MULTI-TYPE CONTENT REPURPOSING AND SHARING
IN MEDICAL EDUCATION

E. Kaldoudi\(^1\), P. Bamidis\(^2\), C. Pattichis\(^3\)
\(^1\) School of Medicine, Democritus University of Thrace
Alexandroupoli/Greece
\(^2\) School of Medicine, Aristotle University of Thessaloniki
Thessaloniki/Greece
\(^3\) Department of Computer Science, University of Cyprus
Nicosia/Cyprus
kaldoudi@med.duth.gr, bamidis@med.auth.gr, pattichi@ucy.ac.cy

Abstract

The current enormous expansion in knowledge relevant to the medical practice constitutes a fundamental challenge to the educational mission of medical faculties. Medical academic institutions spread throughout Europe are increasingly required to invest in order to enrich their curricula with courses given by external experts, while experts working within an academic institution often restrict their state-of-the-art knowledge to a very limited audience. In order to support the emerging integrative curricula structures and accommodate the over-specialized knowledge available by different experts, information technology can be employed to develop virtual distributed pools of autonomous specialized educational modules and provide the mechanisms for searching, retrieving, evaluating and rating, adapting and revising educational content in medicine and life sciences. This paper discusses the notion of educational content in medicine, various content types, and issues of content sharing, re-using and re-purposing in multi-cultural and multi-lingual educational environments. It also presents the roadmap from simple exchanging of educational content, via customized educational content networks, towards ubiquitous educational networks for content sharing in medical and health education. This roadmap creates the conceptual background and investigates the technological framework within the spirit of the 5\(^{th}\) freedom, that of free movement of knowledge (added to the four original principles of free movement of persons, capital, services and goods in the European Union) newly introduced by the heads of EU states and governments on Friday, 14 March 2008 in a statement following their traditional spring summit.

Keywords [Arial, 12-point, bold, Alignment left]
Medical education, e-learning, active learning, web collaboration, Web2.0, Web3.0, semantic web services

1. INTRODUCTION

Continuous advances in medicine and biological sciences lead to an ever expanding core knowledge relevant to the medical practice [1]. Thus, medical academic institutions are increasingly required to invest in order to enrich their curricula by developing overspecialized courses and corresponding educational content. It is evident that such an overspecialized expertise cannot be readily available in any medical academic institution, thus external experts have to be involved. More-over it cannot be easily available for professional medical doctors in their life-long continuous education. Although there is an abundance of up-to-date overspecialized medical educational content available in individual academic institutions, such content cannot at the moment be easily discovered, retrieved, re-used and thus shared across institutions and among medical teachers and students.

An increasing number of higher academic institutions are using a variety of web-based learning management tools to support their teaching. This gained experience indicates that similar web-based tools can support and enhance educational collaboration on a permanent basis among higher education and research institutions in medicine. Developers of e-learning around the world point out that access to comprehensive repositories of learning objects (LOs) and metadata is the crucial factor
in the future of e-learning. Large international consortiums from research and the industry are aiming to build a common path for this vision of interoperability.

Indeed, a number of research projects are already dealing with the exchange of learning objects (LOs). ARIADNE (Alliance of Remote Instructional Authoring and Distribution Networks for Europe) was among the first consortiums that significantly contributed to technology-based education and sharing of training material. In the case of COSMOS (An Advanced Scientific Repository for Science Teaching and Learning) and COLDEX (The Collaborative Learning and Distributed Experimentation) researchers aim to expand learning resources among institutions for science instruction at secondary and university education. CELEBRATE (Context eLearning with Broadband Technologies) and SLOOP (Sharing Learning Objects in an Open Perspective) also aim to create a database of learning objects for primary and secondary schools throughout Europe and extend it for all levels of formal and non-formal education. Other projects like SeLeNe (Self e-learning Networks) have contributed to the formation of learning communities by relying on semantic metadata describing educational material. EdReNe (Educational Repositories Network) aims to facilitate access to the existing web-based repositories of learning resources by providing recommendations and useful tools. At a national level, UCeL (Universities’ Collaboration in e-Learning) in UK attempts to collaboratively produce and share resources for medicine and other health-professional disciplines. Beyond the borders of Europe, in Canada, Australia, and the U.S., several initiatives have been already launched to create a university-level formal education platform providing reusable learning objects for all disciplines, like GEODE (Global Education Online Depository and Exchange), MERLOT (Multimedia Educational Resource for Learning and Online Teaching), CLOE (Co-operative Learning Object Exchange) and others. Over and above, ARIADNE together with Education Network Australia (EdNA Online), LORNET in Canada, MERLOT in the US, and NIME (National Institute of Multimedia Education) in Japan have established the Global Learning Objects Brokered Exchange (GLOBE) and committed to work collaboratively on a shared vision of ubiquitous access to quality educational content. More recently, the IntraMedNet project, which is in its final phase, has established a Mediterranean intranet for the sharing of educational material in life sciences and during its sustainability study has stressed the need for a standardized, dynamic content sharing infrastructure. Additionally, the eVIP project, currently under way, is working on standardizing a particular type of medical educational material, namely virtual patients, so that they can easily be shared among medical educators. EUROGENE, at its initiating phase, aims to standardize the development and sharing of educational material in the area of genetics. Finally, the LUISA project, currently under way, aims to develop a semantic reference architecture for the sharing of educational content based on service-oriented commonplace web technology. From the above analysis it is evident that although a lot of effort has been put in the area of educational content development, description, and sharing, currently there is no prominent clear and standards-based solution for the seamless sharing of educational content in medicine and in general.

In order to support the emerging integrative curricula structures and exploit the over-specialized knowledge available by different experts, information technology can be employed to develop virtual distributed pools of autonomous specialized educational modules and provide the mechanisms for searching, retrieving, evaluating and rating, adapting and revising educational content in medicine and life sciences. Along these lines, the IntraMEDnet project (IntraMEDnet: A Mediterranean Research and Higher Education Intranet in Medical and Biological Sciences*, funded by the EU Community Initiative Programme INTERREG III ARCHIMED, European Regional Development Fund, 2006-2008) in the Eastern Mediterranean explored the idea of exchanging expert educational material among medical universities. Partners from 5 universities from 3 different European countries developed a distributed pool of specialized educational modules in state-of-the-art scientific issues related to medicine and biological sciences which are then exchanged amongst the partners in order to form integrated educational units [2].

The logical evolution is towards the automated sharing (rather than manual exchanging) of such educational modules. This approach is currently been realized within the WideMEDnet project (WideMEDnet: A Mediterranean network for Higher and Continuing Medical Education Resources*, funded by the EU Community Initiative Programme INTERREG III ARCHIMED, European Regional Development Fund, 2008). The pool of educational modules developed in IntraMEDnet is expanded and seamlessly shared amongst the participants via a customized network of learning management systems.
The next step is to implement efficient brokerage mechanisms for educational content sharing (including discovery, retrieval and seamless use) in higher medical education institutions across borders and irrespective of technological platforms. Towards this end Web 2.0 and Web 3.0 technologies are best candidates to create ubiquitous educational networks that can offer opportunities for health professionals and patients to have open access to information and share ideas, questions, and opinions. This is the aim of mEducator, a newly formed consortium of 14 partners from 10 EU countries, currently under final negotiations to receive an eContePlus2009 EU grant. The aim of the project is to elaborate on pedagogical, technical, standardization, cultural, social and legal issues towards a standard-based infrastructure that enables the sharing of state-of-the-art digital medical educational content among medical educators and students in European higher academic institutions. Results and best practices as developed by this best practice network are expected to be readily transferable to scientific areas other than medicine.

This paper discusses the notion of educational content in medicine, various content types, and issues of content sharing, re-using and re-purposing in multi-cultural and multi-lingual educational environments. It also presents the roadmap from simple exchanging of educational content, via customized educational content networks, towards ubiquitous educational networks for content sharing in medical and health education. This roadmap of the three EU projects (IntraMEDnet, WideMEDnet and mEducator) creates the conceptual background and investigates the technological framework within the spirit of the 5th freedom, that of free movement of knowledge (added to the four original principles of free movement of persons, capital, services and goods in the European Union) newly introduced by the heads of EU states and governments on Friday, 14 March 2008 in a statement following their traditional spring summit [3].

2. CONTENT IN MEDICAL EDUCATION

Educational content in medicine includes a broad range of learning object types that address both aspects of medical education, namely theoretical instruction and clinical apprenticeship. Apart from educational content that is produced by academics and clinical teachers based on accepted scientific knowledge, medical education is greatly based on data and material produced in the hospital and the medical practice [4].

Another important factor that adds to the complexity and variability of medical educational content is the shift from traditional classroom-based teaching towards adult education [5]. The problem of the ever expanding knowledge, core and discipline as well, questions the educational approach where knowledge is seen as a quantity that can be transferred from one individual to another. Current approaches focus on adult education and situational learning and are active, self-directed and experiential, with a readjustment from process to product. The emerging view is of learning as an active, constructive, social, and self-reflective process with the aim to develop problem-processing skills, self-directed learning skills and group competence. These basic research findings on learning suggest the need for educational environments that are learner-centered and knowledge-rich, guided by assessment, and situated in a community of learners. Thus in current medical education, educational programs increasingly include case-based or problem-based learning and other small group instructional models, collaborative organizations to support student-faculty interactions, and technology-enhanced educational tools. Furthermore, new integrative curricula structures are proliferating in the form of multidisciplinary block courses in the basic sciences, blended clerkships (combining two or more specialties into one clinical experience), and integrated clinical experiences in multidisciplinary health care settings.

Under the above considerations, educational content in medicine corresponds to a wide variety of objects. These include:

(a) conventional educational content types also used in other areas, such as lecture notes, books, lecture presentations, exam questions, practicals, scientific papers, graphs, images/videos, algorithms and simulators;

(b) educational content types unique in medical education, such as teaching files, virtual patients, evidence based medicine forms, objective standard clinical examinations, clinical guidelines, anatomical atlases, electronic traces of images, etc; and
(c) alternative educational content types, either reflecting active learning techniques (extensively used in health education) and/or stemming from newly introduced web 2.0 technologies, such as problem/case based learning sessions, serious games (2D/3D), web traces, wikis, blogs/discussion forums, etc., including the notion of medical expert instruction in which ever form this may be presented.

Considering the state-of-the-art nature of such content, it is imperative that medical educational content can be repurposed, enriched, and embedded effectively into respective medical and other related scientific curricula, clinical practice and continuing education, as well as public dissemination and awareness.

Although many higher education institutions in Europe often use educational resources written in non-native languages (mainly English), while some courses (especially at the postgraduate level) may also be taught in English, the rule is that higher education is and should be delivered mostly in the native language. This is especially a mandate in healthcare, as acquired knowledge should be finally communicated to the patient. Additionally, common experience shows that there is also a demand for content localization. In the case of medical, and scientific content in general, this mainly refers to different legislation and local medical regulations, different lab tests norms, reference values and units as well as different medical requirements of various ethnic groups. Moreover, we should also consider the cultural differences among different user groups within the same national healthcare system. Healthcare education addresses a multitude of professions, ranging from medical doctors to nurses and lab technicians, to basic life scientists and even healthcare administrators. Thus, the same educational content often needs to be adapted in order to be delivered to an audience of a different background. Finally, we should also note the different pedagogical cultures present in healthcare education, which range from the conventional lecturing to clinical practice and a variety of active learning methodologies. All of these educational approaches would require the same content to be presented in a different way, e.g. a lecture presentation and notes for the conventional teaching approach should be restructured to be presented as, for example, a list of questions and answers or as a series of real world problems, or a collection of interactive teaching files in the case of a more active learning episode.

Therefore, when content sharing is considered, the notion of re-purposing becomes a central requirement. The term re-purposing is used here to collectively refer to all instances that require any change and re-making of a particular educational content item to account for reasons such as:

- **Multilingual use**: Repurposing of learning resources to different languages increases access and improves opportunity for uptake by other institutions worldwide. The use of a standard terminology is a key factor in this task. For example SNOMED is a multilingual international Clinical Standard Terminology describing more than 800,000 description terms for medical concepts. Keywords based on SNOMED Terminology can index clinical cases, images, relate clinical information, and healthcare educational content.

- **Multicultural use**: Repurposing to a different culture is to change the ‘health care law and social practices in a certain region’ component of a learning resource to fit those of another region. Repurposing of learning resources to different cultures ensures that localised versions will be more appropriate for use in different countries.

- **Different educational levels**: Repurposing a learning resource to different educational levels is to selectively adapt content to match the learning objectives of a group of learners. Repurposing of learning resources to different educational levels ensures that learning resources can be used by a greater number of students. This type of repurposing provides an opportunity to align with the Bologna process.

- **Different educational scenarios**: Repurposing a learning resource to a different educational scenario is to adapt the learning resource so that it can be used in different ways in the curriculum. For example, learning resources can be used before teaching sessions, within teaching sessions, after lessons and before exams, for formative/summative assessment, or for self-directed learning. Repurposing for educational scenarios ensures a greater choice of approach to using learning resources for staff and students.
• Different subject disciplines or healthcare professions: Repurposing a learning resource for a different subject discipline or healthcare profession is to widen the use by different groups from other medical and healthcare professions in addition to undergraduate medical and healthcare students.

• Content enrichment: Content enrichment is applicable to all kinds of repurposing and involves adding new content and media in the form of other learning objects in order to add educational value.

Additionally, reusability of such objects among different organizations requires that they are formally described with standard metadata. Learning objects, as independent units of educational material targeting to specific training needs, constitute one of the main research topics in the e-learning community. Many research initiatives in the field address the issue of LOs’ reusability, via designing standards (official or de facto), specifications and reference architectures. Types of e-learning standards and specifications include among else the following [6]:

(a) metadata standards, addressing attributes used to describe LOs, such as LOM, HealthcareLOM (extension of LOM to healthcare), Ariadne Metadata Specification (which provided input to LOM), Dublin Core, etc.; and

(b) packaging standards, regulating assembly of LOs and complex units of learning, such as IMS Content Packaging/Learning Design, SCORM (which is a combination of other standards), and HealthcareSCORM (extension of SCORM to healthcare).

Finally, seamless global sharing of educational content in medicine requires a flexible and adaptive metadata scheme for medical educational content description based on existing standards (such as LOM, and HealthcareLOM) for medical learning object description. Special consideration should be given to issues such as: (a) metadata multiliguality; (b) metadata to address competency/outcomes profile matching; (c) different presentations of the same content, e.g. for users with special needs, for various display devices, etc; (d) contextual learning objects, i.e. originally designed to have a specific meaning and purpose for an intended audience; and (e) mutated learning objects, i.e. re-purposed and/or re-engineereed from their original design for a different purpose and/or audience, while attaining an acceptable level of validity.

3. EXCHANGING CONTENT OVER THE WEB

Considering current state of the art as well as common practice in related technology, the IntraMEDnet consortium has developed a first approach towards sharing medical educational content. In 2006, the IntraMEDnet consortium of five Universities from three different European countries was granted a 2-year fund to establish a Mediterranean higher education intranet with the goal to employ already proven web-based learning and collaboration tools in order to create a virtual education network among medical institutions [7].

For the needs of the IntraMEDnet project, the research teams of the partners involved in the project have identified general educational topics of common interest, based on current educational needs of the partners’ institutions as well as based on existing expertise and excellencies within the partners. For each such general topic, specific learning objects of interest are being identified and described in detail. The major characteristics of these individual educational objects are the following: (a) they are self contained educational units; (b) they have well specified educational objectives; (c) they are thematically targeted and overspecialized; and (d) they have been developed by overspecialized experts in the specific thematic area. Furthermore, detailed educational object attributes include: creator (person and institute), target institute and course, type, educational goal, target audience, educational objectives, learning outcomes, teaching methods & strategies, content outline, evaluation strategy, learning hours/workload, provision of continuous updates (life cycle information), language(s) of instruction, and bibliography.

All educational activities in the IntraMEDnet project are deployed via open source generic learning management systems already used by the partner universities. Central to this activity is the
employment of the emerging e-learning standard Shareable Content Object Reference Model, SCORM [8]. SCORM has been designed by the U.S. Government’s initiative in Advanced Distributed Learning (ADL, http://www.adlnet.org) as a set of eXtensive Markup Language (XML) based specifications to define, manage, access and deliver modular educational objects so that they can be easily shared among different learning management systems.

At a first stage more than thirty such specialized modules have been disclosed in individual partners’ Learning Management Systems (LCMSs) on the web in a variety of thematic areas that include medical informatics, health and safety, haemodialysis, gynaecology, advanced techniques in therapy, diagnostic imaging, and scientific knowledge management. Each partner publishes their own educational modules in their LCMSs of choice as a SCORM object, and then grants access to these objects to other partners of the networks, who have to manually search and retrieve each affiliated LCMS in turn in order to retrieve specialized modules of interest (Fig. 1). Thus these specialized learning modules can be shared, used and re-used, and incorporated into courses, curricula and continuing education offered by the various partners of the consortium in order to support and enhance traditional instructional teaching in remote institutions.

Fig. 1. Schematic representation of the IntraMEDnet manual content exchange.

A major question raised during this course of educational material exchange involved the potential of using the same pools of educational modules to support active learning episodes (such as problem/case/inquiry based learning) on the web. The requirement here is to be able to combine overspecialized modules developed by different experts in remote institutions, while ensuring their virtual presence as instructors to guide students through the active learning experience. Such an endeavour places certain additional requirements, including mechanisms for personal inquiry, support of active collaboration, strong instructor’s presence, and mechanisms for continuous monitoring and evaluation. To meet this requirement, we combined collaborative tools such as wikis, blogs and forums in order to provide problem based learning solely on the web [9],[10],[11]. In these sessions, instruction is performed by an interdisciplinary team of experts from remote institutions, while the group of learners can be students from the same or different institutions within the consortium. Instructors collaboratively develop a problem in a wiki. Discussion is initiated via a problem’s blog or forum, where students and instructors collaborate to analyse the problem, identify conquered
knowledge and plan actions for problem solving. Then students search (via the web and not only) and collaborate to solve the case via the wiki. Apart from general literature inquiry, this procedure is also based on the on-demand compilation of various individual educational objects provided on the independent LCMSs in order to support and realize a specific medical didactic problem. Student activities, progress and more importantly gained experience and competences are recorded, shared and commended on via their personal blogs. The entire learning episode and all its steps (with the final problem/answer deployment) are recorded, commended on and monitored via the wiki and the participants’ blogs.

4. COLLABORATIVE NETWORKS FOR CONTENT SHARING

A sustainability study for the IntraMEDnet project indicated that further research should elaborate on novel notions of federated educational content repositories, in order to bypass the hurdle of individual, manual content access, search and retrieval, and create an environment for seamless content access. This suggestion is tackled in the follow up R&D project, WideMEDnet.

The first approach towards automated seamless educational content sharing in medicine involves the creation of a network of loosely coupled learning content management systems. The primary goal is to make this network of LCMSs transparent to each partner’s user educators. Thus user educators of the participating institutions need only be aware of their institute’s LCMS as an entry point to the educational network. Via this gateway, they can then access all educational content available by partner institutions.

A straightforward implementation of this notion was to use a custom technology private to the specific open source generic LCMS platform of Moodle (http://www.moodle.org). Moodle is a course management system designed to help educators who want to create quality online courses. The software is used all over the world by universities, schools, companies and independent teachers. Moodle is open source and completely free to use. Moodle emphasizes on social constructionist approach to education, and on mechanisms for rich interaction within online courses. It is multilingual, exhibits several thousands of registered sites, and embraces among else a variety of Web 2.0 technologies.

![Fig. 2. Schematic representation of the WideMEDnet attempt towards automated content sharing.](image-url)
More specifically, Moodle versions 1.8 and higher are enriched with Moodle Networks, a unique Moodle feature that provides a viable solution of linking moodle servers with each other so as to create a virtual single moodle website for each user. Every user logs in their own home moodle server and instantly gets access to roam and enrol to courses in the networked servers. Key features of this technology include: (a) single sign in on a server works for the whole network; (b) sharing of resources between the servers; (c) each server maintains its own user management rights; and (d) secure communication between servers with SSL and AES encryption without the need of HTTPS.

WideMEDnet partners are currently using this feature to share seamlessly educational modules available within the consortium. This way, educators as well as users can access educational modules in a technologically transparent way, via their own LCMS as a single gateway to the network (Fig. 2).

However, content sharing is still not ubiquitous. Firstly, there is the obvious limitation for the choice of technological platform, which has to be Moodle. Additionally, for further development and sustainability of the approach of module exchanging, educational modules should be described in a broader sense, considering all different pedagogical approaches employed in medical education (from instructional teaching to case/problem/inquiry/evidence based learning etc), including a variety of tools and technologies used in medical education. Further research should elaborate on a flexible and adaptive metadata scheme for medical educational content description so as to cope with different cultural, language, social and legal requirements of the different countries and to ensure semantic interoperability of educational content. Finally, requirements for efficient brokerage mechanisms for educational content sharing, including discovery, retrieval and seamless use, in higher medical education institutions across borders should be efficiently addressed.

5. TOWARDS UBIQUITOUS EDUCATIONAL COMMUNITIES

Effective technology-supported interventions are usually created when there is a successful alignment of the specific requirements with the potential and the use of technology. Therefore, requirements for flexible, adaptive and ubiquitous online content sharing should evoke notions, practices and technologies from respective state-of-the-art evolutions in the Web.

Recently the Web has changing towards a second generation of dynamic services and communication tools that emphasize on peer-to-peer collaboration, contributing, sharing, both among humans and programs. This revolution is usually known under the collective term Web 2.0 [12]. In Web 2.0 the user is seen as a contributor, rather than a recipient. Content is created by participation and collaboration as an emergent product of human interactions. In the core of Web 2.0 lies an ensemble of standards, protocols, technologies and software development architectures and approaches that enable the seamless communication of third party programs thus creating the communities and networks of services that bring people together. One can argue that a major characteristic of Web 2.0 is the fact that it continually improves and grows in size, function, complexity and approach, thus making the term even more uncertain and difficult to define. All this emergent behaviour that characterizes Web 2.0 is enabled one way or the other by a variety of applications and tools that form the core of Web 2.0, and by their turn are empowered by an ensemble of technology, embracing both familiar technology from the early days of the Web as well as innovations. Among common Web 2.0 tools that are being explored for their possible use in education [13] are wikis, blogs, podcasts, social networking tools and virtual worlds. Most often Web 2.0 sites combine more than one of the above applications, and have in common a variety of tools and features that enhance participation and collaboration such as search engines, links to other resources, ability for the user to add content and/or comments, tools for organizing content (e.g. tags, extensions by similarity, rating, etc), and signals for updates. Of particular interest are mashup and RSS feed technologies. Mashups are web applications that merge data from one or more sources and present it in new ways. In many cases this is made possible by data providers that develop application programming interfaces (APIs) for their data. These APIs follow standard web service protocols and/or generic internet formats to represent data (such as RSS) and can easily be implemented in different programming languages. At the same direction notification services offer continuous updates of web sites in a standardized for use in mashups and in a variety of other applications. Usually under the term “RSS feed” borrowed from the commonly used data representation standard RSS (meaning Really Simple Syndication or, as renamed, Rich Site Summary), they include summarized text and respective metadata and they can be read either by standalone special purpose software or by software embedded in commonly used internet tools (e.g.
web browsers, mail clients, etc). RSS feeds and similar syndication technology is also used to distribute streams of audio and video data files to personal computers and portable media players – what is known under the term podcasting.

A further interesting advancement that is currently emerging and shows potential to grow into the next Web revolution, involves what is commonly referred to as Web 3.0. The notion and the prediction of this evolution is attributed to the founders of Web Berners-Lee and colleagues [14] almost two decades ago. However, the explosion of Web 2.0 has really prepared both technology and users to emerge in the paradigm of semantic networking of information and services, thus the Web 3.0 is currently arising with a promising potential for educational applications [15]. Among other things, Web 3.0 is about making information and services more meaningful to individuals as well as programs. Such an environment is expected to shift focus from ‘finding information’ to constructing ‘meaningful and relevant information maps’, leading to personal learning agents that will eventually support individuals in maintaining and administering their personal education and personal learning network [16].

Along these lines, the aim of the newly formed mEducator consortium (14 partners from 10 EU countries) is to elaborate on pedagogical, technical, standardization, cultural, social and legal issues towards a standard-based infrastructure that enables the seamless sharing of state-of-the-art digital medical educational content among medical educators and students in European higher academic institutions (Fig. 3).

Fig. 3. Schematic representation of the mEducator approach towards ubiquitous educational communities.

The goal is to research, implement and compare two alternative solutions for educational content discovery and retrieval on the web. The first solution is based on traditional isolated learning content management systems, loosely associated via commonplace web 2.0 technologies. Each partner publishes their content in their own LCMS. Notification and updates of newly published content in other affiliated LCMSs are performed by RSS feed mechanisms. Subscription to the RSS feeds will also be open to institutions, educators and students outside the consortium. "Mashup" technology will be used in order for content to be shared by the use of standards. An independent "mashup" platform/repository will store educational content, both as assets and as aggregation objects. All network participants can upload and download educational content to use on their isolated LCMS. The second solution draws from Web 3.0 paradigm and is based on a federated architecture of LCMSs.
which is founded on a reference Semantic Web Service (SWS) architecture [17] for search, interchange and delivery of learning objects.

Collaboration and content sharing (i.e. virtual expert educator sharing) in medical education will inevitably alter the overall process of developing and preparing course materials. Participants in a content sharing network share responsibility for ensuring that the collaborative process is successful. The formation of task forces (or consortia) of participants is one approach to ensure that full responsibility is not vested in just one of the institutions involved. With this in mind, the notion of collaboration goes beyond merely sharing tasks and content across different educators. Shared resources should be used along with educational standards for the interoperable use of medical educational material across Europe in order to maximise content uptake by medical educators in attempting to underpin and extend current teaching and learning, minimise inefficient practice, reduce costs, and eventually improve the consistency and quality of health care and well being of patients throughout the EU.

Acknowledgement

This work was supported in part under the grants: (1) “IntraMEDnet: A Mediterranean Research and Higher Education Intranet in Medical and Biological Sciences”, 2006-2007, which is co-funded by the EU Community Initiative Programme INTERREG III ARCHIMED, European Regional Development Fund. (2) “WideMEDNet - A Mediterranean network for Higher and Continuing Medical Education Resources”, 2008, co-funded by the EU Community Initiative Programme INTERREG III ARCHIMED, and the European Regional Development Fund, and (3) “mEducator: Multi-type Content Repurposing and Sharing in Medical Education”, 2009-2011, under final negotiations for funding by the eContentplus 2008 program, Information Society and Media Directorate-General, European Commission.

References


