Geotagged Repurposed Educational Content through mEducator Social Network Enhances Biomedical Engineering Education

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Abstract— **Biomedical Engineering and Medical Informatics complete educational programs are offered throughout european institutions. Common curriculum and level of provided knowledge is trying to be reached through protocols and guidelines from international and European organizations. Educational material that used, shared and repurposed across institutions could be an indication of the differences between educational curriculums. We propose a mashup tool that represents the different repurposing types across institutions that can be used as an indicator for different knowledge provision. This tool can be accomplished due to the mEducator Social Network, comprised of two distinctive and interacting networks, one with persons and the other with dynamic connected learning objects with both persons and other learning objects.**

Keywords— **WEB2.0, mashup, Medical Informatics Education, content repurposing, learning object.**

I. Introduction

Nowadays, Biomedical Engineering and Medical Informatics complete educational programs are offered throughout European Institutions both in post- and undergraduate level. Each institution is responsible to define the curriculum within his departments according to national health care systems and to local and international scientific needs.

Different needs and different access to educational material, lead the institutions to different curriculums and resultant to different level of knowledge for the new scientists in the era. To this extend, each institutions provide to its student different quality of educational material especially state-of-the-art educational material. The inequality in knowledge of the new Biomedical Engineers or Medical Informatics scientists across Europe can both influence the industries and the research activities.

During the last few years international nonprofit organizations tried and produced some recommendations on education in Biomedical Engineering and Medical Informatics. These recommendations based upon current curriculums and new trends in the scientific field. However, there is no tool that can "measure" or at least provide a few indicators on the differential of knowledge provided in institutions between countries or even between cities in the same country. To fill in the gap, we propose a mashup tool that provides us with visual indicators of how state-of-the-art educational material is exchanged and how it is repurposed and adapted across institutions.

The long term aim of this system is to re-establish education in the field of Biomedical Engineering and Medical Informatics, to provide a common line for further discussions and recommendations on educational activities in this field and to enforce and enhance education and research across european and international institutions.

The remainder of this paper is structured as follows. In section II we are setting the scene presenting efforts for a common curriculum on Biomedical Engineering and Medical Informatics education and current trends in state-of-the-art educational content sharing and geottaging as a mashup tool in health. In section III a Social Network of learning objects is shortly presented followed by different perspectives of content repurposing. Map as a representation tool for repurposed learning objects and curriculum differential indicator are given in section IV, followed by a discussion of key issues of concern.

II. Setting the scene

A. Biomedical Engineering and Medical Informatics Education

The rapid development of European Union and freedom of movement raise the issue of recognition of professional qualifications. Bologna Declaration aims to set the base of comparable criteria for inter-institutional mobility and curriculums development [1]. Based on it, traditional engineering curriculums harmonized relative easy across EU institutions. In the contrary, bioengineering and biotechnology due to the rapid development and the small educational units without all the specialties to can be fully offered, urge for a common curriculum [2].

IFMBE (International Federation for Medical and Biological Engineering) and EAMBES in 2005 in recognition of the need for guidelines for the professional formation and development of the Clinical Engineer publish through BIOMEDEA project (http://www.biomedea.org/) the "Protocol for the training of clinical Engineers in Europe" [3].

P.D. Bamidis and N. Pallikarakis (Eds.): MEDICON 2010, IFMBE Proceedings 29, pp. 967–970, 2010.
www.springerlink.com

This protocol contains guidelines for institutions on curriculum details at different stages of the training programs. The basic principles that this protocol is based is the "*experience of those currently working in the field, international developments regarding Clinical Engineering, current and proposed professional structures and benchmarking across the international approaches to the professional formation and development of Clinical Engineers*". To this extend, IMIA (International Medical Informatics Association) publish "Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics - 1st Revision" [4], [5]. The educational needs are described as a three-dimensional framework: professionals in health care, type of specialisation in biomedical health informatics and stage of career progression. The recommendation based on reports and current literature in the field, as well as workshops proceedings and formal discussions. Furthermore, models for common educational curriculum worldwide have been set as a main goal in IMIA's strategic plan [6].

B. State-of-the-art educational content share and re-use across EU

Continuous advances in Bioengineering and Medical Informatics and lack of a common curriculum lead to an enormous need of state-of-the-art educational material.

A number of research projects try to enable educational material sharing across EU institutions [7]. In this context, "mEducator", an EU funded best practice network (funded by the European Commission under the eContentPlus2008 programme, Contract Nr: ECP 2008 EDU 418006) [8], aim 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.

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

Different perspectives of content repurposing across institution in Bioengineering and Medical Informatics education can be an indicator of the needs and the variation of educational curriculums in the field.

As described in [9] and extended in [10], could be a variety of situations where re-purposing educational content is desired, including the following:

1. Re-purposing in terms of the actual content: Add or mutate content, integrate content from different learning objects, re-organize existing content, etc. or a combination of the above.
2. Re-purposing to different languages: Especially a mandate in healthcare, as acquired knowledge should be finally communicated to the patient.
3. Re-purposing to different cultures: Can be viewed as content localization and includes 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.
4. Repurposing for different pedagogical approaches: Pedagogical cultures present in healthcare education 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.
5. Repurposing for different educational levels: Content needs to be adapted to match different pre-requisites and consecutively different learning outcomes for different levels: undergraduate, postgraduate, residency, specialty training, and continuing life-long education during medical practice, public education, etc.
6. Re-purposing for different disciplines or professions: Healthcare education addresses a multitude of professions, ranging from medical doctors to nurses and lab technicians, to basic life scientists and even healthcare administrators.
7. Re-purposing to different content types: Contemporary medical education exhibits a considerable variety of content types. Thus a common aim of repurposing is to change a learning object from one type to another. For example, a lecture presentation to a didactic problem or course notes to presentation and so on.
8. Re-purposing for different technology: Finally, we should account for changes to a digital learning object that affect its technological characteristics, such as digital format, digital size and quality (e.g. for images), metadata description scheme, computer platform, etc.
9. Re-purposing to educational content: Re-purpose content created for a different purpose to content used for education.
10. Re-purposing for people with different abilities: This includes re-purposing content for people with special needs, e.g. from written to spoken form, etc.

C. Geotagging as a representation mashup tool in web-based application

The last decade due to the release of many information administration APIs applied on a map, a huge expansion of web-based applications represent information on map have

been launched. Representative examples could be "Healthmap", a map that represents global infectious diseases based on media reports [11] and "biomedexperts" (http://www.biomedexperts.com/), a literature-based scientific social network that represents among others the connections of scientists across the world. These two and many other application use mashup tools in order to represent in a more human-understandable way useful and complex informations.

III. Content repurposing in mEducator social network

There are numerous social networks that enable collaboration in general and between specific groups. Facebook (http://www.facebook.com), probably the most famous example and MySpace (http://www.myspace.com) have grown rapidly the last few years, proving that relationships from real life can be transferred to a virtual network. Linkedin (http://www.linkedin.com/) and Xing (https://www.xing.com/) emphasize in professionals linking and new business contacts, while Epernicus (http://www.epernicus.com/) and SciSpace (http://www.scispace.com) are some of the social network platforms dedicated to scientists and researchers.

Kaldoudi etal [9] propose a social network that can be viewed as two distinctive and interacting networks. The first one is a network of persons, including authors, potential authors and final users of learning objects (students, or teachers or others, e.g. educational managers, etc). The second is a network of published learning objects. WEB2.0 approach allows users to interact through blogs, chat and other mashup applications and create a scientific network and group of interests. At a different level, learning objects (LO) themselves create an equivalent social network with interactions with other learning objects as well as with persons. These interactions are variable and dynamic, thus create an evolving, user centric and goal oriented organization of objects and persons, based on social dynamics.

The LO itself can be a resource in an LMS, another repository, a resource on the web etc. and its location is stated by its description or it can also be an associated file or files uploaded in the social network itself. A complex and dynamic organization is created based on the user generated tags that have been declared for each of the LO description fields. Finally, a third type of organization is a hierarchical one, describing the repurposing history of each object. The current deployment of this learning objects social network is implemented using the Elgg open source social engine (http://elgg.org/) (Fig. 1).

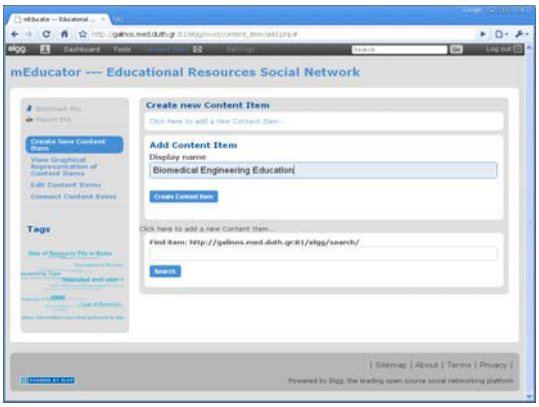

Fig. 1 Learning Object Social Network

IV. Map as a representation tool for repurposed educational objects and curriculum differencial indicator

The repurposed history of a learning object can reveal the educational level of the institutions of the users that share, use and repurpose it. To this extend, the different Curriculums and the lack or the completeness of them would be easily figured out, so as the guidelines for common educational curriculum can be correctly adjust to be referred to all EU institutions.

A learning object that repurposed "for different educational levels", for example from an undergraduate level in an institution A to a postgraduate level to an institution B and accompanied from many others within the same repurposing category, can be a serious indication that the postgraduate curriculum of institution B may have the same educational and knowledge level with undergraduate curriculum of institution A. It should be noted that the representation of this repurposed history is only an indication of the level of the educational curriculum and should be combined with other indication and proofs in order to come to a certain conclusion. For example if the repurposed history reveals that the majority of these specific learning objects repurposed also in terms of "different culture", the indication of the different educational level between the institutions is being strengthen. Assuming that this example involves institutions of two different cities or countries, the indication can be valid for those two different cities/countries.

In order to visualize this representation we created an automatic annotated map, where repurposing history of objects can be viewed. In terms of map representation, there is a two dimension framework to enable the appearance of learning objects in the map. The first dimension considers whether all the objects that are repurposed appear on the

graph, or just repurposing history of one object appears. The second one gives the opportunity to user to select a type of repurposing. So as an example the end-user can select to see all the repurposed learning objects that have been repurposed in term of language and different disciplines or professions or a single repurposed path of an object repurposed on different pedagogical approaches. Fig. 2 depicts the map.

Fig. 2 Map as a mashup tool that represents the different repurposing types across institutions.

Map representation was implemented based on Google map API (http://code.google.com/apis/maps/) and elgg social network API (www.elgg.org).

V. CONCLUSIONS

We proposed a mashup tool within a social network of learning objects that "at a click of a button" provide information about sharing and repurpose educational material between institutions of the same or different countries. We pointed out that repurposing of learning objects across institutions is relative to the level of knowledge provided in them.

Our geotagging tool was established to represent repurposed learning objects across different cities and countries. However, there are some considerations that should be taken under account when talking about indicating different knowledge level across institutions. The indicators are only theoretical and should be taken under consideration as a start point or as additional indicators through a cross-institutional curriculums analysis.

Nevertheless, a representation of this kind could be a useful tool in hands of curriculums designers and educational guidelines creators. It could, improve collaboration between European countries and help to the recognition of professional qualifications not only across Europe but all over the world. Biomedical Engineering and Medical Informatics education may vary based on different needs and different national health care systems. In spite of this variability common knowledge and educational curriculum can be identified and enhance education and research across european and international institutions.

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