OER'S Production cycle with Social AuthorShip and Semantic Tools

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Abstract— **Open Educational Resources (OER) are digital content that are accessible through web repositories. They are used as support tools for education, especially for higher education, and they promote equality and social justice by providing access to, applying, and generating knowledge. Until now OER's have been developed from the pedagogic perspective, without taking advantage of the recent developments in communication technologies.**

Integration of social tools improves the active participation of both the developers and users of the OER's. This promotes the rapid creation of content that is easily accessible via search engines linked to educational platforms and social networks. It also allows *tagging*, which gives users the ability to add descriptive metadata. Authorship is recognized through the use of intellectual property licenses that promote open use of the material so that it can be used and edited. And above all collaborative learning is promoted.

In this article a new cycle of OER production is proposed that includes activities to incorporate social networks and semantic technologies. The phases of the production cycle are developed using the ADDIE instructional model. The purpose of each phase and the social and semantic components to be included are identified. And finally, application guidelines are presented that detail the strategies and expected results for each phase of the proposed cycle.

We have determined that the primary reasons for developing a production cycle for OER's using social authorship are: to allow educators and students to develop resources collaboratively; to reduce the amount of time spent in resource development; and to provide for reutilization of quality OER's. Finally, it should be recognized that the success of the model and its application depends on the institutional context where it is implemented, as well as the policies related to content generation, authorship acknowledgement and distribution of the resources.

Keywords-component; Open Educational Resource; Social Authorshi;, Semantic Web; Collaborative Learning.

I. INTRODUCTION

Open Educational Resources (OER) have been identified by the Flora Hewlett Foundation, one of their primary supporters, as a means of providing equal access to knowledge worldwide [1]. For this reason, many universities throughout the world are involved in these types of initiatives. These initiatives have also raised the interest of international organizations who are working to develop a framework that will assure accessibility, usability and quality of the content and structure and tools utilized to produce OER's.

The Web 2.0 allows users to actively participate in the development of knowledge through the use of tools such as blogs, wikis, RSS, social networks, microblogging, etc. The Semantic Web is the web of data, that is, it incorporates meaning through the use of semantic metadata and ontologies and allows users to find results more quickly and easily.

OER development would be enriched by the features offered by the Web 2.0 and the Semantic Web. These features can be integrated into the production cycle to promote collaborative learning between producers and consumers of resources during both development and implementation. Also, the use of tagging and other semantic technologies optimizes the detection, identification and dissemination of OER's. This proposal also supports the use of Creative Commons licenses for authorship recognition, which should be adapted to the individual policies of each institution.

II. TRENDS IN OER´S

The evolution from a static web to a social and participatory web, with its many manifestations that have gained great acceptance among internet users, provides an opportunity to utilize social software as an e-learning method, to develop the skills and capabilities needed in the knowledge

society (the abilities to analyze, synthesize, communicate, and resolve problems, among others).

OER's – resources that provide educational content with an open license that facilitates their use, adaptation and modification – have become key elements for higher education. UNESCO refers to them "web-based materials that are freely available for use in teaching, learning and research" [1]. The Creative Commons licenses allow content and resources to be open and free, in this way favoring open access to knowledge for the benefit of society and at the same time promoting the development and use of OER's.

The William and Flora Hewlett Foundation has supported many projects in this area because of their great potential and their contribution to the development of education. Due to the fact that there is a great quantity of educational material available on the web, but that it is poorly organized and therefore does not contribute to quality instruction, the OpenCourseWare (OCW) projects have been developed.

In 2001 the Massachusetts Institute of Technology (MIT) launched the first OCW initiative offering complete courses with study guides developed and utilized by their educators. The guides were freely accessible and distributed on the internet; their use, re-utilization, adaptation and distribution was permitted, with certain restrictions determined by the licenses assigned by the authors. Hundreds of universities have joined this initiative and have made their materials available to professors, students and laypersons world-wide.

The evolution of the internet includes four phases: the Web 1.0 develops an information network; the Web 2.0 creates relationships between people through social networks which promote collaborative knowledge; the Web 3.0 includes representation of meaning, connection of knowledge and improvement of the internet experience; and the Web 4.0, which is yet to be developed, that involves the connection of intelligence in an ubiquitous and universal Web. [3]

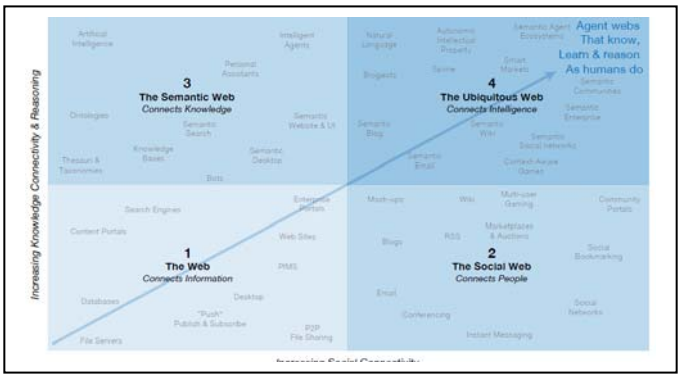

Figure 1. Internet Evolution [3].

The Social Web is driven by those applications that gain value through the actions and participation of their users; it is an attitude not just a technology. In this environment it is possible to gather, distribute and share individual actions within a social context, using tools such as wikis, blogs, microblogging, RSS, messaging, and social networks (Figure 2).

The social web allows the user to participate actively as an author in the knowledge society, and this includes the development, management and distribution of knowledge in a collaborative manner. These activities generate collective intelligence that accompanies the learning process, promoting the development of skills among the participants adapt to the process through open and free discussion opportunities that stimulate creativity, critical thinking and social and communication skills.

Figure 2. Social Tools [4]

In the production of OER's it is necessary to include semantic components to exploit the aforementioned resources.

Since OER's are found on the Web, they are becoming part of the Semantic Web (which gives meaning to all types of information available on the Web). According to [5] the Semantic Web has unique properties that facilitate the development of OER's:

- Improves discovery and storage in local and global databases, and therefore OER's should have semantic information (metadata) to simplify their discovery and re-utilization.
- Promotes the use of ontology that highlights the structure of the resources to assign pedagogic meaning, and
- Strengthens the personalization of educational content and the development of resources to assist the user with significant tasks in the Semantic Web.

The basic semantic technologies that should be used are:

Unicodes1 and URIs2 to identify web resources.

- XML 3 : To present, manipulate, and transmit structured data and documents.

1 UNICODE: http://www.unicode.org/

2 Naming and Addressing: URIs, URLS. (http://www.w3.org/Addressing/).

3 eXtensible Markup Language (XML). (http://www.w3.org/XML/

- RDF4: Provides a model of common data, based in XML NameSpaces, which is used to formalize metadata.
- Educational Ontologies: Used in web-based teaching. [6]
- Ontologies related to the physical structure of the object: So that the OA can be interpreted and utilized in different teaching systems. DAMP5 and OIL6 are used for the development of ontologies.

Social repositories facilitate the storage of resources that are available for users to share on platforms that permit them to download, tag, vote and comment on these materials.

III. OER PRODUCTION CYCLE

An OER is the result of a production cycle with many intertwined phases. Each phase has its own specific purpose and is carried out in a generally sequential manner. Throughout the process the needs of the education community are considered and active participation is promoted.

Normally the development of these materials involves the use and reuse of digital resources such as videos, text, and images, which are considered by many authors to be digital content and information objects. This process also involves the development of metadata associated with these objects, which allow them to be stored, catalogued and searched in data repositories, as well as provide information about copyrights that can be used to determine if the content may be consulted, utilized or edited.

An analysis of several OER production cycles was conducted and the common denominator found was the use of standards for packaging and for metadata. These standards are shown in the following table:

TABLE I. COMPARISION OF UNIVERSITY OER PRODUCION CYCLES

University	Methodology	Packaging	Metadata	Storage or Implementation
Universidad Técnica Particular de Loja (Ecuador)	Based on the principals of LOSADA	SCORM	LOM	DSpace
Universidad de Aguas Calientes (Mexico)	AODDI, based on the instructional model ADDEI	SCORM	LOM	MOODLE
Politecnica de Valencia (Spain)	Via the use of models	SCORM	LOM	Agrega Ruinet
Universidad de Burbula de Venezuela	ADDIE	SCORM	LOM	MOODLE
Politécnica de Madrid (Spain)	TAEE	SCORM	IMS Metadata 1.2.2	MOODLE
Universidad de la Sabana (Colombia)	(Instructional model in learning objects)	SCORM	LOM	MERLOT

This comparison of the OER cycles employed by the previously mentioned universities shows that the majority of these institutions use the ADDIE instructional model. This model is favored because it includes characteristics such as feedback and continuous review, and because it is the most widely-used model in educational contexts.

Instructional Design is a method that defines the steps to take in the process of evaluating student needs, designing the project, developing the educational materials, and evaluating the effectiveness of the OER's in the learning process.

There are more than 100 different Instructional Design models but they are all based on the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model. Each phase of the model produces a result that provides information for the following phase. When the "Revision" phase is added to the process the model is called ADDIER.

The activities performed in each one of the phases of the ADDIE instructional model are described below:

- **Analysis:** The instructional needs (lack of knowledge), the audience, the learning environment and the technical infrastructure are analyzed.
- **Design:** The content and structure of the OER's are defined and categorized.
- **Development:** The development of the OER's, which includes quality control and storage.
- **Implementation:** A strategy is selected to integrate the OER's into a product, and a management and follow-up plan is created.
- **Evaluation:** A comprehensive evaluation is conducted to determine the impact that the OER's have had on the teaching process.

Most Instructional Design models are based on the ADDIE model, which is why the OER production cycle with social and semantic components proposed in this article is based on the ADDIE model.

Furthermore, there currently exist many data repositories that include semantic metadata, such as:

TABLE II. OPEN EDUCATIONAL REPOSITORIES

Project	Number of resources
CAREO	4 137
MERLOT	14 376

4 Resource Description Framework (RDF).(http://www.w3.org/RDF/

5 DARP Agent Markup Language (DAML). (http://www.daml.org/)

6 Ontology Inference Language (OIL). (http://www.ontoknowledge.org/oil/)

Project	Number of resources
EdNA	28 471
DLESE	11 864

IV. OER PRODUCTION CYCLE WITH SOCIAL AUTHORSHIP

For OER's to be created with social authorship it is necessary to develop them in a collaborative manner, using collaborative learning techniques. This process is becoming a common practice within different disciplines.

Johnson and Johnson, in 1998, defined collaborative learning as "a system of interactions carefully designed to organize and promote reciprocity between group members." Collaborative learning is achieved by implementing methods to promote working as a group, which are characterized by the interaction and support between the members of the group for the development of knowledge.

Longmire [7] mentions that "the challenge faced by those that develop educational objects and the repositories to store them is not only to provide the possibility of finding educational content, but also to provide relevant and significant contexts for the students that locate the content." This thought is, without a doubt, applicable to OER's because of the need to incorporate semantic components that provide significant context to the resources and allow them to be located and utilized within the growing supply and demand for web resources.

There are several key characteristics that OER's must possess, and their existence must be guaranteed in the production cycle, as shown in Table 1. Tools exist to evaluate these characteristics, such as the Learning Object Review Instrument (LORI), whose results promote the proactive development of learning objects and support those who actively participate in their development [2]. It is thought that LORI can be a valuable support for the evaluation of OER's.

TABLE III. BASIC CHARACTERISTIC OF OER'S

Characteristics	Brief Description
Quality Content	Precision, veracity, adequate level of detail, balanced presentation of ideas
Alignmen t with objectives	Alignment with the objectives for which they were conceived
User interaz	Visual design that facilitates learning and mental efficiency
Reusability	Educational resources that are usable in various contexts
Accessibility	Design of elements in formats that permit access from other media
Interoperability	Guarantees the exchange of content

In order to produce OER's with the abovementioned characteristics, the proposed production cycle is focused on providing flexible and usable resources. If an opportunity is identified during any one of the phases, ideally during the evaluation phase, the analysis phase should start again and the process should be repeated with the objective of developing a new version or a new meaning for the resource.

For the proposed social OER production cycle the five phases of the ADDIE model have been modified to include specific tasks. For each one of the phases a social and semantic component is proposed depending on its specific purpose.

1. Analysis:

- ***Purpose:*** Identify the needs to be addressed by the OER. What needs to be produced?
- ***Social component:***
  - Use existing social tools such as blogs, wikis, social networks, and microblogging as a source of information by which the users communicate their needs and expectations regarding their education and training.
  - Document the analysis using tools such as wikis, blogs and Google Docs.
- ***Semantic Component:*** Identify terms to associate the OER with metadata.
- ***Application Guidelines:***
  - Utilize social tools (blogs, wikis, social networks) within specific courses or subjects.
  - Allow students to fulfill course requirements by means of social tools.
  - Tabulate suggestions for improving the course using collaborative tools such as Google Docs and the subject blog.
  - Identify the primary metadata.

2. Design:

- ***Purpose:*** What? Who? How? Define objectives, content, structure, categories, metadata, policies and licenses
- ***Social component:***
  - Use social tools such as wikis, blogs, and Google Docs which provide an opportunity for designers, experts, educators, academics, students and technical personnel to effectively participate in the process of defining the objectives, base content, structure, categories, metadata and policies of the OER.
  - Provide opportunities for feedback on proposed definitions.
- ***Semantic Component:*** Define metadata for the resources.

- ***Application Guidelines:***
    - Redefine objectives, basic content, structure, categorization systems, metadata and policies taking into consideration the issues raised during the Analysis phase, as well as the possibilities offered by the Web 2.0 and the Semantic Web.

3. Development:

- ***Purpose:*** Implement the design, search for content resources, storage and quality control elements.
- ***Social Component:***
    - Search and locate resources using social tools, considering the value associated with each resource, comments, and number of visits.
    - Use social defined metadata (folksonomies) to locate available resources.
    - Find and develop resources in accordance with the characteristics defined in the design phase such as interoperability, re-utilization, and re-mixing.
    - Use functionality the Sharable Content Object Reference Model (SCORM) [7] ; metadata definition, metadata specification in XML and packaging.
    - Reload Editor
- ***Semantic Component:*** Linking metadata utilizing folksonomies and ontologies.
- ***Application Guidelines:***
    - Inventory social tools within the university.
    - Select appropriate resources in regards to subject matter, visual quality
    - Adapt or create specific resources for the course.

4. Implementation

- ***Purpose:*** Integration and management of the resources.
- ***Social Component:***
    - Use social recommender systems to link and integrate the resources with other related resources and repositories.
    - Distribute resources using social tools such as microblogging and social networks, and make the resources more accessible by including RSS and other technologies related to this purpose.
    - Apply the SCORM runtime environment guidelines, sequencing and navigation.
    - Associate the resources with reputation systems, version control, and feedback and monitoring systems that improve management activities.
- ***Semantic Component:*** Link the folsonomy or ontology to the network.
- ***Application Guidelines:***
    - Use RSS feeds to link other related educational resources with the institution's OCW.
    - Use social tools to distribute new resources.
    - Use reporting tools to track the number of visits to course resources.

5. Evaluation:

- ***Purpose:*** Monitoring, control, improvement of the resources.
- ***Social Component:***
    - As with the creation and distribution of the resources, evaluation and feedback will also be conducted by the users using social tools. The users will be given the opportunity to communicate whether the resources fulfilled their expectations and to provide suggestions for improvement through their comments.
    - Rubrics will be used to determine the quality of the resource using a scale based on parameters that the user considers pertinent.
- ***Semantic Component:*** Effective access to the resources in relation to their significance and context.
- ***Application Guidelines:***
    - Use the course blog to solicit feedback from students about new resources posted on the institution's OCW site.
    - Evaluate materials from the Information Fundamentals course.
    - Implement version control through a shared Google Docs document accessed by educators and the team responsible for the current cycle's proposal.
    - Utilize reporting tools to track the number of visits to course resources.

The figure 3 is a representation of the phases of the model, with the social and semantic components included.

7 http://www.adlnet.gov/adlnews/Documents/News%20Archive/ADLReachesAgreementwithIMSandIEEEonUseofSpecificationStandardsWorkinSCORM%C2%AE20043rdEdition.aspx

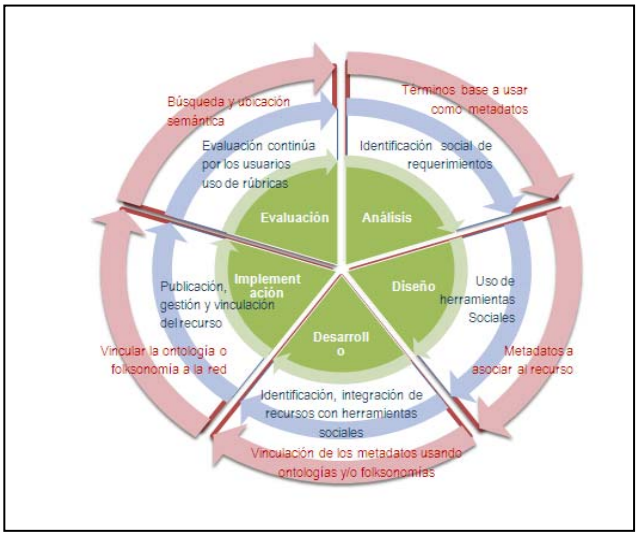

Figure 3. OER'S Production Cycle considering social and semantic components

The production cycle should adhere to the fundamental principles of Open Educational Resources – the resources should maintain an educational focus on developing the knowledge, skills and abilities of the users and they should be publicized using the appropriate legal framework within the Creative Commons licenses and its principal variations: Commercial/NonCommercial, ShareAlike, and NoDerivs:

Attribution or Recognition

Recognition and Share Alike

Recognition and no derivative works

Recognition and Noncomercial

Recognition Noncomercial and Share Alike

Recognition Noncomercial and no derivative works.

V. Application Of The OER Production Cycle Using Social Authorship AndThe Semantic Web

To complement the proposed OER production cycle using social authorship and semantic tools the following is a discussion of the expected results from each phase of the proposal, followed by a brief case study:

1) Analysis Phase:

- ***Purpose:*** Identify the need to be addressed by the OER. What needs to be produced?
- ***Expected Results:***
  - Social tools (blogs, wikis, social networks, among others) implemented.
  - Student requirements tabulated and organized.
  - Suggestions to improve the course gathered.
  - Metadata defined.

2) Design Phase:

- ***Purpose:*** Why? For whom? How? Define objectives, content, structure, categorization system, metadata, policies and licenses.
- ***Expected results:***[8]
  - Course structure and components reviewed.
  - Objectives and course structure redefined.
  - Resource types to be included identified and categorized.
  - General, specific and social metadata taxonomy established.
  - Metadata management strategy developed.

3) Development Phase:

- ***Purpose:*** Find resources for content, storage and quality control
- ***Expected results:***
  - Resources are identified.
  - Measurement tools for resource evaluation (criteria, values) are identified.
  - Resources are selected.
  - Necessary resources are created or adapted.

4) Implementation Phase:

- ***Purpose:*** Implementation and management of the resources
- ***Expected results:***
  - New structure and components established, resources designed and implemented.
  - RSS established linking other open educational resources related to the course within the platform in which it is implemented.

8 Not all results are required in this phase will depend on the identification made

- New resources are distributed using the social tools of the course.
- Tracking tools for the course and resources are implemented.

5) Evaluation Phase:

- ***Purpose:*** Assess and improve resources
- ***Expected Results:***
  - Feedback from users on the course and its resources obtained.
  - Results from the course evaluation system obtained.
  - Versioning of the Google Docs documents shared between educators and the work team completed.
  - Reports from course tracking tools obtained.

The OER production cycle using social and semantic tools was implemented in a course that is posted on the UTPL's OCW site. The process made use of the application guides previously described. Below is a summary of the process:

The course entitled "Information Fundamentals" was selected because it is one of the first courses available through the UTPL's OCW project and because the course instructors were available to implement the production cycle. In the analysis phase a blog was created (http://blogs.utpl.edu.ec/fundamentosinformaticos/); and subsequently the course requirements were obtained via the blog and the UTPL's Virtual Learning Environment (EVA). During the process of information collection the students suggested in increase in the utilization of social tools and other resources (videos, presentations, and additional documents) in order to improve their active participation and to support the theoretical portion of the course. In response, the instructors were asked to revise the course outline and redesign the course structure so that social tools could be utilized more readily, and to allow linkages to resources other OCW sites that could be reused and/or revised and adapted to the course. Also the first metadata were identified.

In the design phase the objectives and content of each section of the course were redefined by the instructors, taking into account the information obtained during the analysis phase as well as the suggestions from the work team responsible for the OER social production cycle. Thereafter, the resources were categorized by type and subject. Three types of metadata were identified according to their role. These metadata were used to create a unique taxonomy for the Information Fundamentals course within the Schools of Science and Computation. These metadata were managed by including them in all of the course's social tools; they were classified using the system previously described. They are governed by the UTPL's institutional policies regarding academic OER production, and they must conform to these policies.

In the development phase the taxonomy defined in the previous phase was utilized to search for resources using the OCW search engines. The resources were evaluated by applying the designations "Very Good", "Good" or "Average" to different criteria. After the resources were evaluated it was suggested that only those with all criteria qualifying as "Good" or "Very Good" be utilized, and those with criteria qualifying as "Average" be discarded. The last step of this phase was to adapt and/or create resources.

In the implementation phase the resources produced in the development phase were combined. RSS feeds from Information Fundamentals courses from external OCW sites were linked via the RSS feed portlet. The new resources were distributed via the EVA social network and the subject blog.

In the evaluation phase the course blog was used to acquire new information; the resources of the Information Fundamentals were evaluated. Also, a Google Docs document was created to share ideas between instructors and the proposal team to obtain feedback from the students, and report tools were used to track visits to the course resources.

As shown in Figure 3, the proposed production cycle is circular and the evaluation phase serves as feedback for the next production cycle.

VI. CONCLUSIONS

The following points have been identified as a result of this study:

- Although ADDIE is a linear instructional model utilized for production cycles of various types of resources, in the case of OER's it is necessary to include evaluation and quality control components within an educational context.
- Including social components in the OER production cycle facilitates collaborative learning between teachers and students.
- Web 2.0 tools improve OER searches by using their semantic meaning, and improve the evaluation of the quality of the educational content by reputable systems.
- The OER production cycle with social and semantic components reduces the time needed for development of these resources since available resources are being re-utilized and are available via social tools.
- Including social and semantic components in OER production is without a doubt an opportunity to take advantage of the benefits of these new web-related trends that provide pertinence, relevance and meaning to the resources.
- The success of this Model depends on the institutional context in which it is implemented, as well as the policies of content generation, author recognition and distribution of the resources.

- The use of social tools with resources is an improvement, but it has been observed that the time needed to access the resources increases for those users with slow connections.
- With institutional support, and especially that of the instructors, the production cycle will not produce the expected results.
- In the development of OCW courses, the use of other OER's is feasible because there are many quality educational resources available that can be reused in other contexts.
- When adapting existing OER's, quality assessment is an important activity for the optimal production of resources.

ACKNOWLEDGMENT

This research project has been partially supported by the Republic of Ecuador through the National Secretary of Sciences and Technology (SENACYT).

This project was developed thanks to financing from Project AL_PID09_036 of the Universidad Politécnica de Madrid.

REFERENCES

[1] D´Antoni S., "Open Educational Resources The Way Forward", Feb. 2008, [Online], http://oerwiki.iiepunesco.org/images/4/46/OER_Way_Forward.pdf

[2] Nesbit J.,Belfer K., Leacock T., "Learning Object Rating Instrument (LORI) – User Manual", Versión 1.5, [Online], http://www.elera.net/eLera/Home/Articles/LORI%201.5.pdf

[3] Davis M., "Semantic Wave 2008 Report: Multibillion Dollar Market Opportunities, Executive Summary", Project10X's, July 2008 [Online], http://cmpe.emu.edu.tr/aelci/Courses/D-583/principles/exsum_sopps/exsum_sw2008.pdf

[4] Rodríguez G., Cueva S., "Social Network and OER, OCWC Global 2009", April 2009, [Online], http://www.slideshare.net/grrodriguez/social-networks-andoers-1351031

[5] Santacruz-Valencia, Delgado Carlos, "Objetos de Aprendizaje: Tendencias dentro de la Web Semántica", Spain, 2004, [Online], http://en.scientificcommons.org/1734567

[6] Hernandez H., Saiz M.; "Ontologías mixtas para la representación conceptual de objetos de aprendizaje". [Online]. http://rua.ua.es/dspace/handle/10045/3123

[7] Longmire, W.,"A Primer on Learning Objects. En Learning Circuits", [Online]. http://www.astd.org/LC/2000/0300_longmire.htm.