A rules based on context methodology
to build the pedagogical resources

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Abstract

The main feature of a learning content management system is the capability for the teachers to build pedagogical resources without higher IT knowledge. So the computer science offers a lot of software programs all-purpose. An open problem in this area is to create educational content automatically depending on the context of the instruction process. In this paper the author defines the context of the educational process and a set of rules based on the context which can be turned into a software program.

Keywords: Context for learning process, Rules based on context. Learning content management system.

1 Introduction

The concept of learning content management system is derived from the concept of course management system. A course management system is an authoring tool which enables teachers to produce and manage the pedagogical resources.

Example of LCMSs are the commercial products like WebCT, Blackboard, eCollege and the open sources like Moodle (at the address http://www.edtechpost.ca/pmwiki/pmwiki.php/EdTechPost/OpenSourceCourseManagementSystems, a list of open source management systems can be found).

Also the concept of LCMS is hard linked with the concept of CMS (content management system). Boiko shows (Boiko, 2005) that the content management system is a system with three functions: collecting, management and publishing information in a unitary whole (like a magazine, newspaper). So, a CMS must be designed from three points of view:

- collecting system;
- management system;
- publishing system.

The collecting process involves the building of the components, acquiring and converting them in standardized formats. Speaking from the point of view of building an electronic course, the components are pieces of information, like the modules of courses, which according to Adascalitei (Adascalitei, 2007) “must be updated, improved and adapted in accordance to the needs of the addressee”.

The management function is conductress with the recording, updating of the components and editing the links between components.

The publishing function is conductress with the automat linking between components and accomplishing a publication.

The LCMS concept reports on CMS used in the instruction process that helps teacher to build, organize, publish online courses, track the student progress, offer communication tools, course statistics. The most important feature is that a LCMS offers a frame used by teachers to build good courses and used by the students to learn and to be evaluated.
Short-speaking, a learning content management system is a combination of hardware and software that enables the users to collect, organize and publish pedagogical resources and enhances communication between teachers and students.

Ullman C. and Rabinowitz M. (Ullman et al, 2004) show the benefits of using a CMS in the learning process:

“By using the CMS for the course’s organization, then the purpose of class time would be almost exclusively devoted to discussion and student activities. Freed from having to repeat past activities, instructors could become more engaged in the process of sharing ideas. The students could become more active learners, taking more responsibility for what they learn and becoming more important in the dynamic of the classroom.”

2 The context of the learning process

The learning process is the process of converting information received by the human sensors into knowledge and skills.

The information process involves building a cognitive structure about the learned material by the students. The students are actively involved in activities of processing, memorizing, retrieving information and teachers are involved in helping students to develop the skills of information process, which systematically applied leads to accomplishing the learning objectives.

In this way, a structure was developed that implies three layers:

1. sensorial input and record;
2. the short term memory (STM);
3. long term memory (LTM).

![Figure 1. Information Process](image-url)

The context of the learning process is defined by a whole of factors that affect the learning.

To define the context of the learning process, it is necessary to define all the conditions in which the instruction process unfolds. This is a complex concept noted by Cole and Griffin (Cole et al, 1987).

The instruction context could be referred as social context, emotional context, mental context, school context, technological context, knowledge context. In this paper, we take in consideration some of all factors that affect the learning: motivation, goals, previous knowledge, interest, teaching styles, learning styles, classroom climate, parents, preoccupations, hobbies, etc.
Mental context (MC) includes general abilities and knowledge, the intelligence of the student, mental structure and the capacity of the learner to learn, understand and practice the material.

Social context (SC) includes the familiar context, familiar stress, friends view.

Technological context (TC) refers on course structure, format, informational technology, technological equipment.

Knowledge context (KC) refers on previous knowledge, past experience related on the topic presented in course.

Emotional context (EC) refers on motivation, interest, goals of students.

Classroom context (CC) includes teaching methods, the structure of students (age, gender, ethnical structure, etc.)

Certainly, it’s an absurdity to affirm that a course is good for all students. So, it’s necessary to develop a based on context methodology to build e-courses and this methodology has to be included in the LCMS.

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### Figure 3. LCMS And The Context Of Education

#### 3 Rules based on context methodology

The general form of a rule is [1]:
\[ r = (c_1 \land c_2 \land \ldots \land c_n) \rightarrow (a_1; a_2; \ldots a_k), \]

where \( c_i, i = 1, n \) are conditions and \( a_i, i = 1, k \) are actions.

In our case conditions are the contextual factors of the learning process and actions are pedagogical resources patterns that have to satisfy the pedagogical resources.

So, a rule turns into [2]:

\[ r = (cf_1 \land cf_2 \land \ldots \land cf_n) \rightarrow (p_1; p_2; \ldots p_k) \]

The contextual factors are pieces of information (facts): the student is male, the student is 40 years old, the student is working, the student has no previous knowledge.

Pedagogical resources patterns are recipes of pedagogical resources. These patterns gather all the experience of teaching and learning in a specific domain taking into account the contextual factors.

The problem of this methodology is that there aren’t enough patterns for all combinations of contextual factors.

Let’s consider the rules [3].

\[ r_1 = (cf_1 \land cf_2) \rightarrow (p_1) \]
\[ r_2 = (cf_3 \land cf_4) \rightarrow (p_2) \]
\[ r_3 = (cf_5 \land cf_6) \rightarrow (p_3) \]

Let’s assume that the learning process is satisfying all the contextual factors from 1 to 6.

If there is a rule of form [4]:

\[ r_j = (cf_1 \land cf_2 \land cf_3 \land cf_4 \land cf_5 \land cf_6) \rightarrow (p_1) \]

the problem is solved, while we can select it and it can be build a pedagogical resource using the description \( p_1 \).

If there isn’t a rule of form [4], the problem is the order of applying the rules from 1 to 3, and how operates the stream of conversion of a primarily educational material (knowledge) in a pedagogical resource.

\[ \text{knowledge} \rightarrow \text{partial e-course} \rightarrow \text{partial e-course} \rightarrow \text{Pedagogical resource (e-course)} \]

\[ \text{Figure 4. The Stream Of Building Pedagogical Resources} \]

One solution is to define a priority to each contextual factor, and the priority of the rule is the sum of the priorities of the contextual factors that composed the clause of the rule. So the rules will be selected according to the priority of the rule.

A pattern (description) depends on the domain of knowledge that will be transferred from teacher to students and the contextual factors.

The pattern is composed by a curriculum and learning objects. The pattern described in the schema 5 is adapted from Cisco. A Learning Object is built using a combination of a presentation, a resume, an
evaluation and information objects. A learning object has only one object of instruction. Each Information Object is built starting from derived objectives from the objective of Learning Object.

**Figure 5. A Pattern Of Pedagogical Resource**

If the learning process is satisfying the contextual factors no.3 and no.4, the stream of conversion of a primarily educational material (knowledge) in a pedagogical resource is represented in the schema 6.

**Figure 6. The Model Of Applying A Rule**

Another issue is how apply automatically a pattern to a set of complex information to result a pedagogical resources. Doubtless the primarily information have to be structured and the teacher have to help the system to build good pedagogical resources.

A set of rules

\[ r_1: \text{past\_experience}=\text{none} \rightarrow p, \]

\[ p = \text{Presentation} \]
\[ \quad \text{Information Object} \]
\[ \quad \text{Resume} \]
\[ \quad \text{Evaluation} \]
\[ \quad \text{Reading} \]
\[ \quad \text{Lecture notes} \]
\[ \quad \text{Exercises} \]
\[ \quad \text{Simulations} \]
\[ \quad \text{Projects} \]
\[ \quad \text{Bibliography} \]

\[ r_2: \text{past\_experience}=\text{all} \land \text{motivation}=\text{good} \land \text{capacity\_to\_learn}=\text{high} \rightarrow p, \]

\[ p = \text{Presentation} \]
\[ \quad \text{Information Object} \]
\[ \quad \text{Resume} \]
\[ \quad \text{Evaluation} \]
\[ \quad \text{Reading} \]
\[ \quad \text{Exercises} \]
\[ \quad \text{Projects} \]
\[ \quad \text{Bibliography} \]
\[ r_3 : \text{motivation}=\text{enough} \land \text{capacity_to_learn}=\text{enough} \rightarrow p , \]

\[ p = \]

- Presentation
- Information Object
- Information Object
- ....
- Resume
- Evaluation

- Reading
- Lecture notes
- Simulations
- Bibliography
- FAQ

\[ r_4 : \text{IT}=\text{high} \land \text{capacity_to_learn}=\text{high} \rightarrow p , \]

\[ p = \]

- Presentation
- Information Object
- Information Object
- ....
- Evaluation

- Lecture notes: video, films
- Simulations

\[ r_5 : \text{learning_style}=\text{visual} \land \text{teaching_method}=\text{project_method} \rightarrow p , \]

\[ p = \]

- Presentation
- Information Object
- Information Object
- ....
- Evaluation

- Lecture notes: video, films
- Projects
- Bibliography
- FAQ
4 Conclusions
The major challenge of the e-learning still remains the process of building pedagogical resources; while in this process have to contribute a lot of specialist from different areas like instructional design, domain teaching, web programmers and software developers. In this paper it was proposed to consider the context of unfolding the instructional process and a set of rules based on context, which have to be used.

5 References

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