E-LEARNING NETWORK ENVIRONMENTS WITH TREES OF KNOWLEDGE

Progress Report

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Abstract: A shift in e-learning systems with web 2.0 technology has brought up a different approach on structuring content and collaborative learning spaces. This paper initially presents a general survey on emergent web based e-learning systems both technological and social-oriented and then describes our ongoing project for developing a collaborative learning tool. The proposed tool is twofold, including (1) trees of knowledge which are directly related not only how knowledge is structured but also accessed, distributed, stored, shared and methods that allow it to be built up and maintained; (2) applying theory of connectivism, which asserts the learning of knowledge in a distributive manner, based on network of connections formed from experience and interactions with a knowing community. The proposed approach should be implemented and later validated in a class of high school students. By combining trees of knowledge with semantic social networks we are in fact trying to perform a true collaborative learning environment, where students and teachers will actively interact towards wisdom.

1 INTRODUCTION

The World Wide Web has definitively changed the way people interact with information. In this paper we will address the interactions of users in dynamic learning scenarios, which play a key role in knowledge construction.

Our research explores learning environments with use and reuse of learning resources. We have started by analyzing the existing difficulty in the internet for search, organization and relationship of diverse topics from a determined knowledge area, where doesn't exist any aggregation. After that, we headed towards the understanding of what are the ingredients in a learning web system for having an active role in school. A second step, now under development is to provide an engineering solution, which all actors of learning, namely teachers and students will actively be evolved in reaching critical thinking. Finally we intend to develop and test it in a real learning situation.

An initial proposal of an e-learning web architecture was presented on January 2006 (Silva and Restivo 2006a), appealing to the use of web semantics in learning contexts. Also a poster was presented on April 2006 (Silva and Restivo, 2006b) where some ideas were clarified. After that a pedagogical perspective with argumentation visualization techniques for collaborative environments, was introduced. The core idea was the ontology's usage as formal representation of knowledge with the possibility of dynamically integrating distinct ontologies from different users (same knowledge domain) and also visualizes this integrated knowledge as a single dynamic pedagogical ontology. Also the ideas of social networks applied to knowledge construction and argumentation usage were integrated. This study was presented on September. (Silva and Restivo, 2006c)

Now, our research is heading towards two perspectives. On one hand the formal representation of Knowledge. This was initially directly referenced to ontologies architecture but now we believe trees of knowledge architecture as more appropriate for organizing data, such as learning contents, and define the relationships between data. Ontologies

might have an interesting usage in interoperability issues, but at moment we are only concerned in a well structured information system with a simple semantic approach. All knowledge is represented not only by the facts, but also by the relationship between the facts. Furthermore it's very important how the facts are stored and organized. On the other hand we are certain that collaborative environments will undoubtedly be strengthened with social networks of knowledge acquisition. In particular, the theory of connectivism supports this approach. For (Downes, 2006) the newly empowered learner, the member of the net generation, will give more focus to systems learning based on conversation, interaction, on sharing, creation and participation. He regards learning not as a separate activity, but rather, as embedded in meaningful activities such as games or workflows. The new e-learning 2.0 systems go in this direction because comprises resources and services organized in order to offer learning opportunities in a network environment.

Also the computer supported collaborative learning (CSCL), which supports learning activities, considers scripts usage for facilitating social and cognitive processes in collaborative learning environments. By shaping the way learners interact with each other we will provide an effective learning system.

Furthermore in computer supported inquiry learning (CSIL), which involves students in an active engaged and constructive learning process, we enable students to investigate a domain, actually learn about it and build inquiry skills. Several systems have been developed, such as (WISE, 2006), (CoLab, 2006), (Inquiry Island, 2006) and (Cool Modes, 2006).

In this progress report a survey about web based e-learning systems is presented next. After on chapter 3 our ongoing project for developing a collaborative learning tool is described, along with some expected problems, technological and social-oriented solutions.

2 WEB BASED LEARNING SYSTEMS

E-learning has the potential to become more personal, social and flexible with new web services, empowering students in a truly learning environment.

For enabling computers to play a key role in collaboration environments, one's must combine computers with people. (Downes, 2005) argues that personal descriptions, as found in social networks, and resource descriptions, as found in the semantic web, should be merged to form a single network, the semantic social network. Also (Marchiori, 2006) claims there are in learning systems cost relations between technological and social aspects. Therefore learning systems should have:

- More interaction like the Digg swarm (Diggs Lab, 2006)
- More connection between social space and data space with the semantic web usage;
- Go social with social software where by spreading the load, multiplies the benefit;
- Go visual creating interactive systems enticing the user like in (MMORPGS, 2006) environments;
- Maintain the social cost low by using poor semantics and reasoning, like old keywords approach, rather precise semantics and exact reasoning from semantic web.

Some good examples can be found such us (Tagworld, 2006) for meeting people; (Flickr, 2006) for sharing photos, discover, bookmark, and promote news; (Technorati, 2006) for tracking blogs; (Wink, 2006) for making tutorials; or (Eurekster, 2006) system for vertical community web search.

Nowadays there are innumerous web tools and we present next a table where some available web tools are classified according to user's interaction. The first level only enables access to data and information. The second level considers the formulation of opinion based on others points of views and a third level where user's contribution is possible to be added (Table 1)

Table 1: Tools analyses.

Types of tools	Factual information	Formulate opinion	Contribute own opinion
Alerts	✓		
FAQs	✓		
Webcasts	✓		
AudioBlog	✓		
Podcasts	✓	✓	
Blogs	✓	✓	
Chat interview	✓	✓	
Discussion Boards	✓	✓	✓
Quick poll	✓		✓
Survey	✓		✓
E-portfolios	✓		✓

The tools analyzed where users access to factual information and also can contribute with their own opinion are the ones we consider more important. These tools are Discussion Boards (open forum), Quick poll, survey and e-portfolios because they

combine access to factual information and users can contribute with their opinion. Milligan describes this as PLE (Personal Learning Environment) where learners will have greater control over their learning experience, managing resources and activities they participate in. Also they would personalize their own learning environment and interact with the web system to access content, assessment and other activities. (JISC e-Learning Focus, 2006)

But directly related to our project there are two other interesting references. The SEE-K project is a platform for collective laboratory from (Trivium Soft, 2006),accessible via a navigator Internet and does not require a heavy technical investment. Trivium Soft has two explorative types: a traditional method with relational data and a cartographic mode to make visible complexity. (ArBor & SenS, 2006)

Another interesting project is (BitTrees, 2006) where it is designed to be a flexible way to store and share information in a social way. The objects are stored in a hierarchical tree, with relationships and organizing all data in a personalised manner. All the objects can be pieces of text, links to images on the web, links to websites and personalised discussions. One interesting thing is the ability to view the object in the form of a blog using a treeview and also link other user's objects into an own tree.

Also e-portfolios, tools used to construct one's identity within social networks and organizations, are value learning in forms of collection, archive, learned, reflected or presented assets. With (E-portfolios, 2006) learners build and maintain a digital repository of artefacts, which they can later use to demonstrate competence and reflect on their learning.

Another issue we consider very important are quick poll and voting. While polling can measure opinion, voting can actually be a decision maker. Both add social aspects, especially active user's participation.

Furthermore web based learning systems can be used for e-participation. By definition this is concerned about information and communication technologies (ICT) supporting participation in processes involved in government and governance. This might be accomplished if people can actually find or access information, as well as, understand it better. This information dissemination can actually broaden and deeper democratic involvement, not only with the number of people involved but also better quality involvement. (Macintosh, 2006)

3 ON GOING PROJECT

3.1 Description

A web learning environment where students have no guidance does not result in effective knowledge. Consistently pure discovery learning, without any guidance does not result in knowledge acquisition. Therefore guidance in the form of scaffolds is needed. As (McKenzie, 1999)reported, a web system must provide a structure, support the student investigation, keep students on the path while seeking "the truth" about whatever issue. Having this in mind we headed our research on two dimensions: collaborative environments and technology development. (de Jong, 1998)

For the first dimension, learning is seen with a socio-cultural perspective. For us the process of learning incorporates different forms of signs, symbols and tools in social activities (Vygotsky, 1978). Furthermore learning and intellectual development are undoubtly related to social interactions: the learner constructs knowledge due to interaction with others. (Driscoll,1994)

We consider the Zone of Proximal Development, our approach theory. It was described by (Vygotsky, 1978) as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers". In other words, a learner can perform a task with teacher tutoring or with peer collaboration that could not be achieved alone.

For the second dimension, technology issues arise and we are trying to relate emergent web concepts as mediation tools for knowledge construction and Ajax techniques or Ahah simple technique to develop our web system. (Microformats, 2006)

The idea is to merge both dimensions while building a formal Knowledge platform through a representation map, with semantic social networks where people can dynamically get connected and interact online.

3.2 Research Question

This research is deeply concerned in understanding how people can use computers in collaborative learning environments, bringing people together, while constructing knowledge or how web systems might change the computer's usability in learning processes. But the underlying question is: Why do

students need the learning community to develop knowledge mechanisms? The complex brain activity can find in web systems a link to social networks and trigger the learning action. It would be possible for students and teachers interact in learning environments and dynamically participate in the learning process. These systems should add some value to traditional systems, instead of simply mapping them. Our hypothesis is based on the complementary of real class dynamics with web supported learning environments. This field of interest is often called blended learning, where both systems merge giving place to an integrated environment increasing the active participation of students in their studies.

3.3 Expected problems

On this section we first identify the problem. Next we describe and then analyse our system approach. We present an architecture layer, as well as, the deployment diagram. After that we describe the use case diagram and introduce a learning scenario where teacher's and learner's interact. Finally we describe the next phase: construction and deployment of the system. We call it L-Tree as for learning trees of knowledge.

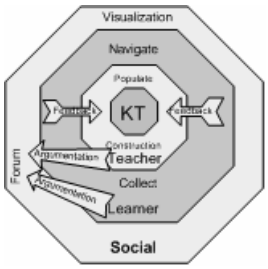

Figure 1: Layered Architecture

In learning environments, on the student's point of view, motivation is a key issue and despite social phenomena being crucial, each student has his or her own learning rhythm. Also the freedom of choice and not being tied to the curricula or teacher's perspective is very important. On the teachers side being able to synthesise all the learning content and having some feedback on the student's level of achievement is crucial. Both perspectives have led us in finding a solution for an e-learning network environment, where both actors interact.

We are developing our web solution based on this concept and on figure 1 there is the layered architecture where the Knowledge Tree (KT) is on the centre, the teacher has the ability to construct it and populate it with content. The student can navigate through the KT and more important make a collection of subjects (different resources: doc, ppt, pdf, url, podcasts, quizzes, and others), enabling the teacher to become aware of this collection. A third layer is presented where both actors: teacher and students will interact in an argumentation visualization system: Forum. In this layer the student can have some system information about the learning content and also discuss the matters with other students or even the teacher.

Another way of presenting our system is with a deployment diagram, figure 2, where the L-Tree Knowledge system presents the teacher's inputs and outputs as well as the student's interactions on the System KT and on the Social KT.

The system KT comprises, on the teacher's side, the structure construction and populating it; and on the student's side the navigation and collecting facility. This will be the system core. Also there will be the learner's feedback associated with monitoring tasks.

The Social KT comprises the forum, where all users can socially interact accordingly to their collection of items – visualization and also put some discussion around their interests –argumentation.

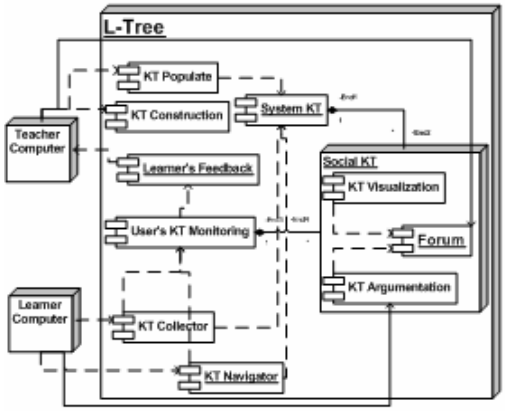

Figure 2: Deployment Diagram.

Furthermore the use cases diagram of teacher and students on figure 3 presents, in more detail, all the system sections and introduces the pedagogical scenario approach. The teacher might have some possible scenarios when constructing activities. Also the forum should have some argumentation schemas enabling students to interact with, for example accordingly to (Toulmin, 1969) argument pattern (data, claim, warrant, backing and rebuttal), or with polling and voting facilities. Another issue is the user's KT monitoring, where learner's feedback will be available namely for student's assessment.

For the next phase after the L-Tree system specification, we consider developing it with rapid prototype by using Ajax and php technology. Also very important should be deploying it with some delivery feedback to make some adjustments.

3.4 Research Methodology

The method used up to now can be synthesised to an exploratory research on learning theories and representation of knowledge. Also some social software for networks were tested, namely (InFlow, 2006), (Apache Agora, 2006) by Stefano Mazzocchi and web 2.0 technologies such as Ajax. The actual method is writing a research proposal with the state-of-the-art and then analyse some software tools such us e-portfolios, blogs or podcasts with feeds, which can later be used on our platform.

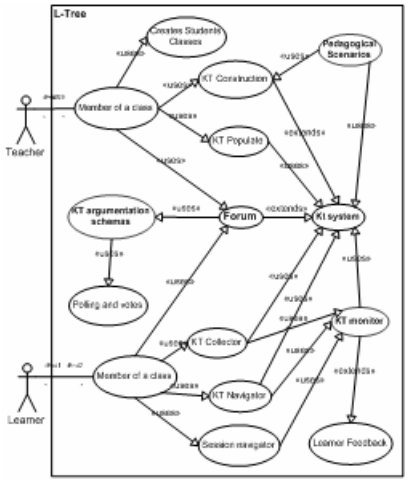

Figure 3: Use cases diagram.

In order to validate our learning approach we intend to develop a web tool which will have the pedagogical dimension described before. This system can later on be used in a high school class, where we can retrieve some data to analyse. Our current approach uses a tree of knowledge approach and enables users to navigate through it and collect the objects they choose. The social network is very important and our idea is to add some feedback from previous users into the system and enable an open discussion through the forum usage. Also discussion with argumentation visual techniques should be interesting to provide another learning perspective. Finally some tests should be made with a class to see the real usage of this new tool.

More important than having to specify and develop a software learning tool based on learning theories is to provide an interesting software solution where users can truly get profit out of.
Some characteristics such us: open system, integrating learning resources, interaction with users, collaboration facilities and personalised knowledge acquisition are essential for the success of our learning system.

3.5 Aims and Outcomes

Our aim is to develop a tool which supports social networks of learning around learning activities and actively improve user's social learning capabilities. Therefore there are two complementary deliveries.

-Organize and structure the learning content available by the teacher;
-Dynamically improve the students learning process on the proposed activities.

To reach these two deliveries one can take advantage (1) of the teacher expertise, (2) learners interaction through social networks in web systems and (3) Web 2.0 technologies, namely semantic web.

Our Outcome should be a tool where teachers and students can complement their class work by building bridges of knowledge.

In more detail the system will have an object repository. It might have multiple items: documents, simulations, quizzes, podcasts, animations, games, or other activities, provided by the teacher. But these learning contents are dynamically classified. Each student will collect the more appealing ones. Also the tree can classify all the objects according to a specific subject. With this dynamic, interactive and visual learning collaborative tool the resources are personalised and organised by learners. The system should give some information to the teacher regarding the objects the students have in fact studied and to the student which objects his or her colleagues have chosen. The discussion tool will enable students to contribute with their opinions.

In a social perspective we can better enhance knowledge acquisition by enabling learners to interact together. Therefore the system should present to learners some information regarding who collected the objects. The web system should also have some intelligence because by giving suggestions to users which object should be interesting, is in fact contributing for the learner's success. The difference between system and peer suggestions is mainly because it's dynamic and doesn't depend on previous students choices

Up to now some considerations have been made. Hopefully after the completion of this research

study, the development of the web system will result in an interesting solution which might be used by students and teachers. The difference between this one and the other systems is namely its effectiveness and social support for learning activities based on our learning theory approach.

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