Best Paper Award

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in the Proceedings of

PRO-VE'09:

10th IFIP Working Conference on Virtual Enterprises, Thessaloniki

Greece, 7-9 October 2009

pp. 769-776

A Springer Publication

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mEducator: A BEST PRACTICE NETWORK FOR REPURPOSING AND SHARING MEDICAL EDUCATIONAL MULTI-TYPE CONTENT

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Although there is an abundance of medical educational content available in individual EU academic institutions, this is not widely available or easy to discover and retrieve, due to lack of standardized content sharing mechanisms. The mEducator EU project will face this lack by implementing and experimenting between two different sharing mechanisms, namely, one based one mashup technologies, and one based on semantic web services. In addition, the mEducator best practice network will critically evaluate existing standards and reference models in the field of e-learning in order to enable specialized state-of-the-art medical educational content to be discovered, retrieved, shared, repurposed and re-used across European higher academic institutions. Educational content included in mEducator covers and represents the whole range of medical educational content, from traditional instructional teaching to active learning and experiential teaching/studying approaches. It spans the whole range of types, from text to exam sheets, algorithms, teaching files, computer programs (simulators or games) and interactive objects (like virtual patients and electronically traced anatomies), while it covers a variety of topics. In this paper, apart from introducing the relevant project concepts and strategies, emphasis is also placed on the notion of (dynamic) user-generated content, its advantages and peculiarities, as well as, gaps in current research and technology practice upon its embedding into existing standards.

1. INTRODUCTION

The recently witnessed and technology-driven knowledge explosion in medical practice (ranging from genomics, neuroscience and epidemiology to decision making and medical informatics) constitutes a profound challenge to the mission of medical schools which are often required to alter and enrich their curricula with new courses (Kaldoudi et al., 2008). To support this, information technology may be employed to develop virtual distributed pools of autonomous, self-described specialized educational modules, but also provide the mechanisms for searching,

retrieving, evaluating and rating, adapting and revising educational content in medicine and life sciences.

To support their teaching, academic institutions often use a variety of web-based Learning (Content) Management Systems (LCMS), as well as, educational standards which are developed and adopted to enable the universal description of educational content, namely, IEEE Learning Object Metadata (LOM) (IEEE-LOM, 2009), and SCORM (ADL, 2009). Both standards are currently being expanded and adjusted by the MedBiquitous Consortium (Medbiquitous, 2009) to address issues specific to healthcare educational content.

Moreover, to implement efficient brokerage mechanisms for educational content sharing "mashup" technologies have recently been used. Web 2.0 applications offer new opportunities for health education since it allows open access to information, sharing of ideas, questions, and opinions etc. But, current e-learning research indicates that access to comprehensive repositories of learning objects and metadata is the crucial factor in the future of e-learning and the vision of interoperability.

However, to effectively enable the sharing of state-of-the-art digital medical educational content among medical educators and students in European higher academic institutions through a standards-based infrastructure one needs to tackle and elaborate on pedagogical, technical, standardization, cultural, social and legal issues towards.

The cultivation of this need was what lead to a newly launched, EU funded best practice network called mEducator[1], aiming to implement and critically evaluate existing standards and reference models in the field of e-learning in order to enable specialized state-of-the-art medical educational content to be discovered, retrieved, shared and re-used across European higher academic institutions.

The following Table attempts a relatively quick overview of mEducator.

Table 1 – mEducator "attributes" at a glance.

Project Objectives	**Suggested Solutions**	**Expected results**	**Target users**
identify and collect a critical mass of different types of health educational material	Solution 1: based on traditional isolated LCMSs, loosely associated via web 2.0 technologies. Partners publish content in their own LCMS. Updates of content in affiliated LCMSs are performed by RSS feed. "Mashup" technology for content sharing	A metadata scheme for description of all types of medical educational content (standards based)	Medical Educators (clinical/non clinical, in academia)
examine to what extend existing standards can address all types of health educational material - recommend extensions		Recommendations on how to apply and/or extend the medical educational standard Healthcare LOM to address multi- type medical content re-purposing, sharing	Medical Students (under- and post-graduates)

[1] mEducator is funded by the European Commission under the eContPus2008 programme.

	(standards based)	& exchange	
examine to what extend existing standards are adequate to support the packaging and seamless delivery of all educational material types	Solution 2: based on a federated architecture of LCMSs founded on a reference Semantic Web Service (SWS) architecture "LUISA" (2008) for search, interchange and delivery of learning objects.	Best practice recommendations for implementing standardized technology; reference models for medical educational content use, re-use and sharing.	Residents & Specialized Doctors (continuing medical education)
examine possible extensions of existing ontological schemata, describing the semantics of LOs		Multi-type content formally described, re-purposed & delivered (based on standards) in loosely coupled isolated & in federated LCMSs.	
Liaise with standardization bodies to adopt standards extension /recommendations		IPR scheme for educational provided and re-purposed content in academic networks	

So, the essence of this paper is to present the notion of educational content within mEducator, provide various snapshots of content types, and discuss the issues of content sharing. Emphasis is placed on user-generated content, its advantages and peculiarities, as well as, gaps in current research and technology practice upon its embedding into existing standards.

2. MEDICAL EDUCATIONAL CONTENT

2.1 Content sources and types

Educational content in medicine includes a broad range of learning object types that address both the theoretical as well as the clinical aspects of medical education. Its unique nature lies along with the fact that is produced by both academics and clinical teachers, in a variety of places like hospital wards, healthcare practice units, laboratories, classrooms/lecture theaters, and recently the collaborative web and virtual reality spaces (Kaldoudi et al, 2009).

Another important development in medical educational content is the shift from traditional classroom-based teaching towards adult education (Jones et al, 2001). Current approaches focus on 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-resolving skills, self-directed learning skills and collaboration and

group competences. Thus, current medical educational programs increasingly include case-based or problem-based learning and other small group instructional models, collaborative structures/schemas to support student-faculty interactions, and technology-enhanced educational tools.

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

- 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;
- 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
- 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.

2.2 Content item definition

Before going any further, let us define what a medical educational content item is for mEducator. So, a mEducator content item refers to educational material with a registered history of creation, linked with specific educational goals and objectives, as well as, learning outcomes and educational contexts/settings, and is recommended with certain teaching methods and strategies types, while assessed/evaluated by certain means to accomplish the fulfillment of its predefined learning outcomes. To this effect, a content item may be a lecture in Powerpoint slides or podcast/vodcast of any length, or a Virtual Patient of a various size, as long as it is properly accompanied by a clear description (this will be metadata descriptions) of what objectives it meets, what learning outcomes it envisages, how is it supposed to be taught, and how is it assessed (in other words accompanied by its assessment means).

2.3 The notion of user generated content in mEducator

An important aspect of mEducator content refers to user-generated content. Its extent and nature varies with the specific content type itself. However, it has to be mentioned that much of the user-generated content in mEducator refers to a specific didactic approach, that is, active learning through the use of problems (problem based learning, PBL) or cases (case based learning, CBL). In typical use of PBL/CBL the problem of case is set, usually ill-posed by the educator to start with, and questions are raised; students/users are then engaged in trying to provide answers to the problem/case questions; it is this user interaction itself that in a way produces and enriches the content. Such content may itself, be it properly described by metadata and standardised, be utilised as a learning material by the instructors, since it provides hints where possible student misconceptions may lie (the instructor may use this to show to current students what previous cohorts have done in

attempting to solve the problem/case or where mistakes/misconceptions occurred, or to reshape the questions or the problem/case). Existing, concrete examples of such user-generated content already available at the mEducator partnership are (Figure 1):

Figure 1 – mEducator starting examples of user-generated content

- Web2.0 based PBL/CBL (e.g. by use wikis, blogs, discussion forums) on specific content and interaction scenaria where this content is user enriched, loosely instructed and originally ill-posed by the educator (Kaldoudi et al, 2008; Bamidis et al, 2008).
- clinical cases (unsolved) on the MEDTING case repository; user "comments" and "voting" spaces can be utilized to harness opinions from medical educators, medical students or residents (Carber, 2008)
- Interaction with Virtual Patients on Open Labyrinth; a typical user interaction history (where mistakes were done) properly selected by the educator is important educational material (Ellaway et al, 2008)
- Cases in the form of e-traces (web traces of anatomical images); user-generated content relevant for sharing could be the students' image traces that are selected by the educators as being representative of typical misconceptions (Gorgan et al, 2007)
- Interactions with serious medical games. Like in the above examples, in game-based learning, the use of user generated content will include game-play-history, accompanied with the appropriate scenario wrappers for adaptation of established training scenarios, simulations and virtual environments (Hansen, 2008; De Freitas & Martin, 2006).

3. CONTENT SHARING

3.1 The need to standardize the sharing of content

Before going any deeper a key elementary question needs to be clarified: "why would people need to standardize and share educational/training content?" The following list provides some arguments towards the efforts for standardizing the process of collaborative sharing. Peers are interesting in the use of metadata that describe the content to be shared so that they are then able to:

- Transfer content into other organizations

- Modularize/re-use content in other courses
- Overcome platform problems /allow for multiple delivery options
- Keep an account of versioning/updating/life-cycle of content
- Relate content to other situations (re-purpose) and
- Add/alter contexts for content (i.e. "where" content might apply; contextualization of content)
- Facilitate easy content localization and discovery
- Share assets, media, competencies related to content (in connection to any learning outcomes attached to content)
- Contribute to economic discourse and the promotion of open-source tools for e-learning
- Allow for gate keeping and content validity
- Aim for audience focusing
- Achieve a tool agnostic process in the long run

3.2 Content (sharing) standards

As discussed above, reusability of content and such its (discrete) objects among different organizations requires that they are formally described with standard metadata. Learning objects (LOs), 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 (Devedzic et al, 2007):

- packaging standards, regulating assembly of LOs and complex units of learning, such as IMS Content Packaging/Learning Design, SCORM, and HealthcareSCORM (extension of SCORM to healthcare).
- 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.

So, seamless global sharing of medical training/educational content requires a flexible and adaptive metadata scheme for the content description (based on existing standards or the provision of new ones). However, 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-engineered from their original design for a different purpose and/or audience, while attaining an acceptable level of validity.

3.3 Sharing and Intellectual Property Rights

Intellectual Property (IP), in general, refers to creations of the mind and Intellectual Property Rights (IPRs), as a term, refers to a bundle of exclusive rights granted to creators' work that are creations of the human intellect. Moreover, copyright, refers

to the “right to copy”, and is essentially a form of IP applicable to any expressible idea or information that includes creative works (Miller et al, 2008). Recently, a new type of licensing framework ideal for the digital economy has emerged, namely, the Creative Commons (CC) licensing platform, recognized as the “ideal” form of “open” licensing for works generally protected by copyright. CC employs both a “Some Rights Reserved” and a “No Rights Reserved” policy scheme, in contrast to the usual/traditional copyright. A division of CC, namely ccLearn, is dedicated to “realizing the full potential of the internet to support open learning and open educational resources” (ccLearn, 2009). The four available options/conditions for versioning the CC license account for a good allocation and distribution of any shared material and its accompanying rights. More precisely, the conditions are (i) Attribution, (ii) Non-Commercial, (iii) No Derivative Works, and (iv) Share Alike.

4. mEducator open research issues – discussion and outlook

Technology-supported educational interventions are usually successful when specific training requirements are aligned with the learning potential created by and the educational use of technology. Thus, requirements for flexible, adaptive and ubiquitous online content sharing should evoke notions, practices and technologies from respective state-of-the-art evolutions of the Web, but not only. The recent web revolution under the collective term Web 2.0 where the user is considered as a contributor, rather than a passive recipient, together with other artifacts of collaborative educational environments (as outlined in section 2.3), provide multiple facets of what is known as user-generated content. Such educational content is created by participation and collaboration as an emergent product of human education-centred interactions. In the core of research related to the above notion of user-generated content lies an ensemble of standards, protocols, technologies and software development architectures and approaches that enable seamless communication and sharing tools and the creation of communities and networks of services that bring people (medical educators, students, practitioners) together. Are the above mentioned existing ensembles capable of supporting all requirements and resolving all particular issues? Probably not! For example, it is not well defined how current educational standards and metadata might be applied to describe the educational interaction within a PBL Web2.0 scheme facilitated by blogs, wikis and discussion forums. Therefore, the mEducator initiative will have to cluster with standardization bodies and scientific/professional communities to resolve such ambiguities.

Furthermore, central to mEducator is the issue of IPR resolution for the provided content, the newly introduced content (during and after the project) as well as for re-purposed content. The consortium will have to work towards developing a simple IPR procedure to address all these instances of medical content incorporated in a medical educational content sharing network. IPR issues and content description metadata will also be a major factor in determining and deriving content selection rules for content inclusion in the network. Of course, it remains to be seen whether a simple adoptions of ccLearn will be capable of addressing all related mEducator issues or the need for a new standard (or extension of an existing one) might be geared.

It is almost certain that collaboration and content sharing in health education will inevitably alter the overall process of developing and preparing course materials. The formation of task forces and content sharing networks/consortia will ensure that responsibility is not merely 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 in the EU and not only.

5. ACKNOWLEDGMENTS

The project "mEducator: Multi-type Content Repurposing and Sharing in Medical Education", is supported by the eContentplus 2008 program, Information Society and Media Directorate-General, European Commission (ECP 2008 EDU 418006).

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