach, for example, are EducaNext (Europe), FIRE/LRE (a learning resource exchange initiative of the European SchoolNet), the CGIAR – Consultative Group on International Agricultural Research, and university-based projects such as LionShare (Penn State University, USA). EU-funded Information Society Technologies projects in the area of technology-enhanced learning that explored the use of SQI include CELEBRATE, ELENA, ICLASS and PROLEARN. (cf. Simon *et al.* 2005)

Lessons learned by "Focus on Access to Institutional Resources" (FAIR) projects

Under the FAIR programme of the UK-based Joint Information Systems Committee (JISC), a number of projects have been funded with the goal of analysing the challenges associated with disclosure and sharing of institutional resources. In technical terms the projects were specifically invited to explore the use of the Open Archive Initiative Protocol for Metadata Harvesting (and possible alternatives) as a mechanism for disclosure and sharing a broad range of resource (e.g. e-prints, images, museum collection content, and others). Fourteen projects were funded, which started in 2002/2003 and were of one to over two years' duration.

Here we selectively highlight just some of the lessons learned in these projects (for further details, see Baldwin 2005, 20-23):

- Flexibility: Flexibility is important because "the whole area of repositories, open access, and sharing information is fast moving", and projects will have to address new issues as they arise.
- Institutional buy-in: Many projects mentioned the importance of institutional buy-in, which is especially important if the goal is to share resources. This requires a good fit with institutional objectives, involvement of stakeholders, and demonstration of value added.
- Cultural change: All FAIR projects had to address cultural change in one way or another, and the main lessons learned were that changing practices takes time ("years, not months"), needs engagement with users (e.g. academics, librarians, archivers, students), an understanding of what their needs are, and design

of a system (repository, portal, etc.) that integrates with how they work.

- Intellectual Property: This has been a particularly difficult issue as there is often the need to clarify institutional policies regarding IPR and copyright.
- Repository Content: Projects that created institutional repositories generally found that populating a repository with content takes much longer than they had thought (e.g. "two years to start getting a substantial amount of content").
- Technical Issues: Encouragingly, several projects found that building repositories "is not rocket science" and can be achieved with open source software and using the standards that are in place.
- Metadata: Metadata were found to be a particularly intriguing issue: "If standards are too specific, no one will use them. If they are too general, they may not be useful." For example, Dublin Core was found to have considerable limitations stemming from the fact that it was not designed for repositories. Therefore, guidelines must be developed to ensure consistent use. Also, Dublin Core was designed mainly for text documents and has considerable limitations when used to describe other objects (e.g. museum objects). Furthermore, most projects learned that the quality and consistency of metadata is important, within an institution's repository and even more so when it comes to enabling harvesting and searching across repositories.

Open content repositories increasingly surface from the Deep Web

A study conducted by the search company Bright Planet in 2000 established that, although search engines may boast about their ability to index the Web, their spiders (robot programs that crawl the Web) can harvest only a small amount of information from what was termed the Deep Web and estimated to be "approximately 500 times bigger than the surface Web".

According to Bright Planet, in 2000 the Deep Web contained nearly 550 billion individual documents compared with the then approximately one billion documents of the surface Web. There were more than 200,000 Deep Web sites, 95 per cent of which contained freely accessible information (i.e. not subject to fees or subscriptions). In addition, this part of the Web represented the largest growing category of new information on the Internet. (cf. Bergman 2001; for further current information, see http://www.deepwebresearch.info)

There are several objections to Bright Planet's findings such as the fact that the relevant part of the Deep Web may be only two to three times the size of the surface Web [due to many variations of information pages that would not be worth indexing] and that technological advances allow spiders to get around some barriers and harvest more from the Deep Web. (cf. Bruemmer 2002)

However, the remaining Deep Web databases have a severe problem with regard to their potential users. Though the content may be freely accessible, the databases are often isolated (e.g. not part of a resource discovery network). This means that the databases can only be explored one by one through their search interfaces, the set-up of which can differ considerably from database to database, not to speak of registration mechanisms that could cause interested users to shy away.

For most potential users, this simply demands too much effort and, hence, they prefer to "Google" material that is immediately accessible. Consequently, the rich information in the often publicly funded Deep Web databases of government agencies, public archives, educational

institutions, libraries and other cultural institutions is not being used to its full potential. Even worse, many people are unaware that much rich and authoritative information is not within the reach of the Web search engines they prefer to use.

Noticing that the preference for using Web search engines has become ingrained with potential users of their treasures, increasing numbers of publicly funded institutions, in fear of becoming ignored, are choosing to open their repositories to search engines and allow users "to get through the back door".

One important way to make previously hidden resources accessible to harvesters of popular Web search engines is the Open Archive Initiative approach described above. A study of researchers from the Los Alamos National Laboratory (USA) found that in June 2005 Yahoo! indexed 65%, Google 44% and MSN only 7% of "the current OAI-PMH corpus". Twenty-one per cent of the resources were not indexed by any of the three search engines. (McCown / Liu / Nelson / Zubair 2005) Yahoo!'s lead is due to an agreement with OAIster in March 2004 to make their metadata repository accessible to Yahoo! Search. There are similar agreements under the Yahoo! Content Acquisition Programme, for example with the Library of Congress, the New York Public Library and the National Science Digital Library.

Another example of a major consortium that has taken the decision that it is better to open up than to take the risk of being ignored or bypassed is the Online Computer Library Center (OCLC). In October 2004 they decided to open their entire Open WorldCat, which in full development would represent a collection of 53.3 million records connected to 928.6 million physical library holdings from over 15,000 OCLC libraries worldwide, for harvesting by Google and Yahoo! Search. Previously the search engines, as partners in the Open WorldCat pilot, could access only about 2 million records of around 100 academic and public libraries, which led to a hike in WorldCat usage statistics and click-through to the participating libraries' catalogues. (Quint 2004)

5.3.2 Inhibitors

Further success of Open Access publishing of academic resources requires overcoming fears of low recognition among researchers

Open Access publication will need some time before it becomes fully mainstream. Many researchers and scholars are still not familiar with Open Access publishing models and their advantages. And of those who are aware of opportunities to publish Open Access, many think that such publications would not receive proper recognition from their peers and not be taken sufficiently into account in the assessment of individual scientific achievement.

Commissioned by the German Research Foundation (Deutsche Forschungsgemeinschaft – DFG), a large-scale survey was conducted on the publication behaviour of researchers who received funding from the Foundation between 2002 and 2004. (DFG 2005) A major part of the survey addressed Open Access publications. 1,028 questionnaires were returned by established and younger researchers of all disciplines. The following brief summary can only give a general view of some of the survey results, which, for example, show considerable differences between the Humanities and Social Sciences and the Natural Sciences or Life Sciences.

Generally, it was found that many researchers were still fairly unfamiliar with Open Access publishing or had not used it much. For example, on average about 37 % of the respondents were aware of OA journals in their subject, and about 12% had previously published at least one article in such a journal. However, almost 31% had made copies of their published research

results accessible through self-archiving.

While on average about 69% of respondents felt that Open Access can contribute to improving access to scientific research, 65% were afraid that OA publications are insufficiently considered in assessing individual scientific achievement and 58% in proposals for funding. However, among the preferred measures for supporting Open Access, 75% of respondents were in favour of funding OA journals to leverage their competitiveness, and 73% would welcome centralised, discipline-specific archives on the Internet where authors can make their contributions available.

Most interesting for the German Research Foundation may have been the fact that the researchers were very much in favour of the Foundation's promoting OA publications more strongly. In the group of researchers who use OA journals frequently, the approval rate was 80%, among those who use them rarely 69%, and still at 58% in the group who did not know of any OA journals in their field of research.

Critical for the further success of OA publication is certainly to overcome the considerable fear particularly among younger scholars that such publication might not help in achieving academic visibility, credit and impact. It will be important in this context to implement internationally standardised ways of measuring the impact of OA publications that are held in OA repositories (for example, the Counter [Counting Online Usage of Networked Electronic Resources] model for e-journals).

Open Access papers outperform other publications in terms of visibility and citation

Several surveys have shown that academic publications that are openly accessible on the Web are cited considerably more than those that are not. This has been verified in analyses carried out in large disciplines such as computer sciences or physics as well as in a recent cross-disciplinary survey.

The cross-disciplinary survey is based on information about 1,307,038 articles published over 12 years (1992-2003) in 10 disciplines (Biology, Psychology, Sociology, Health, Political Science, Economics, Education, Law, Business and Management). This information was gathered by a Web-trawling robot that collected reference metadata (author, title, journal, etc.) and citation data from the Institute for Scientific Information (ISI) database.

Comparing open access (OA) and non-open access (NOA) articles in the same journal/year, OA articles were shown to receive consistently more citations, the average varying from 25%-250% by discipline and year. The survey also compared the publications with respect to the number of citations. It was found that the annual percentage of OA articles is growing significantly faster than NOA within every citation range (0, 1, 2-3, 4-7, 8-15, 16+ citations) and that this effect is greater with the more frequently cited articles. Further research is being considered to generate other new comparison and impact measures. (cf. Hajjem / Harnad / Gingras 2005)

Need to reinforce institutional Open Access policies and measures

As noted in a previous section, there have been many declarations by renowned organisations on the importance of Open Access to scientific, educational and cultural resources. However, such declarations have often not been followed by practical measures to enforce Open Access

strategies by universities and other larger academic and educational organisations.

Yet, many universities in the wake of the high-level declarations have started to implement institutional self-archiving repositories or more comprehensive Open Access environments (for example, see Müller *et al.* 2006 on the development of such an environment by the Humboldt University Berlin).

One difficulty in institutional self-archiving initiatives was found to be receiving digital copies of journal contributions and other publications from the institution's scholars. Reviews of content recruitment strategies confirm that voluntary policies are not efficient in filling up self-archiving repositories of universities and other larger academic institutions.

Researchers from the Canadian Association of Research Libraries (CARL), which supports institutional repository projects of CARL members, conclude: "Certainly the most effective strategy for content recruitment is to implement an institutional policy requiring the archiving of research publications into IRs [Institutional Repositories]. Such a mandatory policy is infinitely preferable to voluntary compliance (provided that the library is prepared to take on the duties required) because of course it solves the riddle of successful content recruitment." (Mark / Shearer 2006; see also Sale 2006)

Also, the US National Institutes of Health (NIH) have learned that their voluntary public access policy has not produced the expected result. The policy took effect at the beginning of May 2005 and requests that investigators funded by the NIH submit an electronic version of their final, peer-reviewed manuscript upon acceptance to the NIH's digital repository PubMed Central. However, an assessment published in January 2006 found that less than 4% of the research articles that are governed by the policy were added to the repository. (NIH 2006)

Hence, funding bodies and institutions that have already committed themselves to Open Access, or plan to do so in the future, will need to reinforce their policies and implement measures to ensure adherence and proper execution.

Barriers to making research data openly available for further research and teaching

In many disciplines projects aggregate large amounts of datasets of which only a very small fraction finds its way into publications. In addition, such publications usually appear in closed, inaccessible formats. According to researchers from ArchaoCommons (Alexandria Archive Institute), this may represent only about 5-10% of primary documentation, which is a tremendous wasted effort. (cf. Kansa / Ashley 2005)

The reasons for this waste are manifold and include the fact that researchers tend to see the datasets as their property, there are limitations to effectively managing and making available datasets, and there is little professional reward for "raw data".

Open access to collections of datasets would not only allow for a considerable valorisation of the initial investment through further analysis and research publications, such collections would also represent important material for teaching, exercises and further studies of students.

A survey on UK Higher Education teachers' use of numeric datasets in post- and undergraduate courses found that, if teachers use such datasets, the most important reasons are "to add an empirical dimension to the subject", "to teach statistics or data analysis methods" and "to teach numeracy or critical skills". Regarding the data sources used, 50% were collected by the teachers or students themselves, while another 44% were from printed monographs or serials. This confirms reliance on a limited range of own data sources for practical exercises, and published aggregate data for presenting statistical examples. (Rice 2002; Rice / Fairgrieve 2003)

Creation of rich educational metadata will remain costly

The importance of metadata for OER can not be emphasised strongly enough, because missing metadata means that providers and potential users of OER would find it difficult to manage, share, locate and re-use OER effectively. However, the topic of metadata is extremely broad and complex. Therefore, in the following text we can highlight only some issues as identified in OLCOS expert workshops and available literature and surveys.

Previously, when addressing the strong uptake of the Open Archives Initiative approach using the Protocol for Metadata Harvesting, we mentioned the importance of Dublin Core based metadata for cross-domain resource discovery and other services. It should be noted that many content providers use only some of the 15 elements of the Dublin Core Metadata Element Set (DCMES). An empirical study of the metadata of 82 data providers from different domains registered with the Open Archives Initiative (OAI) found that "of the 15 elements, five – creator, identifier, title, date, and type – are used 71 per cent of the time and 54 per cent of the 82 DPs used only the creator and identifier elements for approximately half of their overall DCMES usage". (Ward 2004) The core message here is that, while this may be sufficient for some resource discovery needs (e.g. bibliographic), it will be difficult for the OAI community to build more sophisticated cross-domain services.

A similar situation was found with respect to the usage of the Learning Object Metadata (LOM) standard. According to the final report on the International LOM Survey, "[G]enerally, only about 1/2 to 2/3 of the 'active' (i.e. elements that are populated in indexing) LOM elements were populated in a given record." It was also found that many of the elements "had equivalents in the much smaller set of elements that are specified in the Dublin Core", and that there are considerable problems with respect to the vocabularies used which "appeared to provide little potential for semantic interoperability". Of most interest may be the fact that elements from the Education category (e.g. Typical Age Range [of the intended user], Difficulty, Typical Learning Time, and Interactivity Level) are "surprisingly underutilized for metadata that is ostensibly and primarily educational". (Friesen 2004, 4)

One reason for these survey results is of course that creating rich metadata is very costly, as experienced people are required who need to do a lot of "manual" work with a metadata editor, use controlled vocabularies and the like. Therefore OER initiatives need to think carefully about the costs of creating metadata and secure personnel familiar with metadata creation and management. There may be the expectation that the creators of the resources also provide good quality metadata; however, as experience shows, usually this does not work. In a university OER project that wants to draw on content created by faculty, the requirement to provide metadata would certainly need to be obligatory and supported by dedicated staff.

There has been much research, development and experimentation with automatic metadata generation. However, for metadata such as Dublin Core or LOM, currently only semi-automatic processes provide reasonable results. Moreover, in a survey involving 217 participants (of whom three quarters had three or more years' experience of cataloguing and/or indexing), 96% of respondents "were unwilling to recommend fully automatic techniques for metadata generation. Most participants preferred that an application execute automatic metadata generation functionalities first, but then provide a means for human evaluation and manual intervention." (AMeGA 2005)

However, there are ample opportunities to capture and process a lot of information automatically in the context of production and use of a learning resource. For example, if a "learning object" is pulled from a repository into a course environment managed by a Learning Management System, a metadata record for that material could be created automatically with

information such as the subject of the course, difficulty level, etc. Erik Duval and Wayne Hodgins, who describe such approaches in more detail, urge educational stakeholders to exploit more fully the automatic capturing of metadata in the context of use. They also "predict that, if such work is not undertaken, practitioners in the field will start to quickly lose interest in the creation, use and demand for metadata and the capabilities it enables which would seriously reduce our progress to improve the effectiveness of learning". (Duval / Hodgins 2004)

Much potential for automatic metadata acquisition certainly should focus on what is called "attention metadata", which is data that indicate what users do with specific information objects. Intriguingly, this can be used for capturing and continuously enriching the information about learning materials for which initially only a small amount of metadata is available. Analysing this information can help in identifying those materials in different repositories, and also the content of Weblogs, Wikis, etc. which may be most useful in certain learning contexts. (cf. Njjar *et al.* 2006)

An innovative idea related to this is a "LearnRank", which for learning resources would indicate how useful people have found them without asking them to provide such information. (cf. Duval 2005) To create such indicators, attention metadata would be collected by tracking activities with and related to the learning resources. According to Erik Duval, "[O]bjects that have been used in many contexts, or, more importantly, in many contexts that are relevant to a specific learner, should have a higher LearnRank for that learner." Certainly this is an idea that merits further exploration, as the analysis of "attention metadata" and "usage trails" could provide considerable help in directing teachers and learners to potentially most useful resources.

Ontology-based educational Semantic Webs will have a long way to go

In the past few years the vision of a Semantic Web has gained a lot of interest from educational experts and software developers. Several workshops, conference sessions and special issues of journals have been devoted to the topics of ontologies and Semantic Web applications in education. (Anderson / Whitelock 2004; Dicheva / Aroyo 2004 and 2006; Naeve *et al.* 2006; Sampson *et al.* 2004; Vasilakos *et al.* 2004) As this is a vast and complex field of research, we can only provide some basics and highlight key points from the perspective of open resources.

The basic idea of the Semantic Web is to have resources on the Web described and linked in such ways that they can be used by computers not just for display purposes (e.g. a typical HTML-based Web page), but for detecting "meaning" and – associated with this meaning –re-use across various applications. The vision is "a web of meaning" as opposed to a "web of links" in which the hyperlinks are simply addresses for getting to Web pages. (cf. Berners-Lee / Hendler / Lassila 2001)

In the Semantic Web, resources would connect seamlessly because they are described using common, machine-processable ontologies, which are explicit models of knowledge. Such basic and domain-specific models are formal descriptions of concepts (comprising, for example, properties and classes of entities, relationships between entities, etc.) that enable computers to carry out tasks as if they understood the semantics (meaning) of the information they are processing.

In order to support the creation and processing of such descriptions, working groups of the WWW Consortium have created instruments such as the Resource Description Framework (RDF) and the OWL Web Ontology Language (the Extensible Markup Language [XML] is not a "semantic" language, but is understood to be the basic layer for Semantic Webs). Also, many

ontology authoring and management tools of varying capability have been developed. (cf. the review by Denny 2004)

There are many potential benefits associated with having "semantically aware" applications. For educational purposes this would, for example, allow teachers and learners to identify more easily resources that have some particular properties or are related to each other in specific ways. Also the web of different relationships between resources could be visualised and browsed and interesting resources retrieved and used in novel ways. Moreover, due to their capability to reason over conceptual relationships, Semantic Web applications are expected to support interpretation and argumentation. For educational content providers the use of semantic technologies would allow for enhanced management, sharing and integration of resources within the field as well as with other information providers (e.g. from the cultural or business information sectors).

From the perspective of open resources, the following points may be of particular interest:

The creation of an extensive Web-enabled ontology, which covers all or a substantial part of the concepts of a domain of knowledge, requires an enormous effort from a very large group of experts and can take many years. As it is not meant to be locked away, but used across a whole domain (and integrated with other ontologies), an ontology tends to be an open resource, arguably one of the most valuable assets of any domain of knowledge.

Berners-Lee, Hall and Shadbolt think: "In some areas, the costs – no matter how large – will be easy to recoup. For example, an ontology will be a powerful and essential tool in well structured areas such as scientific applications. In certain commercial applications, the potential profit and productivity gain from using well-structured and coordinated vocabulary specifications will outweigh the sunk costs of developing an ontology and the marginal costs of maintenance. In fact, given the Web's fractal nature, those costs might decrease as an ontology's user base increases. (…) The consequence is that the effort involved per user in building ontologies for large communities gets very small very quickly." (Shadbolt / Berners-Lee / Hall 2006, 99) Yet, there must be a strong commercial, scientific or other interest in having such an ontology and a considerable shared initial investment as the benefits will be distributed, i.e. not capitalised upon by only one or a few investors.

The educational sector may in coming years benefit from the implementation of ontologies in other sectors. Among the areas that are already more advanced in the creation and implementation of ontologies are some natural sciences and the field of cultural heritage, for example (see, for example, the Open Biomedical Ontologies website, http://obo.sourceforge.net; the CIDOC Conceptual Reference Model, http://cidoc.ics.forth.gr; the Finnish ontology project FinnONTO, http://www.seco.tkk.fi/projects/finnonto/).

Another question is whether the educational communities will engage in the creation of more extensive ontologies of their own (for instance, of how they conceptualise educational goals, approaches, learning resources, processes and outcomes). Certainly this would be a tremendous work, particularly as it would involve clarifying, agreeing upon and formalising educational concepts and vocabularies that should be commonly used for processing educational resources. However, without consistent use of controlled vocabularies the semantic interoperability of resources is not achievable. For example, the Centre for Educational Technology Interoperability Standards (UK) carried out a survey on pedagogical vocabularies and found that a wide range of vocabularies exists, "[H]owever the community lacks any overview of how these existing vocabularies are being used, what kind of resources they are being used to describe and how they relate to each other". (Campbell / Currier 2006, 6; see also Currier *et al.* 2005a+b))

In addition, for Semantic Webs to emerge that allow for retrieving resources with particular properties (e.g. some type of learning material on a specific topic that would suit students

of a certain age range), there must be people and/or applications that create the semantic annotations for these resources. For richer annotations a combination of subject experts and smart annotation tools would most often be required. However, there is significant ongoing development in the field of automatic extraction of some semantic aspects from documents.

Finally, semantic annotations do not necessarily have to be extensive, and "a little semantics goes a long way" (James Hendler, Semantic Web Conference 2003). The idea is that on the Web the availability of even some semantically enhanced metadata can allow for more intelligent processing of data than is possible with no semantics at all. Also, there are many opportunities to create useful applications such as Semantic Browsers or Semantic Wikis that allow for novel learning opportunities without the burden of extensively annotating resources (see pages 100-101 for some examples).

It should also be noted that so-called "folksonomies" have nothing to do with the Semantic Web. This is about adding freely chosen keywords or phrases to resources such as bookmarks. Clustering keywords and presenting resources that have the same keywords (e.g. the "tag clouds" of services such as Del.icio.us and Flickr) can provide for easier identification of some interesting resources, although there is "no semantics inside" (for useful introductions to the topic, see Kroski 2005; Mathes 2004; Quintarelli 2005).

Semantic Web resources show some growth

In April 2004, Google's director of search quality Peter Norvig, in a seminar on semantic-based Web protocols, reported the following: "A friend of mine just asked can I send him all the URLs on the web that have dot-RDF, dot-OWL, and a couple other extensions on them; he couldn't find them all. I looked, and it turns out there's only around 200,000 of them. That's about 0.005% of the web. We've got a ways to go." (Norvig 2004)

During 2006, researchers who developed the Semantic Web search engine Swoogle were able to report some progress. In June 2006, the engine had identified 1,500,000 unique Semantic Web documents: "These 1.5M documents comprise about 1M RDF documents, 350K documents with embedded RDF data and 150K documents that look like Semantic Web documents but are currently inaccessible or fail to parse properly. About 3,000 new documents are discovered each day. We estimate that of the 1M RDF documents, about 1% (10K) are ontologies, as opposed to data, examples or test files." (Finin2006a)

As the search engine does not currently crawl the whole of the global Web, the researchers think that "an estimate of five to ten million SWDs [Semantic Web Documents] is quite reasonable". (Finin 2005b; cf. Ding 2006, who sees ten million as the lower bound of indexable SWDs) This is, of course, little compared with an empirically based estimate of about 11.5 billion pages of the indexable Web in 2005. (Gulli / Signorini 2005) Nevertheless, it is a good sign that some semantisation of Web resources is taking place.

5.4 Laboratories of open educational practices and resources

Brief introduction to the main topics

In this section we will present developments in "laboratories" that contribute to the emergence of open educational practices and resources.

One such laboratory has addressed the exploration and discussion among educators of the role of Learning Objects in teaching and learning, which can be said to have ended in a broad agreement that such objects are not the way forward to innovations in education and lifelong learning.

However, there is still a lack of understanding of how to enable innovative educational settings to emerge. In particular, initiatives that set out to establish educational repositories still often follow a "top-down" strategy that tries to deliver educational material to teacher-centred education.

Meanwhile, educational software developers are tackling the problem that the first generations of Learning Management Systems that comply with industry standards only support rather simple didactic models. At present new systems are in the pipeline for creating and handling more complex group-based Learning Designs.

Furthermore, the widespread use of Social Software tools and services (Weblogs, Wikis, social networking, bookmarks and content sharing, etc.) beyond the educational sector has attracted the interest of many educators who are striving to innovate educational practices. Web-savvy students are already integrating such tools and services to run personal environments for study as well as various social activities; however, the major question is whether and how they will be integrated into the future mainstream of education and lifelong learning.

With regard to other important Open Educational Resources, we observe that Open Source Software is already more widely used in Higher Education and Further Education institutions, and that licensing open content will become much easier through available plug-ins for major software packages.

Of particular concern is how educational repositories of Open Educational Resources, which often want to grow based on user contributions and sharing among users, will manage to become more useful for communities of practice. In a somewhat similar situation are library services that will need to adapt better to the considerable changes in information behaviour and Web-based environments.

In addition, we note that users of academic and educational repositories or digital libraries could benefit from having tools available that connect them better to the body of codified knowledge in certain domains (e.g. thesauri, classification systems, domain ontologies). In particular, Semantic Web applications, of which interesting prototypes already exist, will offer new ways of accessing and using such knowledge resources.

5.4.1 Drivers and enablers

Free and Open Source software is more widely used in Higher Education and Further Education institutions; further uptake in schools will require more in-house capacity building

An important inspiration and role model for Open Educational Resources has been the Free and Open Source Software movement. This movement has grown out of the awareness of an

increasing dominance of commercial interests with regard to software, the Internet and digital resources. Free and Open Source Software has demonstrated itself to be a convincing counter-movement. With successes such as the ever wider use of the Linux operating system and the Apache Web server, the creation of software in an open collaboration of freely contributing developers has shown to be do-able and sustainable.

This software development model is attracting increasing interest, not only from "free programmers" but also from well-known industry players and organisations. SourceForge.net, the world's largest Open Source software development and repository website, was hosting 131,098 projects and 1,406,045 registered users at the beginning of October 2006. Of course, not every project started at SourceForge receives the required level of interest and participation to become a success and lead to a widely used software. But this is part of the OSS development model, which is striving, among other things, to develop software rapidly and release it frequently for critical review and further development.

Open source software is already being used by educational institutions not only for basic IT infrastructures but also for educational applications such as Learning Management Systems. Recent empirical evidence comes from the OSS Watch Survey 2006, conducted by the University of Oxford's Research Technologies Services, with 103 ICT managers responding from UK Higher Education and Further Education institutions.

The survey found that more than three quarters (77%) consider open source options when engaging in IT procurement exercises. The most important reasons for choosing OSS are an expected lower total cost of ownership (74%), lower likelihood of getting "locked in" by a software provider (63%), better interoperability with other products (59%), and the possibility to migrate data better across systems (52%).

The use of OSS is most common for database servers (62% of institutions), Web servers (59%) and operating systems (56%); most institutions that use OSS on their servers rely on in-house support for the OSS. Of particular interest are the results regarding the use of Virtual Learning Environments, of which the two proprietary systems Blackboard and WebCT and the open source VLE Moodle were considered in the survey. In the Higher Education institutions there is a greater presence of the proprietary systems (WebCT 20%, Blackboard 17%) than the OSS Moodle (9%). However, 56% of the Further Education institutions make use of Moodle, while Blackboard is used by 21% and WebCT by 3%.

Wikis and Weblogs still seem to be in rather low usage; at least about three quarters of the ICT managers did not provide an answer regarding these applications. Of the Higher Education institutions, 6% used MediaWiki and 3% DocuWiki; of the Further Education institutions, 6% MediaWiki and 3% the Moodle Wiki function. All of the Wikis mentioned are OSS. Weblogs were only mentioned by ICT managers of Further Education institutions, of which 4% used the Moodle Wiki function.

It should be noted that an earlier OSS Watch Survey was conducted in 2003, and that the authors conclude "in general OSS is used more often than in 2003, and institutions have higher levels of skills and experience with OSS compared to 2003. This survey shows that it is likely that in the future, use of OSS will continue and expand alongside the use of PS [proprietary systems]."

Regarding the use of OSS in schools, the British Educational Communication Technology Agency carried out a study on the cost-effectiveness and benefits of OSS. (BECTA 2005) The study looked at a sample of 15 schools to analyse how they employ OSS and compared their relative costs with schools that do not currently make use of OSS.

The results demonstrate that making use of OSS can offer cost-effective alternatives to proprietary software through employing Linux as computer operating system and for client–

server networks, and OSS productivity software such as OpenOffice. Of particular importance is the capability to extend the life of existing hardware and realise savings on new hardware purchases with lower-specification hardware but no impact on performance. For example, the annual total cost per PC in secondary schools was found to be around 20% less and in primary schools half of the cost of that at schools that did not employ OSS. However, it should be noted that of the "OSS schools" most employed a mixture of OSS and proprietary software, and there was a perceived lack of content-specific open source software.

Among the most critical success factors are a pre-existence of technical support skills and exchange of experiences with "OSS champions" from other schools. A lack of such experience and collaboration makes it difficult to capitalise on the potential benefits provided by OSS. Other key factors are lack of leadership by head-teachers and difficulties in overcoming colleagues' anxieties about possible effects of changes in software and applications. (cf. Hepburn / Buley 2006)

Besides making existing proofs-of-concept (such as the "OSS schools" from the BECTA study) widely known, it will be important to build up more capacity in effectively employing OSS in educational institutions. In addition, initiatives such as Schoolforge can help create further momentum through sharing expertise. Schoolforge is a coalition of currently over 180 groups worldwide that are committed to advancing the use of free software and other resources in education.

The "industrialist" Learning Objects approach has run out of steam

"All LEGO blocks adhere to one absolute standard for pin size. Every LEGO piece, no matter what shape, color, size, age, or purpose can always be snapped together with any others piece because of their uniformly shaped pins. This allows children of all ages to create, deconstruct, and reconstruct LEGO structures easily and into most any form they can imagine. If we map this to the world of learning content, we start to see the opportunities that would result if we were able to have the same standards and capabilities to reuse and assemble or disassemble content drawn from any source at any time."

Wayne Hodgins in 1994 when establishing a "Learning Architectures, APIs and Learning Objects" working group of the Computer Education Management Association

The Learning Objects approach in IT-supported teaching and learning has been associated with many expectations, particularly among commercial providers of Learning Management Systems (LMS) and publishers of learning material wanting to market their content in smaller, yet highly standardised pieces.

The key interest behind Learning Objects (LOs) based systems has been re-usability to ensure cost-effectiveness, while the issue of educational effectiveness has been underestimated. Even worse, as stressed by Karen Woo *et al.* (2004): "The end users of these systems have rarely been identified, and seldom given a chance to speak about their needs and concerns. The reason is that many of the learning object projects are driven top-down with market economies as prime motivators for system development."

LOs have been understood as modular building blocks for e-learning courses based on widely shared standards or specifications (e.g. for the way they can be described and packaged). Ideally, they should be smaller "chunks" of information designed to achieve a narrow learning

objective, perhaps together with some assessment mechanism to determine learning success or failure.

Maximum re-usability of LOs would have required making them independent of any educational context, i.e. separating them from pedagogical considerations and different possible learning designs. Because, as Tony Koppi *et al.* write: "The more inherently contextual an object is, the less reusable it may be; something already loaded with context may be difficult or impossible to reuse in a new context". (Koppi *et al.* 2004, 450; cf. McCormick 2003) "There is a paradox", Peter Baumgartner writes: "To make content reusable on a large scale we need to make it context free. But contextuality is the very essence of the learning process and of the art of teaching using different pedagogical models and didactical approaches to fulfil the special needs of the learners." (Baumgartner 2004)

Nevertheless, the concept of LOs has also seen a strong buy-in on the part of educational experts, which has spawned a vast array of publications (among the most valuable readings are Wiley 2001; Polsani 2003; McGreal 2004). The proliferation of conference presentations on the topic reached such a high degree that one author entitled his presentation *Oh no! Yet another learning objects presentation*. (Lamb 2003)

Core reasons for this were the expectations, on the one hand, of greatly extending the range of teaching and learning resources by creating LO repositories and, on the other hand, of benefiting from the basic characteristics of LOs. These are often summarised using the mnemonic "RAID":

- Re-usable – able to be modified and used in many different learning situations,
- Accessible – able to be indexed and found as needed,
- Interoperable – operable across a wide variety of hardware, delivery environments and tools,
- Durable – continuing despite changes in versions of system software, players and plug-ins.

In fact, the interest in LOs has helped clarify many requirements of standardising educational content (e.g. content formats, structure, and metadata) and building educational content repositories. However, there have always been doubts as to whether or not LOs would "fit" with the practices of teaching and learning in schools and higher education institutions.

If one considers the established teaching and learning materials in Higher Education (e.g. study guides, syllabi, introductory textbooks, handbooks, journals, original research, lecture notes, supporting slides, lab instructions, etc.), it is not immediately clear where LOs designed to achieve a narrow learning objective would fit in, or could easily be produced from the available content.

However, the key concern relates to the notion of learning in Higher Education. For example, the E-University Compendium of the Higher Education Academy (UK) stated: "The object metaphor is undoubtedly very attractive, but whilst knowledge, some skills, procedural learning and basic problem solving are perhaps amenable to this approach, it will undoubtedly be considerably more challenging to utilise the principles of object-oriented design in the development of higher order abilities like complex analysis, synthesis and evaluation (i.e. the 'deeper' aspects of learning). However, as part of a portfolio of learning experiences and opportunities, the reusable learning object utilised by a skilled teacher or learner could play a significant part in the educational armoury." (E-University Compendium 2000, 19)

Today, many observers have come to the conclusion that Learning Objects have not really succeeded in becoming part of the educational armoury and that the LO campaign has run out of steam.

Among the numerous practical reasons for the loss of interest are: "Faculty were not

accustomed to sharing and reusing course materials. Developing high-quality learning objects required much time and costly professional expertise. The lack of indexing standards made it difficult to retrieve objects. Institutions have not invested in managing knowledge. And lastly, there was little documented proof that learning objects supported learning any better than the traditional, linearly organized course." (Metros 2005; cf. Campbell 2003; Wiley 2003)

However, there is nothing wrong with the RAID characteristics of Learning Objects (see above). The problem was, rather, that the notion of LOs has been misled by strong forces in the e-learning landscape. First, the commercial interests behind the LO concept: E-learning technology and content providers wanted to sell their proprietary Learning Management Systems and training course modules. The issue here is that these systems and modules are based on specifications such as IMS Simple Sequencing, which mainly support "closed" learning processes, i.e. rigidly sequential training and knowledge acquisition approaches.

Secondly, many educational institutions did, in fact, put LMS in place, either a commercial system or an Open Source system adapted to their purposes. However, while they may have thought they would follow an LO strategy and achieve goals such as cost-effectiveness, educators in schools, colleges and universities did not change their established forms and styles of teaching in the direction of anything that comes close to "click & learn" training courses. In practice, the LMS have been used primarily to provide access to "courseware" (e.g. syllabi, lecture notes, supporting slides, reading lists and links). The reasons behind this are, on the one hand, the reluctance of teachers to experiment with organising and moderating Web-based learning processes and, on the other hand, the lack of capability of LMS to handle didactically more complex learning designs.

New systems for creating and handling group-based Learning Designs are in the pipeline

> *"Arguably, the best learning resources are like a classic Hitchcock film – worth remaking for a new generation, but in order to do so, at least the original script/screenplay must be available."*
> E-University Compendium, 2000, 27

The development of Learning Management Systems (LMS) that comply with the industry application profile SCORM (Sharable Content Object Reference Model) has been geared primarily towards the provision of single-learner "deliver-and-test" training courses. For the support of richer learning experiences there are deficiencies in SCORM in that it relies on the IMS Simple Sequencing specification which has very limited capacity with respect to the range of learning processes that can be defined.

In other words, here the benefits that standardisation can bring were achieved at the cost of pedagogical flexibility, which would be required for learning processes in schools and higher education institutions. Hence, there emerged a quest for a standardised way of supporting more complex e-learning settings that include sequences of group-based learning activities with many interactions of learners with teachers and peers.

The situation is summarised excellently by LAMS International who have developed the Learning Activity Management System (LAMS), which supports such a setting: "E-learning has a well developed approach to the creation and sequencing of content-based, single learner, self-paced learning objects. However, there is little understanding of how to effectively create and

deliver sequences of learning activities which involve groups of learners interacting within a structured set of collaborative environments, or how teachers can make these sequences easily re-usable. – It is now clearly understood that a key dimension of education (particularly K-12 schools and Higher Education) is learning which arises from interacting with teachers and peers (rather than simply interacting with content). The lack of a mature approach to sequencing of multi-learner activities is a significant blind spot in e-learning today. This is surprising given that 'lesson planning' – the process of determining the sequence of activities to be followed by a teacher and students when studying a topic – is well understood in education, but is mainly absent from e-learning. However, there is a growing body of work addressing this blind spot, based on the concept of 'Learning Design'. Learning Design provides the first practical ways of describing multi-learner activity sequences and the tools required to support these." (LAMS website: "Background to LAMS")

The "blind spot" of current SCORM-based LMS has also been acknowledged by the IMS Global Learning Consortium. In February 2003, the Consortium published a Learning Design specification that is based on a generic language that allows for defining different didactical concepts in a standardised fashion. This Educational Modelling Language (EML) was developed by a team of researchers from the Open University of the Netherlands led by Rob Koper. (OU–NL 2000; Koper 2001) They looked at a large number of pedagogical models to see what they have in common. These commonalities form the basic conceptual elements of IMS Learning Design (though the original EML of the OU–NL researchers was somewhat simplified by the IMS Working Group involved).

According to the IMS Global Learning Consortium, their Learning Design specification "has the advantage over alternatives in that only one set of learning design and runtime tools then need to be implemented in order to support the desired wide range of pedagogies". (IMS website, www.imsglobal.org/learningdesign)

The importance of the IMS Learning Design specification has been acknowledged by the funding of the UNFOLD project (01/2004–12/2005) in the IST Programme of the European Union. The main goals of this project were to promote and coordinate the adoption and implementation of IMS Learning Design through communities of practice of system developers, learning designers, researchers and teachers. Also, the EU-funded PROLEARN Network of Excellence (01/2004–12/2007) includes some work packages that address IMS Learning Design, and the TENCompetence Integrated Project (12/2005–11/2009) has as one of its main tasks the building of an open source Learning Design platform.

According to a researcher from the UNFOLD project, LMS that have implemented IMS Learning Design will provide teachers with an environment whereby they "can plan their sessions by sequencing activities such as reading, discussion, tests, conferences, etc., assign roles to learners and learning resources to be used. In searching for Units of Learning, teachers will be able to see how their colleagues have used learning resources and how they have approached teaching certain topics. They can then edit these approaches and use them in their own learning designs. In this way the professional skills of teachers can be valued and made available through the web in a way which has not previously been possible." (Griffiths 2004, 16)

As yet, no fully working platform for managing IMS Learning Design based environments exists in practice, though such a platform is expected to appear in 2007. (cf. Koper 2006, 17) In 2005, there were in existence more than 20 different tools, many of which concentrated on the authoring environment, e.g. CopperAuthor, Reload or MOT+ (see the overview and discussion in Griffiths *et al.* 2005).

Of key importance is the existing CopperCore Engine, which can interpret, validate and set up Learning Design files. Still a critical challenge is the development of a robust Learning Design

Player that would provide the user interface and administration functionality, and integrate the various services that are referred to in authored learning designs. (Further information on the development of Learning Design based systems can be found in Koper / Tattersall 2005a and 2005b; Koper 2006)

Finally, to underline this point: An important goal of the whole Learning Design venture is of course to enable the sharing and re-use of Learning Designs. Some years down the road, such designs could be among the most sought after Open Educational Resources.

LAMS: An existing trialled solution for designing group-based e-learning

A Web-based system already exists that allows for authoring and running sequences of group-based e-learning activities – the Learning Activity Management System (LAMS). LAMS was developed by James Dalziel of MacQuarie University in Sydney and is currently managed by the not-for-profit LAMS Foundation with implementation services provided by LAMS International Pty Ltd.

LAMS does not support the IMS Learning Design specification, and its technical fabric is somewhat simpler than the technical developments around that specification. However, it is understood to be "the first software tool to persuasively demonstrate the concept of learning design in practice". (Britain 2004, 25) In fact, LAMS has already been widely trialled by schools, polytechnics and universities/colleges in Australia, the UK, the USA and other countries around the world. (A detailed report on the JISC-funded "Practitioner Trials" of LAMS in the UK is provided in Masterman / Lee 2005)

In April 2005, LAMS was released as open source software under a GPL licence; in October integration with Moodle, Sakai and Blackboard was completed, and translations into several languages are available or under way. Integration between LAMS and Moodle means, for example, that they have "single sign-on" (only one name and password is needed for a user across the two systems) and a LAMS sequence can be added as an individual activity to a Moodle course. A new Moodle course format has been created for using more than one sequence, and it is possible to launch a Moodle activity at a specific point in a LAMS sequence.

LAMS is written in Java and runs on the most common Web browsers; Flash 7 is also required. LAMS acts as both the authoring environment for activity sequences and the runtime player, which means that LAMS is capable of more sophisticated run-time functionality (e.g. real-time monitoring of sequences by the teacher). However, sequences can only be run in LAMS, though they may be added to a Moodle-based course (see above). One of the most attractive features is the highly intuitive visual authoring interface, which allows a course designer to drag and drop activities (e.g. "chat & scribe", "share resources", "forum", "Q & A", etc.) into the authoring space and use connecting arrows to organise the activities into a sequential workflow. In addition, there is a monitoring tool with which the teachers can track students' progress through a sequence of activities.

For further information see:
http://www.lamsfoundation.org and http://www.lamsinternational.com

Social Software tools and services empower learners to easily create and share content

A wide-open window of opportunity for educational innovation is provided by a new set of low-barrier and easy-to-use tools and services that are called Social Software. The attribute "social" stems from the fact that such tools and services in particular promote connections, exchanges and collaboration among people who share common goals and interests. It is also acknowledged that Social Software fosters bottom-up development of communities of interest and practice, whereas typical institutional IT systems represent a top-down approach with centralised information access, authoritative information, defined user roles and permits. From OLCOS' perspective the most important aspect of Social Software is that it allows for open learning processes that place self-directed and collaborating learners in the centre.

Considering the massive use that Social Software tools and services such as Weblogs, Wikis, social networking, content sharing, etc. have outside the educational sector, even a small "spill-over" into the sector could have a strong impact in terms of changes in educational practices. In fact, the use of Social Software has reached more than a "critical mass"; it is exploding.

Social Software is already being recognised by many educators as a "hot topic", but so far has not made it into the educational mainstream. (cf. Alexander 2006; Dalsgaard 2006; O'Hear 2006) However, we expect that it will be just a few years before Social Software tools and services become the first choice of teachers and learners who want to enhance educational settings through Web-based collaborative work and sharing of ideas and study resources. An important role in promoting this will be played by regional and national educational networks that provide information, services and support for teachers (as a best practice example, see the practical SchoolNetGuide on Weblogs and Wikis of the Swisscom Initiative, 2006 [in German]).

Wikipedia, the world's flagship in collaborative authoring with millions of articles in many languages, clearly demonstrates an important point: Social Software has made it possible for anyone to participate actively as an author in the knowledge society. David Weinberger, Fellow at Harvard University's Berkman Institute for Internet & Society, writes about the many things

Wikispaces offers 100,000 free wikis for K-12 education

In January 2006, Wikispaces, an initiative by a group of San Francisco based software developers, started to offer hosting thousands of Wikis to K-12 teachers for free. These Wikis are full-featured, can be public or private, and have no commercial ads.

They write: "Over 10,000 educational wikis later, we've heard countless stories of excited students and empowered teachers. They've told us about their collaborative essays, group study guides, online lesson plans, and classroom notice boards coming alive on Wikispaces. Now we're taking the next step – we want to give away 100,000 free K-12 Plus wikis. That includes all the features and benefits that normally cost $50/year – for free. No fine print, no usage limits, no advertising, no catches."

In autumn 2006 they also started running online tutorials and sessions on how to use Wikis in the classroom, e.g. for Tapped In, an American organisation that is trying to transform teacher professional development online, or the Australian Networks Community Forum as part of their "Cool Resources for E-learning" month.

Source: http://www.wikispaces.com/site/for/teachers100K

students (and teachers) can learn from Wikipedia: "We hope they're learning that they can't be passive recipients of knowledge. But they're also learning that authority doesn't come only through chains of credentials; that we can get on the same page about what we know; that knowing involves being willing to back away from your beliefs at times; that knowledge is a social product, or at least heavily socially contextualized; that the willingness to admit fallibility is a greater indicator of truth than speaking in a confident tone of voice; that knowledge lives in conversation, not in the heads of experts; that certain people who do not need to be named are just impossible." (Weinberger 2006)

There is also much learning potential for teachers and students in Weblogging, a practice of Web-based authoring and communication that has seen tremendous growth. In April 2006, the so-called "blogosphere", which is tracked by Technorati on a regular basis, amounted to 35.3 million individual Weblogs, 60 times more than in 2003. (cf. Sifry 2006a) The number of Weblogs doubles about every six months, with an average of over 75,000 new Weblogs created every day. The volume of postings in April 2006 was over 1.2 million posts per day, which is about 50,000 posts per hour. Of all bloggers 55% (19.4 million) still created posts three months after starting their Weblog. Three months earlier, in January 2006, only 50.5% (13.7 million) of blogs were active, which means that blogging seems to grow as a habitual activity.

According to a new report by Pew Internet (USA) based on a telephone survey of a nationally representative sample of bloggers, 8% of US Internet users already keep a blog while 39% read blogs. More than half of the bloggers (54%) are under the age of 30, and like the Internet population in general bloggers are evenly divided between men and women.

Most bloggers are primarily interested in creative, personal expression, documenting individual experiences, sharing practical knowledge or keeping in touch with friends and

Professors and students start your own Weblog

Dan Cohen from the Center for History and New Media of George Mason University suggests professors and students should start their own Weblog on topics they cherish and are knowledgeable about.

Some ideas from his longer excellent blog entry (Cohen 2006) are: "The most stimulating, influential professors, even those with more traditional outlets for their work (like books and journals) overflow with views and thoughts. Shaped correctly, a blog can be a perfect place for that extra production of words and ideas." Cohen also notes that a good academic or professional blog "provides a platform to frame discussions on a topic and point to resources of value", and that some may have more readers than a journal in the area of interest. Using a Weblog, a professor can also reach out to a larger audience beyond academia, which Cohen understands to be one of the duties of an academic expert, teacher and public servant.

With regard to students, Cohen expects "that in the not too distant future the right type of blog – the blog that shows how a candidate has full awareness of what's going on in a field and has potential as a thought leader in it – will become an asset not to be left off one's CV".

Nature, the renowned weekly scientific journal, provides a list of 50 popular Weblogs of scientists selected according to their Technorati (Weblog analysis) rank; Weblogs of biologists, in particular, show a high presence: http://www.nature.com/news/2006/060703/multimedia/50_science_blogs.html

peers. About 54% say that they have never published texts anywhere else. 52% blog to express themselves creatively, 57% include links to original sources and 56% spend time trying to verify facts they want to include in a post. 87% of bloggers allow comments on their blog, 41% say they have a blogroll or list of friends on their blog, and 18% already offer an RSS feed of their blog's content. (Pew Internet 2006) Similar findings are reported by the German study „Wie ich blogge?!" [How I blog] with 5.246 participants. (Schmidt / Wilbers 2006)

There are also many highly active bloggers from the education sphere, who blog on a wide range of themes from general questions of pedagogy and didactics to highly specific issues in certain fields of study and learning. The Edublogs Awards (http://www.incsub.org/awards/) give an impression of what is considered by the community to be outstanding practice.

From an educational perspective, it is understood that Weblogging is a self-directed, constructive as well as inherently conversational practice. Students who author a Weblog, which is possible individually and as a group, must make their minds up about certain topics, gather, evaluate and interpret information, take a position, come up with convincing arguments and evidence, and find the right means and style of expression. Teachers who integrate Weblogs into online and hybrid courses will find that this promotes student engagement and achievement. (cf. Downes 2004; Glogoff 2005; Richardson 2006a; Warlick 2005; and many Edubloggers some of whom are to found at http://educational.blogs.com; for a selection of 20 German edublogs, see http://www.weiterbildungsblog.de/archives/2006_09.html).

However, using social software such as Wikis, Weblogs and others to a greater extent in educational settings will require developing solid criteria and practical ways of assessing the learning outcomes of such novel, often collaborative approaches to learning.

RSS feeds enrich educational portals and learners can subscribe directly to thematic content feeds

A comprehensive study on "Publishing in the Knowledge Economy", conducted in 2002 by the business consultancy Pira International on behalf of the UK Department of Trade & Industry, concluded that in the digital era the first step of publishers should be "to take the wrapper off". The authors emphasised that, instead of "simply pushing out more of the same" content packages such as books, magazines, etc., publishers would need to "unwrap" the content and develop truly new products and services.

They observed: "Both publishers and users are beginning to evolve towards new concepts of what they can do with content using new technologies, but opportunities are not always grasped." In addition, the study advised publishers who generate large proportions of their revenues from advertising to think of the additional revenue sources that could be derived from new services, user interaction, profiling, tight targeting and added functionality. (cf. DTI / Pira 2002, 87-88)

Meanwhile, Web-based digital content has become highly fluid. It can be easily produced, syndicated, assembled, and wrapped in different ways. In addition, services that deliver some type of information can be combined to provide astonishing new ways of integrating content (so called "mashups", for example, combining Google Maps with information feeds about certain locations). This allows educational publishers and not-for-profit learning content providers such as open access repositories and portals to provide innovative services to teachers and learners.

The basis of the present explosion of services is the Really Simple Syndication (RSS) Web feed mechanism, which has become a standard for content distribution and syndication. Moreover,

it has effectively standardised the format for content delivery. Items of user-focused Web feeds typically contain a headline, content summary and direct link to the content. Websites that subscribe to feeds of information providers receive continuously updated information. Their visitors can quickly scan headlines and summaries on topics of interest and access articles or audio- and videocasts with more information. Increasing numbers of information providers from large portals to individual Webloggers also allow users to subscribe directly to their content feeds. Several feed readers are freely available and easy to install.

Also, providers of educational content can make use of RSS feeds for bringing fresh, continuously updated information on to their portal and offering individual and groups of learners the chance to subscribe to their own feeds. Furthermore, allowing users to assemble interesting feeds on certain subjects in a personal or group-based "MyEduFeeds" space is an option that educational organisations should consider. (cf. the study by Grossnickel *et al.* 2005 on the importance of start pages like MyYahoo! in the current use of RSS feeds)

Of particular interest is the fact that individual learners and study groups can easily select feeds on certain subjects that provide them with thematically relevant content. This increasingly includes podcasts (audio) and videocasts. For example, the Education Podcast Network brings together in one place a wide range of podcast programming; and a directory of over 300 selected podcast channels maintained by Russell Educational Consultancy and Productions is a registered, BECTA accredited content service for the UK Curriculum Online.

However, RSS feeds do not necessarily have to have an educational label. Rather, students who are focusing on a particular research question will often gain from subscribing to feeds from non-governmental agencies, scientific organisations, business information services or sections of international news services. Also, there are many Weblogs of individual consultants and other professionals that offer an RSS feed which is often a highly interesting source of commentaries and links to up-to-date publications and discussions.

In an introduction to RSS for educational designers, Stephen Downes emphasised in particular the following: "The model provided by RSS is very different from the model provided today by learning content management systems (LCMSs). In the world of the LCMS, everything is contained in one very large software application. Insofar as content is distributed at all, it is distributed in bundled content libraries. This means that educational institutions must make a major investment in software and expertise in order to access learning content. RSS, by contrast, is not centralized. It is distributed. Content is not distributed in bundles, it is distributed one item at a time. There is no central store, repository or library of RSS content; it is all over the internet. To access and use RSS content in a viewer or in a web page, you do not need a large software application. A simple RSS reader will do the trick. (…) Many more people will use a distributed learning object network not only because it's easier and cheaper, but because they can access much more content for much less money. (…) anything that can have an educational application – including images, videos, journal articles, even news items – can be distributed through a learning object syndication network." (Downes 2002) To this it should be added that RSS feeds can also be used to receive selected content feeds in a Virtual Learning Environment.

Licensing open content will become easier through plug-ins for widely used software packages and standardisation of user information

Licensing adds a further task to the publishing of content, but this will become easier than at present with the integration of licensing plug-ins in widely used software packages. Creative Commons offers the ccPublisher tool, which can be installed on a computer to facilitate the licensing process. It is also expected that more and more software packages and Web applications will have built-in CC licensing, which means that users do not need to copy/paste HTML from licenses or add buttons to Web pages.

Leading this development is Weblogging software such as Movable Type, Manila and Squarespace. Recently the engineering team of the Center for Open Sustainable Learning (COSL) also started integrating CC licensing into Plone. In June 2006, Microsoft and Creative Commons announced the release of an add-in for Microsoft Office, which enables embedding of CC licensing information in Word, Excel and PowerPoint documents from within the specific application. (Creative Commons 2006) The add-in is available from Microsoft's Download Center.

Furthermore, it may be interesting to note that Registered Commons has recently been launched (http://www.registeredcommons.org). This service allows authors to time-stamp and archive publications they publish under a CC license.

OLCOS partners conducted a quick review of several portals and repositories and found that from a user perspective it is not always easy to find the available information about licensing. For example, the very popular photo management and sharing service Flickr does not provide newcomers with easily identifiable information about licensing. However, if they already know about "Creative Commons", there is a link to a webpage that starts with "Many Flickr users have chosen to protect their work with a Creative Commons license, and you can browse or search through photos under each type of license."

Another example is Wikimedia Commons, which may demand a bit too much from users when trying to make their minds up about licensing. There is the possibility to use several licenses as well as simply declare the content to be public domain. Moreover, users may be irritated by the amount of information about international and country-specific regulations, and not use the example-based tutorial, which "attempts to give non-lawyers an overview over complicated copyright laws".

In short, content portals and other services currently do not always find a good way of guiding users to licensing information as well as the right balance and detail of information. Therefore we suggest identifying best practice and re-using licensing information from similar projects. It is also generally advisable to keep the number of allowed licenses as low as possible, ideally one license for all the content that is shared. An example of such an approach is Freesound, http://freesound.iua.upf.edu, a growing database of sounds that are licensed under the Creative Commons Sampling Plus License. (cf. Leslie 2005)

Emergence of personal learning environments ("e-learning 2.0")

The tremendous success of Social Software with many users has inspired the idea of a Personal Learning Environment, which integrates several tools and services a learner can benefit from in self-directed and collaborative e-learning.

The idea that such a personal environment could greatly enhance a learner's capability for a more self-managed learning career may also be found in visionary educational strategy

papers. For example, the UK Department for Education and Skills in their e-strategy report "Harnessing Technology" write: "We will encourage every institution to offer a personal online learning space to store coursework, course resources, results, and achievements. We will work towards developing a personal identifier for each learner, so that organisations can support an individual's progression more effectively."

And they describe the learning space as follows: "A personal online learning space: where you can store electronically everything related to your learning and achievements, course resources, assignments, research, and where you can plan your next steps, and build links for professional advice and support. And being online, it will be accessible from home, from school, and, in the longer term, from each new organisation as you progress." (DfES 2005, 3 and 7)

However, such a learning space is not what most educational authors and tools developers have in mind when they write about the concept of a Personal Learning Environment (PLE). This is because it represents a "top-down" approach, which may concentrate too strongly on requirements of formal education, and would possibly exclude much of what the "Web 2.0" offers to empower self-directed learners.

Generally, a PLE is understood to be managed by the learner, not by an educational institution. It is an environment of applications on the learner's devices as well as Web-based applications and services, which is used for individual learning and for communication and collaboration with other learners, and for accessing institutional courseware in addition to many other interesting resources (many of which are brought directly to the user by RSS feeds).

More specifically such an open PLE would include: A personal Weblog, social networking (e.g. through Friend of a Friend [FOAF]), social bookmarking (e.g. del.icio.us), a personal file repository and online content sharing (e.g. images on Flickr), access to networked repositories (e.g. of the learner's university or college or the Global Learning Objects Brokered Exchange). Certainly, a part of the PLE would also form an e-portfolio for documenting, reflecting on and presenting learning progress and results. Some of the results would also be submitted for educational assessment and certification, but, basically, a PLE is understood to be a tool for "deep learning" and personal development. (cf. Attwell 2006; and Tosh / Werdmuller 2004, who also provide a diagram of a PLE)

While some Web-savvy students already run such a personal environment for study as well as various social activities, the most interesting question may be how aspects of the PLE model are transcribed to various models that are defined more from an educational point of view. In the following we describe two of them briefly:

One model puts into question current Virtual Learning Environments (VLEs), which are fairly self-contained systems for handling courses that do not perform particularly well in supporting different learning needs, preferences and styles. An alternative that is explored in the "Personal Learning Environment" project carried out by the Centre for Educational Technology Interoperability Standards (CETIS, UK) would be "to locate a large amount of VLE functionality with the learner either as a desktop application or an independently hosted portal. Institutions would still provide content via repositories, undertake assessment and so on, but learners would interact with these using their personal systems (Personal Learning Environment), comprising their preferred tools and ways of working." (CETIS / Liber 2005)

Another model is an "educational social overlay network", in which the overlay is formed by the learners' individual and collaborative use of social software tools and services. As Terry Anderson, Director of the Canadian Institute of Distance Education Research, writes: "Educational social software can be used effectively to create a type of overlay network to enhance the more formal institutional network consisting of student support, library, tuition, registration and other

institutionalized services." (Anderson 2005)

These are but two possible models inspired by the new opportunities offered by social software based learning, which are in sharp contrast to the limited capability of current institutional VLEs to support (not to speak of to promote) novel forms of ICT-enhanced learning. Other attempts can be found in the context of the current interest in e-portfolios as a possible "hub" for integrating learner self-managed and institutionally managed processes of education. (cf. EUN / Vuorikari 2005)

Semantic applications offer new ways of accessing knowledge resources

In a previous section we addressed the question of how educational information providers could make their resources more accessible on the emerging Semantic Web (see pages 83-85). We noted that, whereas developing widely shared rich educational ontologies and vocabularies would be a tremendous investment, the sector could nevertheless benefit from available ontologies and semantic aware applications from other sectors, once they become available.

Here we want to provide some examples of new ways of accessing knowledge resources for learning and collaborative study projects. This should illustrate the many new opportunities offered by semantic solutions which are already developed and tested by researchers and educators and will become available over the next few years.

A leading example is Magpie, a semantic browser developed by researchers of the Open University's Knowledge Media Institute (UK). The function of Magpie is to create, based on available domain ontologies, a semantic layer for web pages that allows for accessing knowledge resources to develop a deeper understanding of subjects. The web pages can be very simple HTML web pages with some text on a particular subject, which a teacher could very easily create. The trick is that Magpie uses natural language processing to identify and highlight terms used in the text and offer access to a variety of information services for contextualisation and interpretation. In particular, the students can browse the ontologies, which are used for initially creating the semantic "hotspots" in the text, and thereby develop a deeper understanding ("sense making") of the conceptual foundations of the knowledge in the domain(s) to which the subjects of study belong. Such opportunities have, for example, been explored in Open University courses that made use of resources of the Climateprediction.net. Interestingly, this approach allows for "zero-cost" semantic enhancement of learning resources as it avoids the need for manual annotation. (cf. Dzbor / Domingue / Motta 2004; Motta 2004)

An area of considerable interest also is semantic support when using social software tools, particularly collaborative authoring instruments such as Wikis. Generally, the idea behind semantic Wikis is to semantically annotate page content and the often rich interlinking between different Wiki pages (and external resources) by using general or domain-specific ontologies. This can then be used to represent and navigate the knowledge structure of the Wiki content, to search and display semantically related pages (e.g. in a reference box), to explore formalised knowledge resources (e.g. a biological taxonomy) that have been used to annotate some content, etc. An acknowledged example for such a Wiki is the IkeWiki, which has been developed and tested by researchers at the Austrian R&D centre Salzburg Research. They believe that IkeWiki "has many of the features desirable for Wiki use in learning environments". (Schaffert *et al.* 2006, 11; for more technical details, see Schaffert 2006)

These are just two examples of semantic tools that provide many opportunities for supporting learning in diverse new ways. We also expect that repositories that are aware of such opportunities will increasingly provide advanced features such as conceptual browsing.

For example, the Digital Library for Earth System Education (DLESE), which contains more than 12,000 resources for teaching and learning (lesson plans, scientific data, visualisations, interactive computer models, virtual field trips, etc.), has developed conceptual browsing interfaces. Interestingly, this integrates descriptions and visualisations of learning goals (AAAS Benchmarks for Science Literacy and Atlas of Science Literacy). (Sumner 2004; DLESE 2006) This has also been implemented by the Science Education Department at the Harvard–Smithsonian Center for Astrophysics for their collection of digital video materials.

5.4.2 Inhibitors

More cooperation between tools developers and educators is needed

Greater cooperation between tools developers and educators could help in making tools more easily usable in educational contexts. As described by the coordinator of the BAZAAR project, Raymond Elferink, in an OLCOS Expert Workshop, a large gap exists between developers of learning tools and educators. Many tools are available or in development, but there is little opportunity for teachers and trainers to try and compare them and to provide valuable suggestions for improvements. According to Elfering, it is important to know more about how teachers and trainers would use a tool, what existing functions they appreciate or find less useful, and what additional features they would welcome having available.

To help establish such exchanges, BAZAAR organises "Show-me days", an event format they highly recommend to tools developers. In such "hands-on" events educators can test a couple of tools, talk to developers, provide feedback, learn about licensing open source software, etc. Educators will also benefit from information and guidance by more experienced peers who explain how they use a tool in practice. For the adoption of a tool it is also known to be of particular importance for educators to develop a sense of ownership and take an interest in the further development of the tool.

Lack of know-how for enabling innovative educational settings to emerge

Studies conducted in the context of establishing repositories of educational material have found clear evidence that teachers are willing to share their own content among a wider circle of colleagues, but that there are considerable reservations about re-using content from others. (cf. CELEBRATE / Nurmi 2003; COLIS Education Researchers' Report 2003, among others) The most important factor in relation to these reservations is the time needed to find relevant material and to repurpose it for specific teaching and learning contexts. This finding has added to the notion that a top-down strategy of establishing centralised repositories for finding and accessing "learning objects" that are aligned to the curriculum would be the perfect approach to increase the level of IT-enhanced teaching and learning.

What is often not understood is that this delivery mode reinforces the still dominant teacher-centred paradigm of education and runs counter to the goal of innovating teaching and learning practices. In order to see innovative educational practices emerge and flourish, teachers and students must be enabled to become creative and share resources that they find useful in certain learning contexts (e.g. a collaborative study project). What could an educational repository offer to help in this? Some examples are given for illustration:

Teachers and students already often search, bookmark and harvest large quantities of digital

material they consider relevant for working on a specific topic. Why not support them in effectively sharing such resources (e.g. by offering a Web-based bookmark or content sharing service)?

Content needs to be contextualised, but not necessarily by one teacher or even by a teacher at all. Why not offer discussion and annotation functionality for turning some "learning objects" into a starting point for collaborative learning?

Learning is a social process based on ongoing communication, exchange of ideas and opinions, and reconsideration and reworking of study results. Why not provide a Wiki in which teachers and students can work on a topic and link to relevant content held in the repository and elsewhere?

In addition, teachers and learners would benefit from having at hand current "real world" information (rather than old examples that are often simplified and lack fresh data). Why not make sure that they are aware of, and can easily aggregate, available free-of-charge content feeds that show consistent quality of information on certain study topics?

In short, there will be much to reconsider and to do before repositories of "learning objects" make sense in a world of IT-enabled learning in the knowledge society.

Educational repositories will need to think more thoroughly about how to be useful for communities of practice

A report on a Learning Repository Summit facilitated by the Academic Advanced Distributed Learning Co-Lab (USA-based but with international partners) summarises interesting observations with regard to users and usage of learning content repositories. (Holden 2003, 19-20) Among the most striking are the observations "that many previous repository projects had suffered as a consequence of not thinking enough about the community they served" und that experts "warned that it was possible to expend unnecessary energy producing or gathering resources that were not right for the community a given repository hoped to address".

Participants of the Summit therefore thought it to be of key importance "to listen to the community" and use a variety of techniques for assessing user needs. However, it was felt that there was very little well-documented best practice in assessing such needs, that better techniques should be developed and put in place, and that much more sharing of know-how should take place among repository projects.

Interestingly, participants also identified an "Enabler's Enigma", which has at its root "the assumption that the communities of practice that will use repositories in the course of education do not yet exist, and that it is the task of the repository project to create them". (Holden 2003, 19)

We think that this enigma can be addressed by acknowledging that often a provider model that sets out to do something for communities of practice (CoPs), usually to provide access to a growing database of content, will not work out. Rather, such communities must be enabled to do and achieve something themselves. In fact, the notion of CoPs implies that members of such communities share an interest in promoting particular practices, want to further develop know-how in addressing certain problems, and resources such as tools and content.

Considering that in the educational sector repositories often want to support teachers, the core practice to support would be the practice of teaching, i.e. helping students to acquire certain knowledge, competences and skills. Hence, ideally a repository would be a Web-based environment in which teachers can create, manage and share some parts of what they consider useful for teaching. Actually, the question of how to manage content effectively is one of the

most important, and repositories might become much more appealing to teachers by providing assistance with this. However, this requires a good understanding of what teachers do, or would like to do, with digital content.

Some interesting results can be found in an extensive study on the use of digital resources in American undergraduate education in the humanities and social sciences. The study found that the large majority of faculty who use digital resources maintain their own personal aggregation of potentially relevant digital material ("They use almost every conceivable type of resource many of which fall outside of what are formally called 'collections' or 'educational'"), and many "want to build their own reaggregated resources, using their own materials and mixing them with resources they have collected along the way". The study authors also emphasise that there are many tools available for developing, managing and using digital resources, "but the efficacy and interoperability of these tools for the immediate tasks that faculty need supported are questionable". (Harley *et al.* 2006)

An important part of a teacher's content is "courseware", and an easy-to-use personal Web-based authoring and presentation environment in conjunction with a digital repository

Innovation in course-based teaching and learning – Connexions, or the joy of sharing

One of the leading examples of IT-enabled innovation in teaching is the Connexions platform, which is managed by Rice University (USA) but invites university professors and high school teachers from anywhere in the world to participate. Connexions allows them to design, update and make available teaching and learning material in a modular and highly interactive way. All content can be used by others under a Creative Commons license.

Due to Connexions' openness and ease of use, the number of course modules on the platform grew from 200 in 2000 to over 3,500 in 2005. The modules cover many different subjects such as electrical and computer engineering, graphic design, economics, music, art history and many others. Connexions has about 200,000 unique visitors per month who come from over 150 countries.

One active user of Connexions is Davide Rocchesso, an associate professor of Computer Science at the University of Verona, Italy. He began using Connexions due to practical advantages such as the availability of MathML for formulas and equations, the ability to include various types of media, and the ease of generating PDF files for printing. However, the joy of sharing and the possibility to build on someone else's content also became motivators.

Roccesso explains: "I see Connexions as a sophisticated, indexed and search-able repository of materials, including text, mathematics, pictures, applets, etc. (…) It is very handy to have all of these things accessible under a common framework, especially when I consider that my own work gets nicely integrated with other authors' work, and we can share content under a Creative Commons license."

Rocesso's students "appreciate having the lecture notes readily available with updates and corrections, with many hyperlinks, source code, and applets directly available from the online modules", and they "like to be engaged with demonstrations and cross-links, and appreciate seeing that the teacher is part of a community that shares knowledge".

Sources: Jaschik 2005; Rocchesso 2006; a detailed description of Connexions' approach is provided by Dholakia / King / Baraniuk 2006.

infrastructure could be of great help for many teachers. A best practice example for supporting individual teachers in managing their "courseware" is Connexions (see information box above), a project that has also been very successful in promoting open sharing of course modules.

In fact, a core question of repositories with regard to communities of practice is how to convince them to use the repository for open sharing of content. An important observation on the willingness to share knowledge, experiences and content is that people often prefer not to share with everybody but within one or more self-selected communities of colleagues including peers from other organisations. Implementers of a content repository infrastructure and sharing mechanism would need to take this into account, allowing communities to decide themselves who should have access to the collection of resources under their control. In a second step, repositories could seek to grow the proportion of material such communities are willing to make accessible for other groups of users under certain licensing conditions.

An issue repositories should emphasise much more strongly is the question of preservation and perpetual access to results of collaborative projects. Like any other digital entities, academic and educational digital material is "fragile, prone to corruption, susceptible to misidentification, frequently poorly described (if at all), difficult to track, and hard to maintain because of media, hardware and software obsolescence". (Ross / Hedstrom 2005) Hence, there is a need for effective digital preservation and curation solutions for project results, which could be offered by repositories.

Many academic and educational institutions and networks are already aware of the demands of long-term archiving of digital content in a situation of rapid change in information technologies, software, formats, etc. But individual and groups of researchers should, and often do, also care about the future of their digital works. Interestingly, a survey at the University of Vienna's Center for Teaching and Learning on the expectations of research and teaching staff regarding a new digital asset management system found that many are particularly interested in the long-term accessibility of their material. In comparison with this need, topics such as "learning objects" or "metadata" were met with only little interest (reported by Petra Oberhuemer in the second OLCOS expert workshop, Vienna, 14 June 2006).

Educational repositories will need to implement more advanced tools and services

Educational repository projects often think that it is sufficient to offer the ability to "mine" a database for possibly interesting content. If this is the intended core offering of a repository, much consideration must be given to the question of how to add useful services. One service could be to inform users about available new material on topics of interest. For example, Historyguide.de (a subject gateway managed by the Göttingen State and University Library) allows users to store favourite searches and when new metadata records appear that match they receive a notification.

In a previous section we have already pointed out new opportunities that are available to repositories by using RSS feeds, and there are many more examples of how useful tools and services can enhance the use of a database of openly accessible content. As exemplified by the extremely successful bookmarks sharing service del.icio.us and similar services, there need not even be a database of content. In fact, helping members of an educational community of practice to store, annotate and share interesting bookmarks could be an excellent service in itself. (cf. Alexander 2006, 34) However, educational institutions and teachers and learners will expect a bit more than simply sharing bookmarks.

Particularly in the field of Higher Education the stakes for a useful content repository are high for two reasons:

First, the repository should allow for working effectively with the content held in the database by making use of available tools and services. This may be Web-based reference managers, annotation and recommendation tools or the ability to work with datasets stored in the database.

Secondly, a repository should also connect teachers and students to the body of codified knowledge in certain domains. Such knowledge is "embedded" in systems such as thesauri, classification systems and domain ontologies. In the digital environment they are used to tag, index and enhance search & retrieval of resources. Moreover, such systems are an important resource in themselves in that students can learn about the terms used in a field of study, how a discipline classifies entities, and which ontological concepts form the basis of its body of knowledge.

However, creating and maintaining such rich knowledge resources can be very costly, particularly if they should also be usable on the Web. For example, in the humanities a license for using the Getty Art and Architecture Thesaurus or Iconclass (a classification system for iconographic resources, owned by the Royal Netherlands Academy of Arts and Sciences) comes with a considerable price tag.

An important question therefore is how more of such highly valuable resources could be developed as open knowledge resources. Semantic Web technologies, which we have addressed in previous sections (see pages 83-85 and 100-101), will play a specific role in this.

Library services may be slow to find their place in open learning environments

An "Environmental Scan" report issued by the Online Computer Library Center (OCLC 2004) reviewed issues affecting the future of libraries. It acknowledged that the Web has become the most significant engine driving changes with respect to information access, and found that there is among librarians and other established information professions "a subdued sense of having lost control of what used to be a tidy, well-defined universe". Many librarians worry that they are "disintermediated" by search engines and other Web-based services. The report suggested that one of the strategies to counter this development is to achieve "invisibility", in the sense that the library communities' services become ubiquitous and fully integrated into the infosphere of their users.

Lorcan Dempsey, OCLC's Chief Strategist, in a recent article about "The (Digital) Library Environment: Ten Years After" provides a detailed discussion of the challenges libraries have to address and accommodate in a rapidly developing digital landscape. (Dempsey 2006) He expects: "In the medium term, the library will need to engage with major shifts in research and learning practice. In the short term, the library needs to begin building services around user workflows, supporting the remix of content and services in user environments, and developing digital curation services."

Dempsey urges the library community to fully recognise the tremendous developments in Web-based services and to think about how to better service the user in his or her environment of research and learning. He writes: "The network has created a new dynamic of discovery and use around major hubs of information infrastructure: Google, Amazon, iTunes and so on. They have aggregated supply (unified discovery and reduced transaction costs), aggregated demand (brought a large audience to bear), and are developing into platforms which help other

applications reach their goals. These will not replace library services, but they have caused us to think about how to deliver service on the Web. Although the collective library resource is deep, fragmentation of discovery and high transaction costs have reduced impact. Libraries are exploring how better to project a targeted service into user environments, how to develop a switch between the open Web and rich library services, and how to make services more engaging."

What could it mean to project a targeted set of services into the environments of learners? Interestingly, regarding this question Dempsey refers to a diagram of a personal learning landscape that informs the work of the development team of the open source Elgg application. (Tosh / Werdmuller 2004) The "landscape" comprises a learner's Weblog, bookmarks sharing (e.g. del.icio.us), online content management and sharing services (e.g. Flickr for image sharing) and social networking (e.g. through Friend of a Friend [FOAF]). Furthermore, the learner also accesses networked repositories such as the Global Learning Objects Brokered Exchange (GLOBE) and websites of educational institutions (e.g. of the learner's college or university), and receives direct RSS feeds from various content providers.

Dempsey finds it revealing that the authors did not include libraries in the picture, and asks "how would one represent the library if it were to be dropped in? As 'the library'? As a set of services (catalogue, virtual reference, ...)? If as a set of services, which services? And, if a particular set of services, how well would they 'play' in this environment? What would need to be done for them to be in the flow?"

Dempsey leaves these questions unanswered, but it seems that traditional and current digital libraries will have a long way to go before they become part of "the flow" of a new generation's learning landscapes. However, there are many ongoing attempts by the library IT community to develop innovative ways of making offerings such as the bibliographic apparatus and Online Public Access Catalogues (OPACs) more useful for their clients. Perceived as an important element in this are extended linking services based on the OpenURL standard. (cf. the Talis Library 2.0 Innovation Directory, http://www.talis.com/tdn/innovationdir, which lists more than 50 interesting applications; Miller 2006a+b; and regarding "The future of the OPAC", see Vandenburg 2006)

An important further question will be how digital libraries could lock more effectively into course environments. A study conducted by researchers of the Digital Library Foundation on the interplay of digital libraries and course management systems found: "The barriers to finding and re-using extant digital materials in a course context are very high today. (…) We do not have systems in place which make it easy for instructors with limited time and very limited technical expertise to simply locate and reuse digital content." The authors also emphasised that "[M]uch of the thinking to date in this domain has concentrated on formal course management systems. But we know that instructors use many different kinds of systems to deliver teaching materials, including, for example, the use of PowerPoint for classroom presentation, or of a course weblog to share work." (DLF 2004)

LibraryThing – Adding the social dimension to one's catalogue of books

"I've seen the future of online catalogs, and its name is LibraryThing." Steve Cohen, Public Libraries magazine, March/April 2006

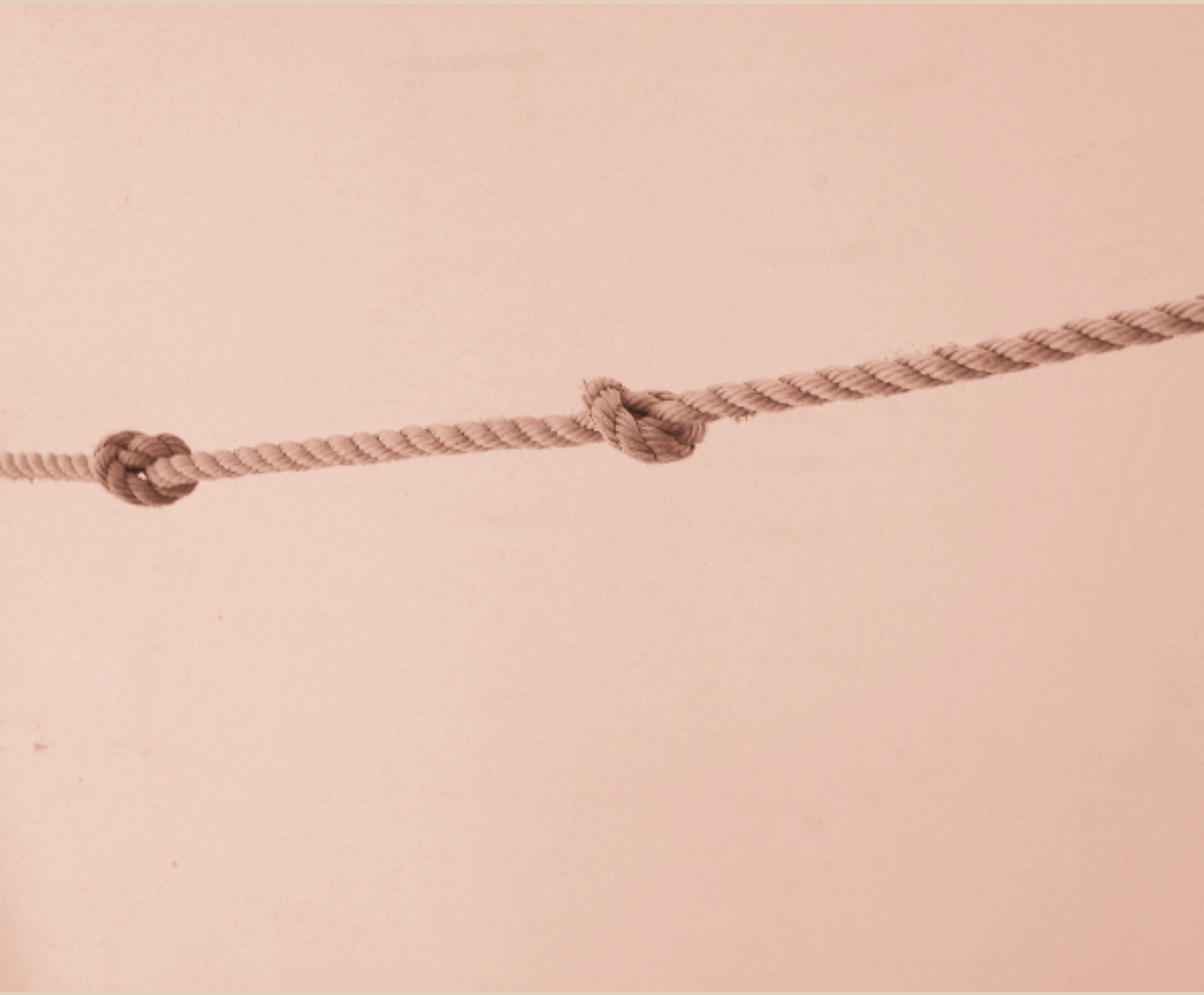
Launched in August 2005, LibraryThing has become the number one "library-meets-social software" service, a thriving online community. At LibraryThing registered users can create a catalogue of their books by simply entering the ISBN numbers or other information such as book titles. The service provides the catalogue information about the books from Amazon and numerous online libraries from around the world. Users can organise and sort their personal library, add keywords to titles, review and recommend books. What does it cost? "A free account allows you to catalog up to 200 books. A paid account allows you to catalog any number of books. Paid personal accounts cost $10 for a year or $25 for a lifetime."

But creating one's own book catalogue is only one thing users can do at LibraryThing. Once users have catalogued some books and set up a personal profile, LibraryThing becomes a social networking tool connecting them to others who have the same books on their online bookshelves. For example, they receive an automatically generated list of links to fellow users whose libraries have the most books in common with their own, and they can browse fellow cataloguers' libraries. And as with other social networking sites users can post notes to one another's profile pages. Users can also create and join groups and participate in forums in which certain books are discussed.

The "social information" page of a book on LibraryThing shows: Member Rating, Recommendations ("People who own this book also own..."), Similarly Tagged books, available Member Reviews and Members who have the book.

On 17 October 2006, LibraryThing's statistics showed among other information: 91,428 members, 6,448,865 books catalogued (1,290,648 unique works), 8,824,229 tags added, 77,917 reviews and 966,412 ratings.

URL: http://www.librarything.com



6 Roadmap Briefs

The following tables are intended to give decision makers a quick overview of the drivers/enablers and inhibitors in the areas covered by the OLCOS road mapping work. The overviews contain the headlines of the sections in the road mapping chapter with brief notes that provide some context or explanation.

We have grouped the drivers/enablers and inhibitors according to their assumed short to medium (until around 2009) or longer-term influence (until 2012):

- The inclusion of a driver/enabler or inhibitor under the category longer-term does not mean that it will not by 2009 have an influence on educational practices and resources. Rather, the idea is that it will have an influence over a longer period of time, and that this influence may be felt much more strongly after 2009.
- The inclusion of a driver/enabler or inhibitor under the category short- to medium-term should indicate that it already has an observable influence, which may continue or gradually decline after 2009.

These overviews may be best used as starting points for discussing initiatives in Open Educational Resources (OER) at a strategic level, for example by identifying inhibitors that should be tackled much more rigorously.

6.1 Policies, institutional frameworks and business models

Policies, institutional frameworks and business models	
Short – medium-term influence (– 2009)	**Drivers and enablers**
	International interest in, and funding of, Open Educational Resources. *Some examples: UNESCO, OECD, World Bank, European Lifelong Learning Programme, Commonwealth of Learning (COL), William and Flora Hewlett Foundation, Soros Foundations Network, and many others.* Healthy competition among leading institutions in providing free access to educational resources. *Many initiatives started after the extensive media coverage for M.I.T.'s Open Courseware (OCW) project, which was announced in April 2001. For example, in the second half of 2006 the international Open Courseware Consortium had over 100 members.* OER "latecomers" will need to convince through highly useful resources;; active user communities will be of critical importance. *Currently we see much provision of static "courseware" (in closed formats); a leading-edge example of a different approach is the OpenLearn project of the Open University UK.* Some Distance Teaching Universities and Open Universities make open self-learning resources accessible as a way to attract new students. *Examples: European Association of Distance Teaching Universities, Open University NL and Open University UK.*
	Inhibitors
	Growing competition for scarce funding resources (also within institutions). *Hence, many projects will not be able to realise state-of-the-art organisational and technical approaches to OER.* Difficulty in finding a balanced approach for open and commercial educational offerings. *Entrenched commercial interests of educational publishers will make it difficult to establish innovative private–public partnerships related to OER.* Possible implementation of rigid Digital Rights Management Systems by many organisations, besides publishers also Royalties Collecting Societies, Cultural Heritage institutions and others.

Longer-term influence (– 2012)	**Drivers and enablers**
	Policies emphasise educational innovation and organisational change to better align educational institutions with the requirements of the knowledge society. *As educational institutions are difficult to transform, only a slow impact of the demand to "innovate" and "change" can be expected.* Understanding that ICT-based lifelong learning needs to be promoted through easy access to educational resources. *OER can help in driving lifelong learning participation; however, e-coaches or "blended learning" will often be required.* The Bologna Process could become a driver for cross-border collaborative development and sharing of study material in Europe, particularly through Joint Programmes and Degrees. Global competition in Higher Education and decline in student numbers in Europe due to demographic trends. *This is one of the incentives for the experimentation of Open and Distance Teaching Universities with "e-taster" OER to attract students.* Creative Commons licensing is firmly established and is being used increasingly. *Expect increasing circulation of teaching and learning content that is openly shared.*
	Inhibitors
	Business models in OER will remain tricky; the right mix of income streams must be found. Lack of institutional policies and incentives for educators to excel in OER. *Experts widely agree that appropriate institutional rewards are the most important factor for successful OER initiatives by academic and educational institutions.* Models that build on teachers in the creation and sharing of OER will need to invest considerable effort in training and support. Little innovation by most academic and educational publishers (problem of investing ahead of "e-readiness" of most educational institutions and teachers). *It remains unclear whether the shift towards Open Access and OER will stimulate publishers to show a greater propensity to invest in innovative products and services.*

6.2 Open Access and open content repositories

Open Access and open content repositories	
Short – medium-term influence (– 2009)	**Drivers and enablers**
	Breakthrough of the Open Access (OA) principle in academic publishing. *Survey data show strong growth in OA resources (e.g. number of OA journals and OA repositories, and volume of OA publications).* Funding bodies require that results of academic and educational projects be made available via OA repositories. *This will give the current OA movement much greater momentum.* Widespread tried and tested know-how in distributed open access repositories (e.g. systems based on OAI-PMH or Peer-to-Peer & SQI). *This allows educational repositories to become active information access providers.*
	Inhibitors
	Further success of the Open Access principle in the academic field requires overcoming fears of low recognition for OA publications, particularly among young researchers. *Favourably, surveys have shown that OA publications outperform traditional ones with respect to citation (i.e. visibility and potential impact).* Need to reinforce institutional Open Access policies. *In order to overcome reluctance, institutions should make it mandatory for researchers to "self-archive" publications on institutional and/or central OA repositories.* Barriers to making research data openly available for further research and teaching will remain.

Longer-term influence (– 2012)	**Drivers and enablers**
	Open content repositories will increasingly surface from the Deep Web. *This will allow for enhanced discovery of, and access to, many more educationally relevant resources.*
	Inhibitors
	Creation of educational metadata will remain costly. *OER initiatives will need to strike the right balance between the achievable richness of metadata and the costs they incur (e.g. due to the need to employ skilled personnel). Note: There is interesting research under way to allow for automatic capturing of data in the context of use of learning material ("attention metadata").* Lack of ontology-based educational Semantic Webs. *Teaching and learning will only benefit in the longer term from an ontology-based "semantisation" of educational resources and Semantic Web applications. Note: Ontologies are among the most valuable OER that domains of knowledge and learning can share.*

6.3 Laboratories of open educational practices and resources

Laboratories of open educational practices and resources	
Short – medium-term influence (– 2009)	**Drivers and enablers**
	The "industrialist" Learning Objects approach has run out of steam. *Wide agreement among educators that availability of a "critical mass" of LOs does not necessarily promote innovation in teaching and learning.*
	Tremendous use of Social Software tools and services (Weblogs, Wikis, social networking, content and bookmarks sharing, etc.) outside the educational sector. *Even a smaller "spill-over" could have a considerable impact in terms of changes in educational practices; there is already some experimentation by individual teachers and educational projects.*
	RSS feeds enrich educational portals and learners can subscribe directly to thematic content feeds (including podcasts [audio] and videocasts).
	Emergence of personal learning environments ("e-learning 2.0"). *The combination of a new generation of easy-to-use Web-based tools and services empowers learners to create and manage their own learning environment.*
	Licensing open content will become easier through standardisation of user information (e.g. on content portals) and plug-ins for widely used software packages.
	Open Source Software is more widely used in Higher Education and Further Education institutions.
	Inhibitors
	Lack of know-how for enabling innovative educational settings to emerge. *Educational initiatives, particularly larger national ones, still follow a "top-down" strategy that tries to deliver learning objects to teacher-centred education, which runs counter to the goal of enabling innovation in teaching and learning.*
	Educational repositories will need to think more carefully about how to be useful for communities of practice. *This is of critical importance if OER initiatives want to grow based on user contributions and sharing of content among users.*

	Further uptake of Open Source Software in schools will require more in-house capacity building. Need for more cooperation between (open source) tool developers and educators.
Longer-term influence (– 2012)	**Drivers and enablers**
	New systems for creating and handling group-based Learning Designs may become more widely used. *IMS Learning Design based applications are currently at the prototype stage; the somewhat simpler system of the LAMS Foundation (which is not based on IMS LD) has already been widely trialled.* Semantic applications will provide new ways to access knowledge resources. *There are already interesting examples of concepts-based access, semantic Wikis and semantic filter and browser applications.*
	Inhibitors
	Educational repositories will need to implement more advanced tools and services. *In the field of Higher Education in particular, researchers and students will expect to find Web-based tools for referencing, annotating and recommending resources; it will also be essential to connect teachers and students more effectively to the body of codified knowledge in certain domains (e.g. thesauri, classification systems, domain ontologies).* Library services may be slow to find their place in open learning environments. *It is widely felt that libraries will need to adapt better to the considerable changes in information behaviour and Web-based environments.*

7 A not too visionary outlook

The OLCOS road mapping work was inspired by a vision of a substantial transformation in educational practices that could be achieved over the next ten years, with the year 2012 as a not too distant reference point.

Generally, the vision is that educational institutions from primary schools to universities and lifelong learning providers will foster and support open learning practices that help equip teachers, students and workers with the competences, knowledge and skills to participate successfully in the knowledge society.

Educational policies, curricula, teacher education and the assessment of students' achievements will emphasise cognitive and social skills such as conceptual thinking, creativity, planning and conduct of team work, etc., which are to be exemplified in the set-up of learning processes and their outcomes.

Educational institutions and teachers will understand their key role in a knowledge society much better, and will be encouraged to employ and experiment with innovative educational practices making use of a rich pool of open resources.

The current dominant paradigm of teacher- and subject-centred learning in formal education will have given way to a learner-centred, competency-based paradigm. In particular, learning communities and collaborative approaches will flourish, making use of a new generation of easy-to-use Web-based tools and information services (e.g. Wikis for collaborative work on study projects, Weblogs for sharing ideas and comments, RSS feeders and aggregators for receiving current "real world" information, etc.).

Furthermore, teachers and students will have an ePortfolio to document study results and creative works, reflect upon learning progress, and share resources and experiences with peers.

Leading educational institutions will build on a new generation of learning organisation systems that offer teachers the opportunity to re-use tried and tested Learning Designs for collaborative study projects that are fully described with regard to learning goals and activities, technical set-up for the suggested tools, and available up-to-date information resources.

Open and easy access to e-content repositories of academic and educational institutions, public sector information agencies, libraries, museums and other cultural institutions will allow for making use of information sources as needed to carry out creative projects and study work. The European Digital Library will be well established and provide access to millions of digital resources of cultural heritage and other institutions across Europe.

Many of the academic, educational and cultural e-repositories, large general ones as well as specialised smaller ones, will already be using Semantic Web technologies to enable enhanced navigation of integrated information spaces based on ontologies. This will also enable learners to develop a deeper understanding of the terms used in a field of study, how a discipline classifies entities, and which ontological concepts form the basis of its body of knowledge.

Perhaps a bit further into the future we may see education and lifelong learning benefit from software agent based Semantic Web services that are capable of assembling individual learning packages according to expressed interests in certain topics and level of mastery (e.g. "introductory" or "professional").

Though not covered in the OLCOS road mapping, we would also expect all larger enterprises and many innovative SMEs in Europe to make use of highly integrated knowledge and learning management systems interlinked with repositories and information services of Higher Educational institutions and other publicly funded centres of research and teaching.

Of the commercial publishers, those who develop innovative offerings that are outstanding in terms of fostering competences and skills for the knowledge society will thrive. In particular, this could be tools and content for exploratory and constructive learning activities (e.g. future "Lego Mindstorms" type offerings), advanced simulation environments for science teaching, or games-based virtual worlds that foster the understanding of social and economic dynamics through interactively changing rules and constraints.

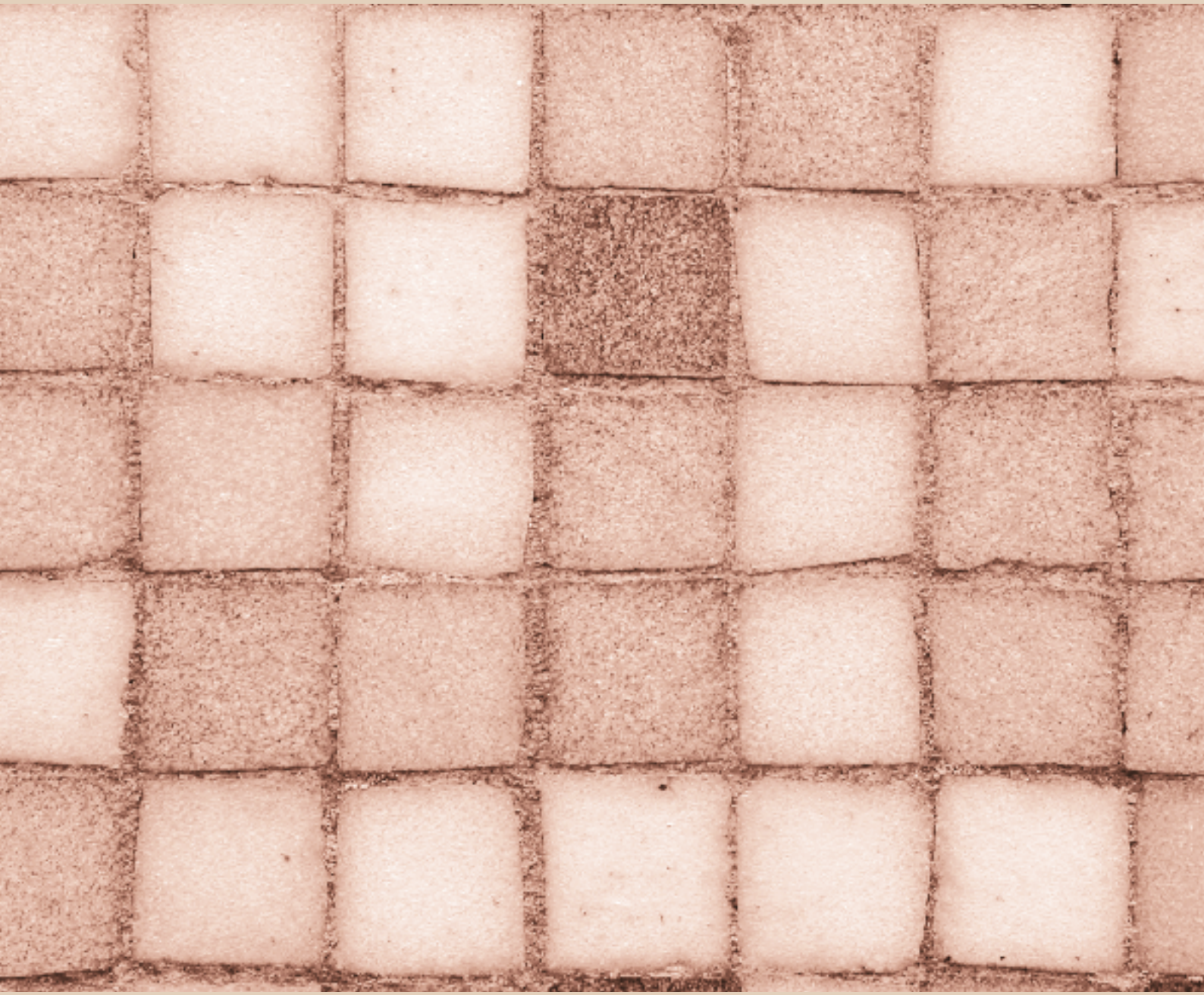
In the domain of basic education, commercial products that allow children to learn as they play will be of considerable interest, while in the secondary and tertiary educational sectors services will flourish that create and update content packages according to study needs. Overall, the critical success factors for educational publishers will be to adapt to the Web services based information environment and develop services teachers and learners want to use in conjunction with a solid basis of didactically state-of-the-art textbook-type material.

In the creation and provision of educational content services for all levels of teaching and learning, re-use of resources will be a routine practice that allows for achieving a much higher return on investment of public funding. The basis for this will be many alliances in the collaborative development and management of content and services emphasising re-usability, i.e. fully based on open technical standards/specifications and licenses that do not restrict effective re-use.

As a rule, all educational material as well as research publications, the creation of which has been publicly (co-)funded, will have to be published under an appropriate open content license. Licensing modules will be integrated into major software applications and in this way licensing can be done easily or will in fact be made automatic for content required to be made available under a certain open content license.

Teachers and tutors will have the skills and tools to easily modify, combine and repurpose useful material for presenting and discussing specific topics. However, a much higher proportion of teachers' work will concentrate on coaching students in assessing the relevance of information from various services, advising on study approaches, and discussing results of students' work critically.

With respect to Open Educational Resources, teachers will not be simple "end-users", as they understand the importance of continuous questioning, evaluation and improvement of educational practices and resources. As members of communities of interest in different disciplines and subjects, they will share experiences, lessons learned and suggestions on how to better foster the development of students' as well as their own competences and skills.



8 Recommendations

The OLCOS road mapping has been carried out to inform and support a transformation in educational practices that brings learning processes and their outcomes closer to what individuals will need to participate successfully in the knowledge society.

Acquiring the competences and skills for the knowledge society will demand that educational practices give priority to learners' own explorative, constructive and communicative activities instead of a teacher-centred knowledge transfer model of education.

OLCOS advocates open educational practices that are more likely to allow for learning experiences that are real, rich and relevant. As the knowledge society builds to a large degree on digital environments of work and social communication, such practices will foster in particular an active, self-managed and constructive engagement of learners with digital content, tools and services in the learning process.

Open Educational Resources (OER) are understood to be important facilitators of educational innovation, but the assumption that OER per se could bring about the required transformation in educational practices is a misleading one.

OLCOS' understanding is that a decisive shift towards open educational practices must take place before educational institutions, teachers and learners will benefit fully from freely and easily accessible and re-usable resources. An educational culture and mindset must be fostered that builds on sharing of resources for, and experiences from, open educational practices.

For teachers, this would for example include sharing within a community of practice experiences, lessons learned and suggestions on how to better foster the development of students' as well as their own competences and skills. This would be part of a new understanding of teachers' professional work that includes a permanent questioning, evaluation and improvement of educational practices and resources.

While this is most important for innovating teaching and learning, there is also an economic aspect to Open Educational Resources that should catch the attention of policy makers and funding bodies. The strong emphasis on re-usability of OER in terms of technical standards and licensing can allow for achieving better cost-effectiveness through sharing and re-using of resources among educational communities and networks. In addition, this has the potential to promote quality control and continuous improvement of resources.

The following recommendations suggest measures that different stakeholders can apply to promote and support open educational practices and benefit from sharing and re-using Open Educational Resources.

8.1 Recommendations for educational policy makers and funding bodies

Recommendation 1: Promote open educational practices that allow for acquiring competences and skills that are necessary to participate successfully in the knowledge society

Promoting open educational practices and resources is a key measure educational policy makers and funding bodies can adopt to bring education and lifelong learning closer to the demands of the knowledge society. Educational policy makers should consult the reference framework "Key Competences for Lifelong Learning" (European Commission 2004) and similar frameworks developed at the national level, and demand educational institutions to ensure that teachers and students acquire the competences and skills that are considered necessary to participate successfully in the knowledge society.

Funding bodies that sponsor educational initiatives should demand that those who propose projects explain how the intended results can effectively support innovative educational and lifelong learning practices that promote required competences and skills for the knowledge society.

Recommendation 2: Foster the development of Open Educational Resources

Educational policy makers and funding bodies should demand that academic and educational resources that have been fully or to a large extent publicly funded be made freely accessible on institutional and/or central e-repositories under an appropriate license (e.g. Creative Commons Attribution–ShareAlike or GNU GPL).

To achieve this goal, they should engage in creating a favourable environment for Open Access, for example in negotiations with academic and educational publishers, learned societies, educational associations and others.

More specifically, they should demand that content be liberally licensed for re-use in educational activities, favourably free from restrictions to modify, combine and repurpose the content. To enhance re-usability, regulations should also emphasise that open content standards and formats should be employed in the content creation and provision.

With respect to software-based systems and tools that are developed by, or acquired for use in, academic and educational institutions, policy makers and funding bodies should require that wherever possible and reasonable open technical standards/specifications should be used and Open Source software licensing be employed.

Regarding publicly funded Internet-based applications and services, open Application Programming Interfaces and authorisations to re-use services should be made available.

Recommendation 3: Support the development of widely used, state-of-the-art and sustainable open access repositories

Many current-generation open access repositories find it difficult to grow and attract a broader base of active users. Part of the problem is that projects often receive only some initial funding and need to be maintained through the work of volunteer educators and "in kind" support of IT personnel and technical resources of an academic or educational institution. Consequently, there are considerable barriers to implementing state-of-the-art technologies for content management, sharing and re-use and, in particular, to supporting communities of practice effectively.

Funding bodies should concentrate on fostering the development of widely used, technologically state-of-the-art and sustainable educational open access repositories. Therefore,

selection criteria should require that project proposals show an in-depth understanding of how as broad as possible an active usage of the repository can be established through integrated organisational approaches and appropriate technological systems, tools and services. Funding schemes should provide projects with a longer-term perspective, in that they will receive initial funding for achieving full operation, and further funding will be based on a critical assessment of factual usage.

Recommendation 4: Demand public–private partnerships to concentrate on ventures for innovating educational practices and resources

Commercial e-learning technology, content and service providers are often interested in cooperating with larger educational institutions and networks based on a public-private partnership (i.e. projects involving public funding). However, they show little propensity to invest ahead in innovations that go beyond what has so far been proven to work from a commercial as well as an institutional point of view. Today, most of what constitutes established ICT-supported teaching and learning has been transposed from the traditional model of knowledge transfer. Innovative approaches are rare and not embedded in regular practices.

Therefore, educational policy makers and funding bodies should foster and support ventures for offerings that are likely to drive innovation in educational practices and resources. As described in the OLCOS Roadmap, such offerings will need to include "social software" tools and services of the so-called Web 2.0 environment. Funding programmes and calls for proposals in the area of ICT-enhanced education and lifelong learning should emphasise that project concepts that integrate such tools and services in convincing ways are particularly welcome. This may also attract proposal consortia comprising partners other than traditional educational technology and content companies, and lead to innovations in products and services that will stimulate the educational market as a whole.

8.2 Recommendations for boards, directors and supervisors of educational institutions

Recommendation 1: Scrutinise whether educational institutions are employing innovative approaches beyond teacher-centred knowledge transfer

Boards, directors and supervisors of educational institutions should understand that, in open educational practices that privilege learners' own activities, competences for the knowledge society are more likely to be developed than in "closed", predominantly teacher- and subject-centred education. Consequently, they should ask whether an institution is employing innovative approaches in which teachers are changing their currently predominant role of dispensers of knowledge to facilitators of individual and collaborative development of competences and skills.

Questions they could pose, for example, are: Do the educational practices foster a high degree of autonomy, self-direction and personal mastery of students? What amount of teachers' work concentrates on coaching students with regard to identifying real world problems, clarifying study approaches, assessing the relevance of information and observations, and critically discussing study results? Do students learn to document and communicate results of individual and collaborative projects, and make them available for others? Do they know about Intellectual Property Rights, copyright exemptions and fair use, and how to license products of their own creative work?

Recommendation 2: Promote sharing and re-using of Open Educational Resources and experiences from open educational practices

Boards, directors and supervisors of educational institutions should be aware that sharing and re-using of open resources from a common pool of content, tools and services can have many favourable effects for the institution, the teachers and students, the educational community and profession, and the public at large.

This includes the fact that content acquisition and development costs can possibly be reduced, and the quality of resources leveraged through quality control and improvements within networks of committed developers and users, a mechanism that has often been shown to lead to good results (for example, in developing Open Source software).

A wider circulation, (re-)use and improvement of resources mean that taxpayers' money will see a better return on investment. However, rather than placing too high expectations on the working of an "invisible hand", educational institutions may be well advised also to establish cooperation directly in Open Educational Resources. Certainly, the fact that resources made available will be assessed critically by partner institutions will also have a positive effect with regard to internal quality criteria and control.

From the perspective of the educational discipline and profession, boards, directors and supervisors should encourage teaching staff not only to make available learning designs and material on open access repositories, but also to reflect on educational processes and share with colleagues experiences, use cases, lessons learned and suggestions on how to improve teaching practices.

Recommendation 3: Establish reward mechanisms and supportive measures for developing and sharing of Open Educational Resources and experiences

In order to foster the sharing of Open Educational Resources and experiences, boards, directors and supervisors of educational institutions will need to question established values, traditions and practices. In the domain of Higher Education institutions, greater value is often attached to research than to teaching, in particular when it comes to academic promotion. Hence, there is little incentive and support for faculty to excel in developing and sharing open educational material and experiences. Also, other educational institutions such as secondary academic schools currently lack such incentives and support.

Boards, directors and supervisors should demand that educational institutions introduce incentives for developing and sharing open resources and experiences, in particular of significant relevance in academic or other promotion. They should also require implementing appropriate training and support to ensure a broader and sustained participation of staff. Initiatives in Open Educational Resources should not be left to individual researchers and teachers; however, those who lead by example should be recognised appropriately.

Recommendation 4: Clarify copyrights and define licensing schemes for making Open Educational Resources available

In many institutions it is far from clear who owns copyrights and what licenses should be used when making resources available for others. Boards, directors and supervisors of academic and educational institutions should demand that contracts of researchers and educators contain regulations regarding copyrights and licensing of any content and/or software they create.

Such contracts should acknowledge the IPR of authors, but require non-exclusive copyrights for the institution to make academic and educational resources available under appropriate open content and open source software licenses.

Furthermore, tools should be implemented that support mechanisms to (semi-)automatically attach licenses to material that is made available.

It will also be beneficial to advise research, teaching and IT staff on what licensing conditions are acceptable when acquiring resources from external sources. This should include favouring available open content and open source software, if appropriate.

8.3 Recommendations for teachers

Recommendation 1: Clarify the professional role, appropriate approaches and required skills of a teacher in a knowledge society

Teachers and tutors should understand the great importance of education and lifelong learning in the knowledge society and clarify their professional role, appropriate approaches and required skills. In particular, teachers should change their role from dispensers of knowledge to facilitators of open educational practices that emphasise learners' own activities in developing competences, knowledge and skills.

However, enabling the development of analytical, conceptual, problem solving and creative skills as well as learners' self-direction, communication and team skills is far from trivial. Therefore, a new professional understanding should include the requirement that teachers regularly question, evaluate and improve educational practices and resources. Also, sharing among a community of practice experiences, lessons learned and suggestions on how to better foster the development of students' as well as their own competences and skills should be an important part of a teacher's professional life.

Recommendation 2: Employ open educational practices to help learners acquire competences for the knowledge society

Teachers should devise processes that engage students in active, constructive engagement with learning content, tools and services. Rather than concentrating mainly on transferring subject-based knowledge, they should coach students in how to identify and study real world problems, assess the quality of information sources, and critically discuss results of their studies. In open educational practices, such as collaborative study projects, teachers should also advise students to document and reflect on their study progress (e.g. in an e-portfolio) and to share learning experiences and results with others.

Recommendation 3: Make use of tools and services that support collaborative learning processes and learning communities

As facilitators of open learning practices and processes, teachers should favour learning designs that make use of tools and services for collaborative learning and sharing of ideas, experiences and study results. Teachers should be aware that there is available a new generation of easy-to-use tools and services commonly referred to as "social software" (e.g. Weblogs, Wikis, RSS-based content provision, etc.). They should experiment with such tools and services that allow for sharing of ideas, collaboratively creating study content, providing comments and links to relevant resources, etc. in an information environment that these teachers and learners can manage themselves. Also, communities of practice of teachers can benefit greatly from making use of such tools and services.

Recommendation 4: Share proven learning designs, content and experiences through open access repositories and open licenses

Teachers and tutors should know about open access repositories and services in their fields of interest, regularly scan interesting resources, and re-use learning designs and resources if appropriate. This can include re-using the structure of some type of content (a template of a work sheet, for example) and adapting parts of the content by choosing other problem descriptions and examples, adding relevant images and figures, providing links to fresh information, etc.

In an open content value chain, proven learning designs, enriched content, and experiences from the learning process should again be made available via an open access repository for others to benefit from such value-added educational material. If not asked for by the repository in any case, teachers should themselves consider licensing their material under an open content license with as few restrictions as possible regarding re-use (e.g., Creative Commons Attribution–Share Alike).

8.4 Recommendations for students

Recommendation 1: Demand educational approaches that allow for acquiring competences and skills for the knowledge society

Learners should demand that educational institutions and teachers help them in acquiring the competences and skills to participate successfully in the knowledge society. They should ask for educational approaches that ensure that learning experiences are real, rich and relevant, for example through addressing real world problems, working collaboratively, using new tools and information services, and critically discussing content and study results. Regarding primary and secondary schools, parents should also take a keen interest in what educational practices are prevalent in the classroom and themselves stimulate children to become self-directed, creative and critical learners.

Recommendation 2: Suggest open learning practices using new tools and services

Students should challenge teachers and suggest learning approaches that allow them to play to their strengths by using creative and social software tools for coursework and carrying out study projects. For example, such suggestions could be: Why not use Weblogs to share ideas, observations and commented links to useful study material? Why not use a Wiki for a collaborative study project? Why not subscribe to thematic RSS feeds that provide a project with relevant and regularly updated "real world" information? Why not document field work with digital recording devices and make available images, sound or video recordings accessible via pod- or videocasting?

Recommendation 3: Develop one's own ePortfolio and make study results accessible to others

Learners should set up and develop their own e-portfolio for documenting and reflecting on the progress and results of their study work. They should also use the opportunity to share results they are proud of in an open access repository of their educational institution or other repositories they consider relevant in order to make their creative work known and accessible to others.

Recommendation 4: Respect IPR/copyright of others and make one's own creative work accessible under an open content license

Learners should respect the intellectual and creative work of others, adhere to principles of fair use, and always acknowledge others' work they build on. For their own creative work they should consider making it accessible to others under an open content license (e.g. Creative Commons Attribution–Share Alike).

8.5 Recommendations for educational repositories

Recommendation 1: Do not follow a top-down strategy of delivering learning objects; empower teachers and learners

Educational repositories should abandon the top-down approach of trying to deliver learning objects to teacher-centred education, as this reinforces the still dominant knowledge transfer model of education and will not promote innovation in teaching and learning.

Instead, repositories should promote open educational practices and empower teachers and learners to do and achieve something themselves. This is not about repository users as consumers but as potential co-creators of shared, commons-based resources.

Empowering users is of particular importance for the sustainability of OER repositories that want to grow based on user contributions. To achieve this they must provide the right environment and remove barriers that hinder the growth of content sharing communities.

Recommendation 2: Support individual content creators and communities of practice with useful tools and services

OER repository initiatives often start from the notion of "build it and they will come", and harbour optimistic expectations that many teachers and learners will share their own and re-use teaching and learning material from others. Yet, experience shows that such repositories have difficulty finding appeal and usage.

A recommendation for a probably more successful approach is to consider more thoroughly how tools and services can make it beneficial for content creators and providers to make use of the repository. For example, individual educators will want to manage, update and license their own course material easily; communities of practice will welcome having, in conjunction with a content repository, tools for collaborative work (e.g. project Wikis), aggregating RSS feeds that are relevant to their subjects and methods, receiving alerts on newly uploaded material, etc.

In short, if a repository does not become a place for individuals and groups who take a keen interest in their own content, including the desire to see it widely used by others, there is little likelihood of seeing it flourish.

Recommendation 3: Make licensing of content as easy as possible

Educational repositories should make licensing of content as easy as possible. This includes, first and foremost, finding a good way to guide users to licensing information as well as providing the right information details. In this context, open content projects may benefit from identifying and following best practice in the field (i.e. re-use of licensing information from similar projects).

Furthermore, repositories should make the licensing task as easy as possible, which will be of particular importance if users are invited to contribute content. If a repository has no licensing functionality, it will be beneficial to direct users to the Creative Commons licensing tool.

It is also generally advisable to keep the number of allowed licenses as low as possible, ideally one license for all the content that is shared, with few restrictions regarding re-use.

Recommendation 4: Allow for easy discovery of and access to resources

Educational repositories should not remain isolated stores of content, but become active information providers who make sure that their holdings can be easily discovered and accessed by potential users.

This requires letting search engines find and index material, which will allow users "to come through the backdoor" rather than use the repository's own database search interface. In addition, repositories should consider making metadata available for federated search across many repositories and other information services (e.g. based on Open Archive Initiative metadata harvesting).

Furthermore, repositories should offer Really Simple Syndication (RSS) feeds that enable education portals to provide continuously updated information, e.g. about newly available resources on certain topics. Such feeds should also be made available for teachers and learners.

Recommendation 5: Assist open content initiatives in the creation of rich metadata and provide semantically enhanced access to resources

Educational e-repositories have an important role to play in the creation of rich metadata and opportunities of enhanced access to resources. Of fundamental and immediate importance is that they should inform initiatives for open resources early on about the importance of quality and consistency of metadata (e.g. controlled vocabularies). This will need to include advising on the right balance of costs and benefits of having rich metadata and the requirement of employing skilled personnel.

In the longer term, e-repositories could connect teachers and students better to the body of formalised knowledge in certain domains. Such knowledge is represented in systems like thesauri, classification systems, taxonomies and richer domain ontologies. Over the coming years such knowledge organisation systems will increasingly be made available via Semantic Web applications. This will provide users with semantically enhanced access to content as well as the opportunity to develop a deeper understanding of the terms used in a field of study, how a discipline classifies entities and which ontological concepts form the basis of its body of knowledge.

Perhaps the best way e-repositories can help in the further development of "webified" knowledge systems and semantically enriched resources is to demonstrate to user communities the benefits of such systems and resources, e.g. by offering concepts-based access to resources, semantic browsing or tools such as semantic Wikis.

8.6 Recommendations for developers and implementers of e-learning tools and environments

Recommendation 1: Involve teachers and students in the development of learning tools

At present there is a considerable gap between developers of e-learning tools and teachers and students. Many relevant tools are available but little opportunity exists for potential users to try them "hands-on" and to provide valuable feedback. Developers of e-learning tools could benefit considerably from receiving more information about what existing functions teachers and students appreciate or find less useful, and what additional features they would welcome

having available.

Therefore, tool developers should actively seek to involve teachers and students in collaborative development, which could help greatly in making tools more usable in educational contexts. In fact, for the adoption of a tool it will be important that the users develop a sense of ownership and take an interest in its further development.

Recommendation 2: Promote open educational practices through help in setting up appropriate tools

In open educational practices teachers and students as part of active, self-managed and constructive learning processes will more often create, manage, license, share and re-use content. Such practices do not require large, centrally managed systems; rather, they will make use of easy to implement and manage tools and services such as Wikis, Weblogs, Web-based e-portfolios, RSS feed aggregators, and others. However, groups of teachers and students will benefit from the technical advice and support of institutional IT staff in selecting, setting up and using appropriate tools. Making use of available licensing plug-ins will enable teachers and students to make their own content available more easily under an open content license.

Recommendation 3: Favour institutional learning environments that support group-based, collaborative learning practices

Educational institutions should favour learning environments that support collaborative study and allow for making use of a variety of information sources. Technology implementers at institutions that already employ Virtual Learning Environments (VLEs) for organising courses should explore and suggest opportunities to make use of Wiki, Weblogging and other "social software" functionality and to integrate thematic RSS feed channels.

Recommendation 4: Closely observe the development and consider testing of Learning Design based systems

At present a new generation of learning management systems is being developed that enable the authoring, handling and sharing of Learning Designs for sequences of group-based learning activities involving rich interaction of learners with teachers and peers. Such systems make use of the IMS Learning Design specification, which was created to allow for implementing a wider range of didactical concepts in a standardised way. Developers and implementers of institutional learning environments should observe this development closely and consider the testing of sufficiently robust applications.

9 Selected projects and resources

The following forty projects and resources have been selected to illustrate the richness and diversity of the current initiatives in open educational and related resources and practices:

AVOIR – African Virtual Open Initiatives and Resources, http://avoir.uwc.ac.za

Center for Open and Sustainable Learning (COSL) / OpenEd conferences, http://cosl.usu.edu

Commonwealth of Learning – Learning Object Repository, http://www.col.org/colweb/site/pid/2922

Connexions (online platform for managing and sharing of open course modules), http://cnx.org

Creative Commons, http://creativecommons.org

Development Gateway – Open Educational Resources (aims at putting the Internet to work for developing countries), http://topics.developmentgateway.org/openeducation

Directory of Open Access Journals, http://www.doaj.org

Edublogs Awards, http://www.incsub.org/awards/

EducaNext (open content brokerage service for Higher Education), http://www.educanext.org

Education Podcast Network, http://epnweb.org

Elgg.net (educational community software initiative), http://elgg.net

Freesound (a growing database of sounds that are licensed under the Creative Commons Sampling Plus License), http://freesound.iua.upf.edu

GLEF Learning Interchange & Edutopia (George Lucas Educational Foundation), http://ali.apple.com/ali_sites/glefli/

Global SchoolNet Foundation (promotes international cooperation in problem/project-based learning), http://www.globalschoolnet.org

GlobalText project (aims to create a free library of 1,000 electronic textbooks for students in the developing world), http://globaltext.org

GLOBE – Global Learning Objects Brokered Exchange (a collaboration of Ariadne, Education.au, eduSource Canada, MERLOT and NIME), http://globe.edna.edu.au/globe/go

INDICARE (Informed Dialogue about Consumer Acceptability of Digital Rights Management Solutions in Europe) project, http://www.indicare.org

iRights.info (an information resource on IPR and copyright; information in German), http://irights.info

Lernmodule.net (open content repository for the school sector in Germany), http://lernmodule.net

LibriVox (promotes free, public-domain audio books), http://librivox.org

M.I.T. Open Courseware (OCW), http://ocw.mit.edu

MathWorld (an extensive free mathematics resource), http://mathworld.wolfram.com

OECD – Centre for Educational Research and Innovation (CERI): Open Educational Resources project/survey, http://www.oecd.org/document/20/0,2340,en_2649_35845581_35023444_1_1_1_1,00.html

Open Education Association (promotes the idea of OER among university and college professors), http://www.openeducationassociation.org

Open Educator (focuses on knowledge sharing, tools and resources on OSS), http://www.openeducator.org

Open Knowledge Network (promotes collection and sharing of local knowledge by using flexible technical solutions; operates in Africa, South Asia and Latin America), http://www.openknowledge.net

OpenCourse.org ("Open Content + Community = Open Course"), http://www.OpenCourse.org

OpenDOAR – Directory of Open Access Repositories, http://www.opendoar.org

OpenLearn – Open University UK, http://openlearn.open.ac.uk

Project Gutenberg, http://www.gutenberg.org

Public Knowledge Project (develops free, open source software for the management, publishing and indexing of journals and conferences), http://www.pkp.ubc.ca

Reading and Writing for Critical Thinking International Consortium (supported by the Soros Foundations Network), http://ct-net.net

Schoolforge (wants schools to enjoy the benefits of Free and Open Source Software), http://www.schoolforge.net

Science Commons (aims at removing barriers to the flow of scientific knowledge and technical information), http://sciencecommons.org

Survey of Open Content Projects in Non-Western Countries, http://oc.openflows.org
Textbook Revolution (a searchable database of free textbooks), http://textbookrevolution.org

UNESCO – IIEP Community of Interest in Open Educational Resouces / OER useful resources, http://oerwiki.iiep-unesco.org

UNESCO Free & Open Source Software Portal, http://www.unesco.org/cgi-bin/webworld/portal_freesoftware/cgi/page.cgi?d=1

Wikibooks (a collection of open content, Wiki-based textbooks), http://en.wikibooks.org

WikiEducator (a Commonwealth of Learning initiative to develop free educational resources online), http://www.wikieducator.org

World Bank – Youthink!, http://youthink.worldbank.org

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