Rapid Production of E-Learning Materials with Reusable Learning Objects: Experiences from the Global Academy for Extension Practice

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ABSTRACT

Open educational resources, institutional collaborations, and content reusability approaches have been quickly emerging to minimize the time and money spent on developing e-learning materials. Reusing content with reusable learning objects (RLOs) is carving a new path for research on reusing and repurposing available high quality e-learning content. Prior research shows that this component-based approach best fits how educators prefer to access materials. In this paper, without arguing the merits and demerits of RLOs as a concept, the authors present an effective and affordable approach to creating e-learning materials with RLOs. The authors also present how they have implemented the proposed RLO approach in converting learning modules of the Global Academy for Extension Practice into multiple e-learning material formats.

Keywords: E-learning, reusable learning objects, Extension, Global Academy, learning content and SCORM.

1. INTRODUCTION

The top-down method[1] of learning from teachers and other pedagogical standards is used not only in the formal education system; extension and training staff also use this method to train extension agents, farmers, nongovernmental organization (NGO) personnel, and students. Even though this way of teaching and learning is part of our culture, changing scenarios and emerging opportunities allow extension and training institutes to explore innovative approaches [1]. Indeed, both efficiency and efficacy demand new approaches.

Advances in information and communication technologies, specifically in multimedia, networking, and software engineering, have allowed an expansion of education beyond the traditional classroom to a geographically diverse audience. Modes of delivery include television, radio, video, satellite, the Internet, and mobile phone [2]. During the last several years thousands of electronic texts, images, movies, and Java applets have been developed to support these new innovative education and learning platforms [1].

To take advantage of this situation, new services were developed and the search, classification, organization, and peer-to-peer exchange of learning resources by learners, instructors, and course developers became commonplace. Metadata [2] help to carry out these tasks, and several specifications for learning objects were produced. Related to this, specialized search engines and indexing tools for learning were also made available [3].

The increasing use of the Internet [4] and its technological capabilities, in addition to the huge amount of learning resources, allowed for the evolution of a high number of technology-based learning platforms such as open educational repositories *Open Courseware Consortium* [5], *MIT Open Courseware* [6], *MEROLT* [7], *GEM* [8], and *Wikipedia* [9]; content management systems *Plone* [10], *Drupal* [11], and *Joomla* [12]; and learning management systems *Blackboard* [13], *ATutor* [14], *TeN Acado* [15] and *Moodle* [16]. As they are usually developed *ad hoc*, to meet the requirements of a particular institution, heterogeneous systems appear with no interoperability mechanism among them.

When these systems were reviewed, our conclusion was that they provide very similar functionalities: content delivery, learner tracking, learner management and administration, questionnaire evaluation, communication and collaboration facilities, search tools, etc. Therefore, we can state that most online learning systems share some common functionality, usually implemented from scratch for each one of them. In this sense, software reuse would be a must to reduce the time-to-market factor.

The "observable problem" is that there is a lack of interoperability mechanisms among heterogeneous platforms. Such mechanisms would allow for a particular online learning system to provide its own content delivery module, which uses a common learner administration system provided by an external institution and, maybe, developed by a different vendor.

The identification of a common architecture, composed of basic software components that provide open interfaces, would contribute to both reuse and interoperability.

[1] In a top-down method of learning, teachers impart knowledge to those who they are teaching. Teachers talk in front of the class, and the pupils have to listen and write down what the "knowing" teacher says.

[2] Meta-data is data about data, which provide a common way for learning resources to be described. Learning resources that have been described by meta-data can be searched for and retrieved for use and reuse.

Keeping this in mind, an experiment was carried out from July to December 2010 at Iowa State University's Global Extension program. The work focused on developing a method to create a reusable, interoperable, accessible and durable reusable learning objects (RLOs) repository for rapidly producing e-learning materials to support Global Academy for the Extension Practice activities.[3]

2. OBJECTIVES

A. Content (learning material) generation.
B. Creation of Reusable Learning Objects (RLOs).
C. Rapid customization of Reusable Learning Objects to produce e-learning materials.
D. Delivery of E-learning materials

A. Content Generation

E-learning content includes elements such as lessons, quizzes, tests—essentially anything that a lecturer or teacher/instructor/trainer would want to make available to the learners on the Internet. In our Global Academy for Extension Practice project, the e-learning content related mainly to extension material and primarily took the form of either static (or) dynamic content.

The learning content in the form of HTML pages and Flash documents, along with any images or audio or video files embedded in these pages, generally is known is static e-learning content. This type of learning content (static in nature) does not change for the learner. Also, nothing is stored about the learner in a database or as a file for the extension agent, trainer, or instructor to refer to.

The learning content related to quizzes or tests require results to be stored in a database so that the extension agent, trainer, or instructor can refer to the results for each learner. This requires a dynamic system to record the personal information of the learners and their results. Using several programming languages such as JSP, CGI, PHP, ASP, etc. to develop this kind of learning content is widely practiced.

The content designers and developers of electronic learning content generate both static and dynamic learning content to support e-learning environments for learners of different domains around the globe. This way of content creation is common in e-learning environments and best suits the requirements of a particular institution. This kind of e-learning content is context- and technology-specific, and often modifications to the existing e-learning content or adoption of this learning content for other purposes requires reworking of the content. For example, the content in the Flash exe format does not allow for making any changes and the HTML format requires delinking all the existing pages and linking them again with added pages in a newly defined order. This has been viewed as an expensive and time-consuming process. Therefore, the development of content enabled to be packaged as RLOs is carving a new path for research on reusing and repurposing content across multiple e-learning platforms.

B. Creation of Reusable Learning Objects

RLOs are a specific chunk of digitized instructional content that can be reused in many different courses. According to Dahl and Nygaard [17], learning objects are elements of a new type of computer-based instruction grounded in the object-oriented paradigm of computer science. Object orientation highly values the creation of components (called "objects") that can be reused in multiple contexts. Reigeluth and Nelson [18] suggested that when teachers first gain access to instructional materials, they often break down the materials into their constituent parts. They then reassemble the parts in ways that support their individual instructional goals. This is the fundamental idea behind RLOs: e-learning content designers and developers can build instructional components that can be reused a number of times in different learning contexts. These RLOs can be tailored according to specific needs and delivered over the Internet, meaning that any number of people can access and use them simultaneously. Moreover, those who incorporate learning objects can collaborate on and immediately benefit from new versions.

To facilitate the widespread adoption of the RLOs approach, the Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronics Engineers (IEEE) formed in 1996 to develop and promote e-learning technology standards [19]. Without such standards, universities, corporations, and other organizations around the world would have no way of assuring the interoperability of their e-learning platforms and technologies, specifically their RLOs. Though many standards, such as ARIADNE [20] , IMS [21], AICC [22], SCORM [23] etc., are available we have adopted SCORM specifications for our work to make RLOs technically independent.

SCORM Specifications: Sharable Content Object Reference Model (SCORM) is a suite of technical standards and speciation given by ADL,[4] that enables electronic learning systems to find, import, share, reuse, and export learning content in a standardized way. The purpose of SCORM is to achieve interoperability, reusability, accessibility, and durability [23].

Building of a SCORM Compliant RLOs Repository: The repository, in this context, refers to the server/computer where RLOs are organized and stored. Newly created RLOs are continuously added to this repository in an organized way.

Creation of RLOs: An RLO can be created with the help of objects available in the repository or by new user-defined objects. The design and development of RLOs follow pedagogy and SCORM specifications. SCORM specifications include both the content aggregation model (CAM) and the run time environment (RTE). CAM deals with the process of creating, discovering, and gathering together simple assets into complex sharable learning objects and the organization of

[3] Global Academy for Extension Practice is a strategic coalition of regional, national and international partners for extension practice. The program is designed to bring widespread systematic change in the existing extension functionaries by (a) inculcating core competencies in the extension professionals; (b) enhancing institutional level capacities with pluralistic approaches; and (c) creating a cadre of new extension professionals, with rural women and youth, to promote the rural innovation necessary to achieve sustainable food security, reduce poverty, conserve natural resources, and address other rural problems. More details may be found at http://wikieducator.org/images/5/5e/Mary_Holz-Clause.pdf [1].

[4] ADL: Advanced distributed learning http://www.adlnet.gov/index.cfm

those learning objects into a predefined sequence for delivery. RTE deals with the delivery of RLOs.

For instance, *Aphid* (see Figure 1) is an RLO created with simple assets (two images and text). This instruction describes with images the description, damage symptoms, and management of aphids.

An RLO can be developed in any format (i.e., html, flash, .doc, .ppt, jpeg, gif etc.). The content authors are interested in content rather than on technology. This particular approach enables the content authors to use the content available in any technical format.

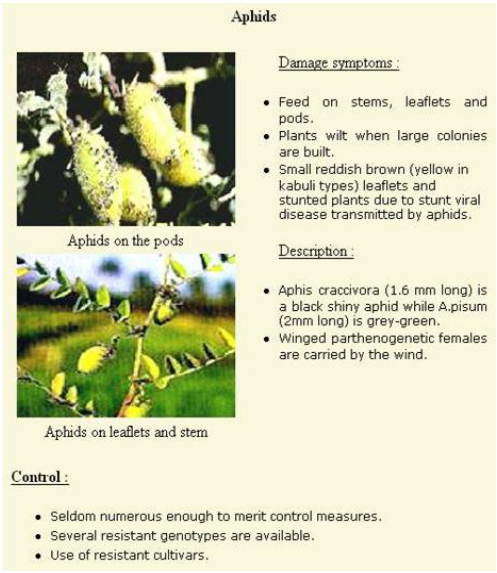

Figure 1. Aphid RLO

C. Rapid Customization of Reusable Learning Objects (RLOs) to Produce e-learning Materials

This section describes the step-by step-procedure to customize RLOs for creating an electronic learning content.

Course Organization: Content authors have to identify the subject of interest and develop the relationship between/among the RLOs. Accordingly, authors and designers should organize the sections and subsections of the course.

Linking RLOs: Tailor or link the RLOs using any user-friendly editor: GUI, ADL SCORM Editor, RELOAD Editor. Customization of RLOs using RELOAD editor is explained in Figure 2.

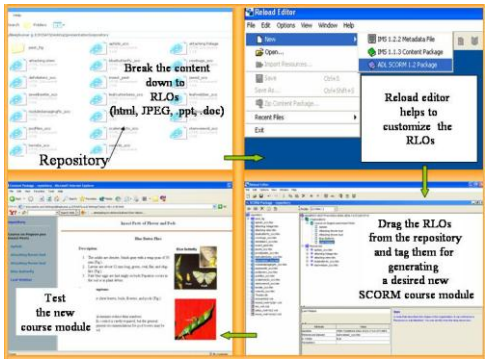

Figure 2. Process of customization of RLOs for creating an electronic course

Customization of RLOs: After selecting the *New > ADL SCORM 1.2 Package* from the *File* menu, open the desired section of repository in the reload editor left resource pan. Add an organization for the new course by right clicking on the organization available at the right manifest pan (top frame), and change the organization name according to the course title by renaming it at the right attribute pan (bottom frame). Now drag and drop the RLOs from the left resource pan to the right manifest pan. Change the section and subsection names according to the new course. To preview the new course, click on *Preview Content Package* from the *View* menu. Click on the *Zip Content Package* from the *File* menu if the new course is ready in its desired form (Figure 2).

D. Delivery of E-learning materials

Deliver the packages to learners by uploading them into learning content management systems (LCMS) or content management system (CMS), or develop an application program interface to provide a run time environment to support various e-learning platforms ranging from Internet Radio to mobile phone.

3. PRILIMINARY RESULTS

The compatibility of content packages was tested on ATutor, TeN Acado and Moodle. The SCORM compliance RLO content packages were downloaded from ATutor (open source learning content management system) [14] and played in TeN Acado (commercial courseware management system) [15] and Moodle (open source course management system) [16] as a new learning content module with newly defined modifications.

For instance, the chickpea learning content package (consisting of production practices, insect pests, and diseases) was downloaded from ATutor and uploaded to TeN Acado to create a chickpea insect pest course. In Acado the production practices and diseases sections were deleted and the insect pest sections were edited to create a new course, “Chickpea Insect Pests.” This approach shows that the SCORM compliance content packages could be playable in any standard open source and commercial CMS, LMS, or LCMS. The entire process took only a few minutes time and produced new learning material from existing learning material. This approach shows a way to produce e-learning materials rapidly from existing learning materials from an RLO repository.

We have started implementing this approach in our project, the Global Academy for Extension Practice, to minimize the time and money spent on producing need-based e-learning materials for our regional hubs located in developing countries.

The Global Academy for Extension Practice learning materials are available at http://courses.extension.iastate.edu/course/category.php?id=18 (Figure 3) for noncommercial usage, testing, and feedback.

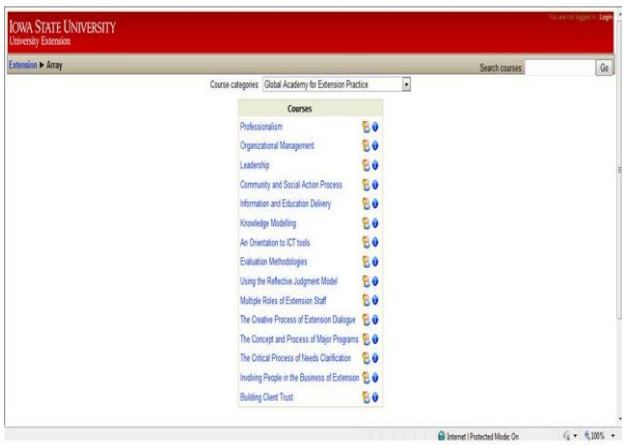

Figure 3. Global Academy for Extension Practice E-learning platform

4. CONCLUSION

The most crucial problem that exists today in electronic learning is creating need-based location-specific electronic learning content in an affordable way and delivering it across heterogeneous platforms. This has been even more challenging in mass agricultural extension and education as the learning content varies with various cultures, climates. and geographic regions.

In this paper, the presented RLO approach addressed a central aspect of this issue effectively, i.e., rapid production of desired e- learning content from the RLOs (reusable, interoperable, durable, and accessible) resource pool with required changes and modifications. We have demonstrated through experimentation with existing learning content packages throughout various learning management systems how the new learning materials can be generated and played among and across multiple e-learning platforms with the RLOs approach and SCORM specifications.

REFERENCES

[1] M. Holz-clause and D. Guntuku, "The Sixth Pan Commonwealth Forum on Open Learning (PCF6)," in *Access and Success in Learning: Global Development Perspectives*, Cochin, 2010.
[2] J. Anderson. (2010) UNESCO. [Online]. http://unesdoc.unesco.org/images/0018/001892/189216e.pdf
[3] D. Guntuku et al. (2004) ICRISAT Website. [Online]. http://test1.icrisat.org/Vasat1/research/Project%20report_MS%20IT%20Agri.pdf
[4] P. A. Galagan, "The e-learning revolution," *Training and Development*, vol. 54, no. 12, pp. 24-30, 2000.
[5] Open Courseware Consortium. [Online]. http://www.ocwconsortium.org
[6] MIT Open Course Ware. [Online]. http://ocw.mit.edu/index.htm
[7] Multimedia Educational Resources for Learning and Online Teaching. [Online]. http://www.merlot.org/merlot/index.htm
[8] Gateway to Educational Materials - GEM. [Online]. http://www.learningcommons.org/educators/library/gem.php
[9] Wikipedia. [Online]. http://www.wikipedia.org/
[10] Plone. [Online]. http://plone.org/
[11] Drupal. [Online]. http://drupal.org/
[12] Joomla. [Online]. http://www.joomla.org/
[13] Blackboard. [Online]. http://www.blackboard.com/
[14] ATutor. [Online]. http://atutor.ca/
[15] TeN Acado. [Online]. http://www.ten.us.com/products/acado.htm
[16] Moodle. [Online]. http://moodle.org
[17] O. J. Dahl and K. Nygaard, "An algol based simulation language," *Communications of the ACM*, vol. 9, no. 9, pp. 671-678, 1966.
[18] C. M. Reigeluth and L. M. Nelson, "A New Paradigm of ISD? ," in *Educational Media and Technology Year Book*. Englewood CO: Libraries Unlimited, 1997, pp. 24-35.
[19] (2000) Learning Technology Standards Committee Website. [Online]. http://ltsc.ieee.org
[20] Alliance of Remote Instructional Authoring and Distribution Networks for Europe . [Online]. http://www.ariadne-eu.org
[21] Instructional Management Systems Website. [Online]. http://www.imsglobal.org
[22] AICC – Aviation Industry CBT committee . [Online]. http://www.aicc.org
[23]Sharable Content Object Reference Model (SCORM). [Online]. http://www.adlnet.gov/index.cfm

[i]End note

[i] The paper was written when both the authors were associated with the Iowa State University Extension, USA.