Learning content creation and collaboration management system

Jacek Worotyński
SoftMedia P/L
j.worotynski@soft-media.com

Ewa Worotyńska
SoftMedia P/L
e.worotynska@soft-media.com

Abstract: The purpose of this publication is to introduce a new e-learning content creation and collaboration system. The system is a part of a research and development project conducted by SoftMedia Pty Ltd. The system enables the development of the user-driven, community-regulated e-learning curriculum content elements and arrangements in the collaborative method. The innovative approach of the system is based on modularity of the curriculum basic elements and their ability to evolve through the participation of the educational community will be presented.

Keywords: e-learning, virtual laboratories, interactive learning systems, multimedia in education

1. Introduction – current industry status

During the last few years, progress in computer science introduction of cloud systems and greater interest of the scientific community in collective intelligence systems encouraged SoftMedia’s research in building a framework for a dynamic content creation and collaboration e-learning package.

E-learning systems used today can be divided into two major categories (Content Management Systems / CMS List, n.d.):

- First – academic community-driven learning management systems [LMS] or content learning management systems. These LMSs are usually the result of the subsequent “add-on” modifications of the old systems that started as a desktop application (Blackboard – Learning Management System, n.d.). As a result, their structures are defragmented, they do not consider development in computer science methodology and are not suited for today’s dispersed users’ network. These systems are typically human driven administration systems that control users and content in a static way.
- Second – authoring programs that concentrate on content creation and in some cases limited collaboration between users.

The major problems facing users of the above systems are (Stark & Schmidt, 2002):

- System domain. The majority of these systems are designed to work in a localized environment.
- Their complexity caused by numerous modifications and subsequent transfer to more advanced platforms and technologies.
- Absence of the flexibility in adapting to changing conditions or automation. As a result, human participation in all elements of the system is vital. The human factor limits the system’s ability to modify and evolve.

In conclusion, there is a need for new learning systems that would:

- Be built from the ground up as a cloud application.
- Allow for evolution and automation of system control.
- Be more adaptive to changing technology.
- Replace an administrative control of the content with community driven quality control.
- Be effortless to use.
2. Overview of LC3MS™

LC3MS™ is a name derived from LCCCMS which stands for Learning Content Creation and Collaboration Management System. The package consists of three main distinctive components:

1. A self-regulating component for creating the e-learning content objects and constructing curriculum through community participation.
2. A monitoring component for detection and elimination of unsuitable content elements.
3. A performance evaluation component.

Due to the theme of the conference, this document will concentrate only on the first part. For the readability of the article, LC3MS™ and the word “system”, when used, refer to the first part of the entire program.

The main goal of the system is the initiation of collaboration between educational content creators in a highly adaptable interactive manner. LC3MS™ also provides the functionalities of a learning management system. It allows for management of user entities as educational institutions, curriculum managers, instructors and students similarly to other management systems.

The previous paragraph could indicate that LC3MS™ is one of many universally used authoring systems, adopted by software developers for years. In fact, LC3MS™ uses a new strategy in the content creation process. The main significance of the system is the collaborative development of each learning element by instructors. It gives educators the ability to produce interactive e-learning courses without the assistance of software engineers.

Every component of the LC3MS™ used in the design of an educational curriculum is called an educational object. Starting from the basic screen or interaction, any educational object created by a LC3MS™ user can be reused in the construction of more complex objects of the taxonomic scheme (Wilkinson, 2002) such as presentations, tests, topics and others.

Every educational object can also be used as a base for the next new object of the same type or next generation object. It supports the evolution of educational objects in an entirely interactive way.

In LC3MS™, a user who creates the educational content and assigns learning material to a student or students group is called an instructor. This term was abbreviated from “instructional designer” role, widely used in e-learning terminology.

LC3MS™ has a unique approach to the creation of educational objects as it allows an instructor to select a group of instructors to be a collaboration team. Even at the early stages in the development of an educational object, the collaboration team members may act in an advisory role on the instructor’s work. This process helps to produce educational objects using an effective, and less error-prone, approach.

The system is a cloud service (SaaS) and for all basic courses requires Adobe Flash player only. If a course consists of Wolfram’s Mathematica (Mathematica – ultimate application for computations, n.d.) elements, it also demands Mathematica’s player. Both are free plugins and are commonly used by educational institutions.

The main intention of the system is to provide the basic building blocks that sustain effortless production of complex educational modules. The adaptability and modularity of the system supports future extensions, following users’ input.

3. Educational object lifecycle

There are four main stages of an educational object lifecycle in LC3MS™:

1. The authoring stage – where an instructor assembles and edits an educational object.

At this stage, the instructor can work alone, and the draft object is visible only to the instructor. The author can also invite other instructors, as collaborators, to seek their advice. Collaborators have ‘read only’ privileges. In general, at any stage of an educational object lifecycle, only the author of an educational object may edit the object.
2. When the author finishes the authoring process of the educational object, the object can be deployed. At the deployment stage, the object becomes visible to all instructors connected to the system. They can use that object to include as a part of their curriculum or develop new generation of objects based on that deployed element. At this stage, all instructors can introduce their comments and assign the rating that reflects their opinion on the quality of the object.

3. At the assignment stage, the object can be assigned to a student or group of students as a part of their curriculum.

4. The last stage of the object's lifecycle is its removal from the system. This could be done by the author, by a panel of instructors or the performance evaluation component.

4. Curriculum editor

The curriculum editor allows the arranging of educational objects into complex structures. There is a specific hierarchy in which LC3MS™ organizes the educational objects. The 'leaves' of this hierarchical 'tree' are the pages and the questions. These are the only objects that include multimedia content. Questions can be compiled into tests arranged from sequentially displayed question screens. Pages and questions can be compiled into presentations. These are sequentially presented page and question screens.

At this point, it is worth noticing that a question can be placed in both a presentation and in a test. The difference is that the question placed in the test will not reveal feedback to a student. When placed in a presentation, it will display the feedback following student interaction. A test is an analogy to an exam where a student can freely navigate between questions, answering them in any order or altering the answers’ selection. The results are presented after completion of the exam. A question placed in the presentation is an educational exercise, where feedback enables immediate self-assessment for the student.

Presentations and tests are independent educational objects that can be assigned to a student as a part of an individual student's curriculum. They can also be a part of advanced structures such as topics, modules and courses which are at the top of the educational objects hierarchy (Fig 1).

![Figure 1. The educational objects hierarchy](image)

Since the hierarchical visualization of educational objects resembles the file explorer, LC3MS™ adopts the same strategy in navigating and organizing complex educational objects.
The process of creating compound objects is as simple as dragging and dropping a lower level object into an object higher in the hierarchy. The system automatically validates the dragged object, prohibiting its duplication or preventing inserting an under-construction object into a deployed object. The presentation or test screens are displayed in top to bottom order. To change the display sequence, an instructor can move and drop a page or question into a new location.

There are other techniques to insert new objects, for example by using the context menu, commonly called right click menu. The added object is always appended as the last one in the structure. The structure order can be rearranged by dragging its components to a new position.

After the deployment, the author can modify the advanced structures in the same way as during the authoring stage. The only difference is that deployed objects are visible to all instructors connected to the system. They can be assigned to students as a part of their curriculum.

5. Educational objects evolution

LC3MS™ supports the cloning of existing questions or pages in order to create new ones. Any instructor can apply this method to his own objects as well as objects authored by other instructors. As a result, newly generated objects form a base for the following generation. If an object has an ancestor or ancestors, the list of its predecessors can be displayed on demand. An author can choose any ancestor from this list and adopt it for a foundation of a new evolutionary branch (Fig 2).

![Figure 2. Evolution of educational objects; generations](image)

The cloning retains all the content of its ancestor. An instructor can freely modify content of a cloned object, without alterations to its predecessors as, at that moment, the instructor becomes the author of the new element.

While copying an object, the instructor has the option to replicate the structure/design without including the content. In this case, the object’s multimedia containers remain as placeholders in a new screen. The new object can be populated with new content while still holding a common layout with its ancestor. The approach eliminates the need for storing and managing object templates. As demonstrated, any object can be used as the template for a new one.

The collaborative participation of the community of users during creation and monitoring of the system repository both provides quality control and leads to the evolution of educational material.
6. Content editor

The content editor provides an infrastructure for building the content of basic educational objects, which in turn can be used to compile advanced structures. These basic educational objects are called screens and can be displayed to students during presentations or tests. From the user's participation point of view, there are two types of screens:

1. Screens that do not evaluate the user's actions,
2. Screens that assess the user's actions.

The first category reflects pages in a manual or a book, therefore, in LC3MS™ they are called pages. The user can interact with the content if the content has interactive elements; however, the results of the user interaction are not stored. The second category requires an answer, an action from a student. Following the same logic as earlier, these elements are called questions.

Both elements, pages and questions as with all other educational objects of the LC3MS™, are created in the Curriculum Editor Module. Their content is assembled or edited in the Content Editor. An instructor can import multimedia elements such as text, audio, video and place them on the screen within specialized containers. A container can be moved around the screen and scaled by the use of container handlers. There is also a collection of tools that enable positioning, alignment and scaling a group of selected containers.

Typical e-learning software offers a variety of different question types. There is essentially one question type in LC3MS™. A question was intentionally created as a container for different types of user interactions. It eliminates the need for memorizing different types of questions each with its own restrictions. An author can assemble any type of question from the supplied interactive containers. The author or any instructor can also use an already built question as a template for a new one, using the cloning technique described earlier. LC3MS™ has a built-in validation algorithm that analyzes the question readiness for deployment.

7. Style consistency

It should be considered that presentations or tests can be assembled from pages and questions designed by several authors, each using different style. The collaboration of many authors and reusability of educational content is the essence of LC3MS™. Since various authors could use different visual styles to demonstrate their educational material, the presented screens could suffer from inconsistent appearance. To unify the style of a presentation, an instructor can apply a text format collection that will be automatically implemented to all screens of a particular presentation. A format collection can be created by any instructor or administrator in the Style Guide Module. The collection can be later selected and applied to any instructor's presentation or test. If the text format collection is modified after its application, the modifications will be automatically propagated to all educational objects that use that text format collection. Similarly, the user can choose the same background that would be applied to all screens of a presentation or test.

Keeping the information that comes from several authors intact and simultaneously implementing uniform appearance delivers the optimal educational experience to a student.

8. Assignment editor

The Student's Assignment Editor is used by instructors to designate a deployed educational object to a student or a student group. Creating a new assignment is similar to the creation of a new educational object; by dragging and dropping an educational object into the group assignment grid.

The allocated object becomes an assignment. Each assignment can be customized for a group of students by setting specific properties such as the time limit for a test or a maximum score obtained from an individual question or test. The instructor can also set dates between which the assignment is visible to the selected group of students. All these properties can be changed anytime by an instructor.
9. Notice board
The noticeboard is a communication module that allows instructors to place announcements. Setting a list of recipients limits the group of people that can view an announcement. A recipient group could include instructors, students, student’s guardians or a mixed group of any of these users. Each of the recipients can commence a conversation with the announcement’s author. The conversation is only visible to the author and the recipient.

10. Summary
Considering the limited space available for this document, the above description of the system was limited to the brief presentation of major modules. Currently, the first part of the system – self-regulating component for creating the e-learning content objects and constructing curriculum, is undergoing preliminary trials. The majority of tests can be conducted internally within an organisation. Some beta testing will be carried out by selected educational institutions. The monitoring and performance evaluation components are under development. During trials, the monitoring component for detection and elimination of unsuitable content elements will require the participation of a greater number of users and an established content repository in order to draw practical conclusions. Modularity of LC3MS™ allows for the introduction of each major part independently providing more flexibility during modifications and implementation of improvements.

In the authors’ opinion, the active collaboration of instructors combined with reusability of educational objects and ability to evolve is the main strength of LC3MS™. The system consistency combined with the easy to use interface gives instructors, even with non-technical background, a highly efficient tool which they can utilize in their everyday educational work.

11. Bibliography

System dostarczania treści edukacyjnej, zarządzania nauką i współpracy
Streszczenie
Słowa kluczowe: e-edukacja, systemy zarządzania nauczaniem, systemy interaktywne, materiały multimedialne w edukacji.
Celem artykułu jest przedstawienie nowego systemu komputerowego służącego tworzeniu elektronicznych kursów edukacyjnych z wykorzystaniem współpracy pedagogów. System jest częścią pracy badawczo-rozwojowej prowadzonej przez firmę SoftMedia. Program pozwala na tworzenie regulowanych i nadzorowanych przez nauczycieli obiektów i złożonych struktur programu edukacyjnego poprzez współdziałanie użytkowników. Zaprezentowane jest nowatorstwo systemu, polegające na modularności podstawowych elementów z jednoczesnym umożliwieniem ich ewolucji poprzez udział grup współpracujących pedagogów.