CONCEPTUAL LEARNING ASSESSMENT AND CONTENT MANAGEMENT IN E_LEARNING PLATFORM BY MEANS OF CONCEPTUAL MAPS

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ABSTRACT

We describe tools that use conceptual maps to manage the atomic content of a e-learning platform and to assess the conceptual learning of the students.

KEY WORDS
Conceptual map, LCMS, conceptual assessment.

1. INTRODUCTION AND OPERATIVE BACKGROUND

The e-learning platforms that are commercially available have been developed mainly to satisfy the needs of the industry, whose goal is the fast acquisition of competences that should be immediately re-injected in the productive process. On the other hand, universities deals with learning processes that develop themselves on a medium or a long term period, and their main mission is to help students to develop a cognitive representation of those sectors in which they are expected to operate. This is just one of the reasons that induced us to develop our own e-learning platform, "Home-University". In developing the platform we have used only cross-plat technologies: PHP, Java and MySQL.

In this paper, due to the lack of space, we will focus only on two aspects that characterize our platform [1]: i) optimized re-use of the didactic material; ii) conceptual assessment of the learning process.

Both can be dealt with a unique tool, as we will see in the following: the conceptual maps.

As well recognized by the international community an optimized re-use of the didactic contents implies the reduction of such materials in atomic unities; unities that, then, should be recombined in autonomous and interchangeable Learning Objects, LO[2]. Up to now, however, there is not a general agreement, or specific indications, about the atomization level of the contents and on the content format that one should adopt.

The nowadays practices can be resumed in two main orientations: a) materials to be used with the help of an internet browser (assembled either on the basis of an international standard, e.g. xhtml, or realized in proprietary format, e.g. .swf); b) materials to be used off-line (assembled either on the basis of de-facto standards, e.g. .rtf, for which there exist free-charge readers, or using proprietary format, e.g. .ppt).

Any "best practice" should be cross-plat and allow to assemble LO in a format usable either on-line and off-line, independently on the OS and on the platform of the user. In addition the system should be flexible enough to allow for the use of whatever pedagogic methodology. Fig.1 shows the architecture that we have developed in order to satisfy the above requests.

![Conceptual Map](image)

**Fig. 1**

The atomic multimedia content (figures, video, sounds, animations, formatted text files) are stored in the content server while the plain text atomic unities (descriptive contents, bibliography, links, historical notes, appendixes, exercises) are stored in the MySQL database. A second textual db stores questions and answers to assemble tests.
3. LO AND USE OF CONCEPTUAL MAPS

Starting from the atomic components LOs characterized by different level of granularity can be assembled: a) didactic cards (dynamically assembled - first level); b) conceptual maps (CMs) of specific area (that allows to interconnect cards by means of CMS); c) didactic modules (that may be based on several interconnected CMs); d) courses (that may be based on several interconnected didactic modules).

Once that the "atoms" have been stored in the server the teachers have not to worry any longer about assembling didactic cards; when needed, this task is automatically operated by the platform. They have to concentrate only on the assemblage of the didactic modules (starting from available cards identified by their title/keywords) by means of a CM, a portion of which is shown in figure 2.

The design of the conceptual map can be done on-line by means of an applet, or off-line by means of a cross-plat Java application. Once that the map has been created it can be recorded, as plain text, in a database or, as a file with the .mc extension, in the content server and can be published for the student consultation. Each object of the map has a set of tabs, see fig.2, that allow to create links to various kind of didactic materials: materials characterized by a low level of interaction (like movies), on-line and off-line interactive materials (e.g. hypertexts) electronic transpositions of the books (e.g. like the .rtf and most of the .pdf and .ppt files). One of the tabs, then, allows to connect the object to other conceptual maps and thus to develop more complex LOs.

The tools described here above provide a solution to our first goal: to achieve an optimized use and reuse of the didactic material in the respect of the specific teaching style and methodology of each single professor.

The conceptual maps, however, can be used in a more collaborative manner and, indeed, we allow the user (student, tutor, etc.) that accesses to a published map to modify it by creating and linking new objects; objects that in turns may be linked to any resource available on the platform, or on the web. Once that the map has been modified it can be recorded and made available to the learning community, or used for personal purposes. We have imposed only one restriction: the user cannot modify or delete the object (nodes or links) created by the owner of the map. Modification of the original map can be done only by the map's owner, after considering all the modifications proposed by the learning community.

As far as the tests are concerned the teacher, starting from the atomic content, can assemble any sort of classical test by specifying the subject, the number of questions of any typology (multiple answer, yes/no answer, open answer, etc.), the level (single level, progressive level, adaptive level) and eventually the role of the learner.

Here, however, we concentrate on our second goal: the assessment of the conceptual learning. This is always a very complex task and, usually it is obtained in an indirect manner by checking the ability to answer to standard test or to solve problems. We believe that, at least, a better assessment of the conceptual learning can be obtained by asking the students to reconstruct conceptual maps.

With this in mind we have adapted the application already described in the previous paragraph to prepare also "conceptual map tests", CMTs. Basically the teacher designs a conceptual map and than ask the application to prepare a test starting from such a map. It is worthwhile noting that the teacher can assign to the link a weight between 0 and 1 and thus propose multiple solutions with different levels of validity. Opening the test, the learner finds all the elements of the map to be reconstructed listed on the leftmost part of the screen and no links at all. Once that the reconstruction has been completed the student can ask for its evaluation. The application compares the reconstructed map with the original one and give the answer in two different forms: an integrated form represented by a normalized numeric value ranging between 0 and 1 and a visual one that shows the original map with, as an example, the right links in green, the wrong ones in red, and the absent ones in yellow. The result of the tests are recorded in a database and can be used for statistical purposes.

CMTs can be used also to evaluate the logic used by the student in solving problems. As well, it is possible to compare various maps and work out statistical indicators to evaluate the efficiency of the didactic modules. Anyway, this latter and other possible applications of the conceptual maps are beyond the goal of this paper.

In conclusion we have shown that the conceptual maps can be used: a) to optimize the re-use of didactic contents recorded in databases and in multimedia content servers; b) to design in a very simple manner didactic units; c) to favor the collective sharing of the knowledge; d) to assess the conceptual learning of a student by means of CMTs.

REFERENCES

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[2] see documents published on the following websites: www.imsglobal.org and ltsc.ieee.org