Modeling a Web-based Educational Environment

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The advent of the Internet has brought about an immensity of opportunities for educational innovation. Many people, all over the world, are attempting to explore the inherent challenges. However, most of them tend to merely concentrate on* content*. Our belief is that there is no real future in content if* context *is not carefully taken into account.

This paper aims at stressing the importance of* context *– a much neglected core component of Web-based educational environments –, relating it to some key concepts proposed by Vygotsky, Argyris and Senge.

To this end, we present some of the learning activities that can be explored in Web-based environments, we relate them to the main learning philosophies and associated cognitive and affective competencies, and we propose a model for the representation of educational intranets that borrows the UML notation from Software Engineering and takes into account both* content *and* context*.

1. INTRODUCTION

Since the emergence of the World Wide Web, efforts have been made so as to use it for educational purposes. Nevertheless, almost all these efforts consist on the mere transposition of the old teaching models to the Web. This does not only misuse Web capacities, but also explores activities in ways that are inappropriate for the Web environment [4]. Yet, the emergence of the Web "may well lead to redefining formal educational activities" [3].

Another aspect to take into account is context. In spite of all that has been said, content is not everything, and may even not be the most important component of an educational Web page. When not integrated with adequate context, content may end up producing just ephemeral results. This is in full agreement with Vygotsky's proposals of twenty years ago [10], that tells that knowledge acquisition is facilitated by social interaction, and that interacting with the environment and with peers fosters the internalization of development processes [6].

Argyris and Senge have equally stressed the importance of interaction and proposed the creation of learning communities [2,8]. They described those communities as privileged spaces for sharing ideas in ways that facilitate a more solid construction of individual knowledge and the appearance of a valuable collective wisdom. Those communities are characterized by a shared vision, a group of rules of conduct, and guiding values.

With the aim of promoting the creation of such learning communities on the Internet, we present the idea of an educational *intra*net: a reserved space of interaction where people can get together and share a common context where they can learn.

To this end, we suggest some educational activities and we relate them to the learning philosophies they support and to the competencies they help developing. After that we present a possible representation of an educational *intra*net making use of the Unified Modeling Language (UML).

2. ACTIVITIES, LEARNING PHILOSOPHIES AND COMPETENCIES

A large number of educational activities have been identified, over the years, as being particularly suited to fulfil the aims of learning. Neves and Figueiredo [7] have emphasized and described the following:

- Case Studies;
- Debates;
- Directed Dialogues;
- Games;
- Panel Discussions;
- Problem Solving;
- Projects;
- Question Posing;
- Role Playing;
- Simulations;
- Small Group Discussions;

Neves, A.L. and Figueiredo, A.D., Modeling a web-based educational environment, 1998.
Paper accepted to Euroconference'98 – New Technologies for Higher Education.

- Socratic Dialogues;
- Storylistening;
- Storytelling;
- Tutorials.

Even though they were all created for classroom purposes, they all lend themselves to exploration in Web-based environments, and some may even benefit from the shift. Indeed, the Web facilitates the creation of communities at a global level, it makes possible the access to large amounts of information, and offers the opportunity to interact with other users in synchronous and asynchronous ways.

Of course, choosing an activity also involves taking conscience of the competencies we wish to develop. We suggest the following [7]:

- Application *(Bloom, Foley)*;
- Argumentation [7];
- Autonomy *(Hunt)*;
- Comprehension *(Bloom, Foley, Orlandi)*;
- Conflict Resolution *(D'Hainaut)*;
- Creativity *(Kamii)*;
- Critical Thinking *(Foley, Orlandi)*;
- Curiosity *(Kamii)*;
- Decision *(Palkiewicz)*;
- Execution *(Foley, Orlandi)*;
- Group Work *(Hunt, Orlandi)*;
- Interest *(Burns, Foley)*;
- Leadership [7];
- Listening Ability *(Orlandi)*;
- Research *(Orlandi)*;
- Responsibility *(Orlandi)*;
- Synthesis *(Bloom)*.

Independently from the competencies they foster, activities may also be chosen or analyzed according to the learning philosophies they support. Indeed, each one is based on different principles and assigns different roles to the learners.

Action learning - "learning requires action and action requires learning" [6]. Groups are created in order to accomplish some task. To do so, they need to learn.

Conventional teaching – This follows the instructor-centered paradigm. The instructor presents the learning material and evaluates students through tests and exams.

Incidental learning - "Learning happens whether we pay attention to it or not" [1].

Learning by design - To learn by design we accomplish some task that involves abstraction and an integrative approach.

Learning by doing - "There is really only one way to learn how to do something and that is to do it" [9]. Learning by doing is acquiring knowledge by accomplishing some simple tasks.

Learning by exploring – Knowledge is acquired through an autonomous search for information.

Learning by reflection - Learners are encouraged to reflect about the way they think when solving a problem and to compare their way of thinking with that of experts and of their peers.

Learning by teaching – Learners play the instructor's role, teaching the others.

Learning from mistakes - "When the outcome matches our expectations, we don't learn a great deal" [9]. This is about using our mistakes as a way to improve our knowledge.

Situated learning - "Knowledge and skills are taught in contexts that reflect how the knowledge will be used in real-life situations" [6].

In a previous paper [7], two maps have been made of the relationships between learning activities and the learning philosophies they support, as well as between learning activities and the competencies they develop. From those tables, some inferences can be made.

For instance, in spite of everybody's' disagreement with *conventional teaching*, this philosophy is shown to play a very important role in today's learning processes, even on the Web. *Tutorials* are also identified as being a very easy way of teaching through the Web, although they do not seem to be very successful in the development of competencies. *Autonomy*, *comprehension*, *critical thinking*, *listening ability* and *synthesis* seem to be the only competencies to be enhanced by *tutorials*, and even so in a rather moderate degree. *Storytelling* and *storylistening* are very specific activities, since they tend to be used exclusively with children, and this may explain their reduced employment.

The proposed activities try, above all, to enhance *application*, *comprehension*, *critical thinking* and *interest*. Also, learning by reflection is the philosophy most supported by the activities listed.

Among all those activities, *project* and *problem solving* are the ones that lead to the development of a broader range of competencies, which suggests their special relevance for the learning process in Web contexts. *Simulations* and *small group discussions* should also be mentioned because of their completeness.

3. THE INTRANET

Designing an educational intranet involves many responsibilities. Its structure and its contents must be carefully chosen and thought out. Representing the intranet through a commonly accepted language does not only make possible its analysis by the designer, but also by all stakeholders of the process. Moreover, the usage of a standard language is the best way to facilitate discussion and incremental improvement while providing the architectural framework for implementation. The language we chose for this purpose is the Unified Modeling Language (UML) because of its increasing popularity and particular suitability to satisfy the above objectives [5].

Our first step was trying to represent the architecture of an educational intranet using a class diagram. In that diagram we considered each HTML page as a class. In such a diagram, a class is characterized by its attributes and also by its operations. So, the first thing to do is to identify those elements. In the case of an HTML page, the attributes (what uniquely identifies a page) are its content, images, background, and the elements of the forms it may contain. Indeed, these are the obvious attributes, as each one has a value, a type, and a visibility. Also, their values can be modified through some operations. However, when describing at high level the representation of an intranet, the inclusion of information regarding background and images will only add confusion. Thus, our description will be restricted to the content of the pages and to the elements of the forms that they may include.

On the other hand, operations are the links that provoke jumps to other pages and the form's buttons that cause some kind of action.

With this in mind, we need to decide about where the learning activities belong. Taking into account the definitions of attributes and operations given by Fowler and Scott [5], we have decided to consider them as attributes or as operations depending on the level of interactivity they involve. If an activity demands some kind of local interactivity, we consider it as an operation; if it only requires off-line work, then it will be considered as an attribute.

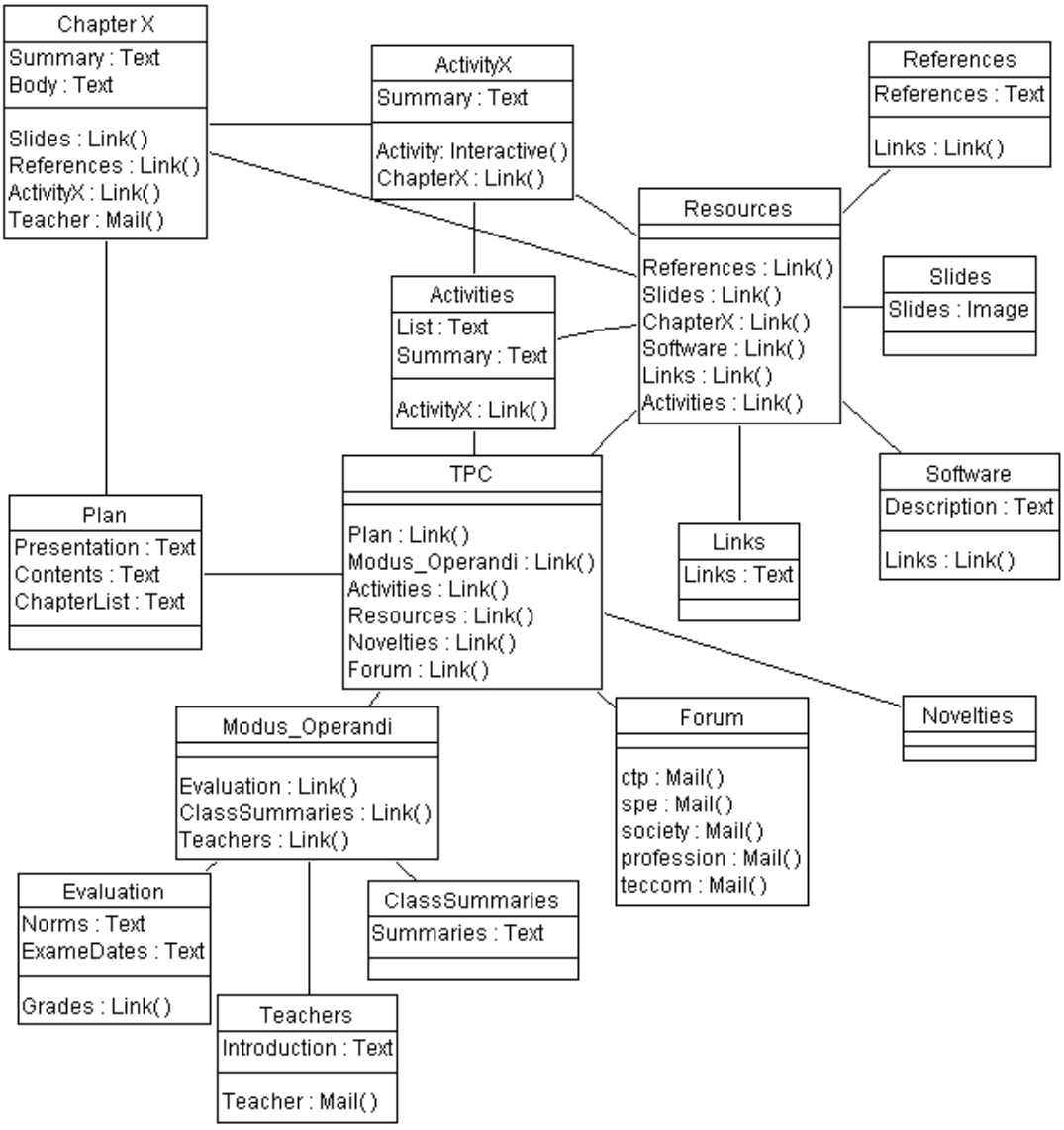

Figure 1

Figure 1 represents a class diagram describing the intranet we have created for a course in Technical Professional Communication (TPC). In this representation we have only considered some of the elements: texts, links, activities and mail.

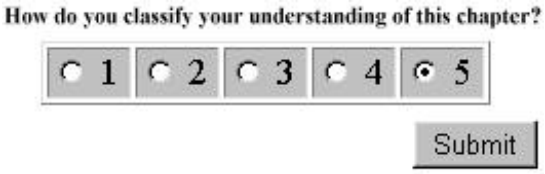

Figure 2

In order to clarify our abstract representation, suppose we have an HTML page where a chapter is presented to the learner. This page starts with a brief description of the chapter, followed by its body. To practice and explore the material taught, the page offers a *simulation* activity where the learner is given the opportunity to change some values, immediately seeing the consequences. After that, the learner can jump to a page of links related to the chapter and is allowed to send an e-mail message to the instructor. At the bottom of the page, a form lets learners classify their understanding in a 1-to-5 scale (Fig. 2). This classification is then sent to the instructor.

Figure 3 is the class diagram of this fictitious page and adds to figure 1 some form elements.

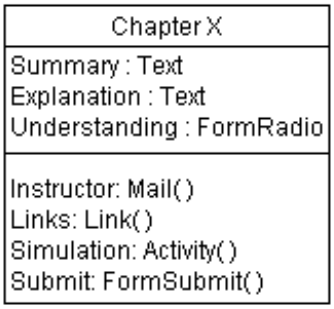

Figure 3

4. CONCLUSION

This paper offers an approach for the creation of an educational intranet. The objective was to stress the importance of a correct choice of learning activities, that can be used as the context for the exploration of educational content, while accounting for the competencies we wish to develop and the modes of learning we wish to explore. The paper also presents, though in a sketchy manner, the first steps of an abstract representation of educational intranets that takes into account both the content and the context of learning. This representation resorts to the UML notation and is currently in the process of being improved through further research.

5. REFERENCES

[1] Allee, V. *The Knowledge Evolution: Expanding Organizational Intelligence.* Butterworth-Heinemann, USA, 1997.

[2] Argyris, C. and Schon, D. *Organizational Learning: A Theory of Action Perspective*. Addison-Wesley, 1978.

[3] Duchastel, P. Design for web-based learning, 1996; see http://www.nova.edu/~duchaste/design.html

[4] Duchastel, P. A web-based model for university instruction, 1997; see http://www.nova.edu/~duchaste/unimodel.html

[5] Fowler, M. and Scott, K. *UML Distilled - Applying the Standard Object Modeling Language.* Addison Wesley Longman, Inc., USA, 1997.

[6] Lankard, B. New ways of learning in the workplace. 1995; see http://coe.ohio-state.edu/cete/ericacve/docs/learning.htm

[7] Neves, A.L. and Figueiredo, A.D., Designing the educational intranet, 1998. (submited)

[8] Senge, P. *The Fifth Discipline: The Art and Practice of The Learning Organization*. Doubleday, , New York, 1990.

[9] Schank, R. Engines for Education, 1994; see http://www.ils.nwu.edu/~e_for_e/

[10] Vygotsky, L. *Mind in Society – The Development of Higher Psychological Processes.* Harvard University Press, USA, 1978.