Workflow Systems in E-Learning Environments

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INTRODUCTION

In the last few years, the Internet has become the most up-to-date way of structuring educational settings. Different styles of web-based learning technology jump up every day and its acceptance among educational community is unprecedented. With the networking technologies providing infrastructure for new educational formats, the opportunity is ripe to create e-learning community of problem solvers (Singley, Fairweather & Swerling, 1999).

In this new context, Computer-Supported Collaborative Learning (CSCL) emerges as an innovative pedagogical support. Collaborative learning consists of small groups working together to complete academic tasks, which involve a range of objectives, such as searching for facts, applying skills, concepts and principles, problem solving and creative thinking. The teacher acts as the coordinator, setting guidelines, encouraging cooperation, reviewing performance and uniting the groups (Woodbine, 1997). Collaborative learning works positively in promoting inter-group relations, and can help to overcome barriers to friendship, interaction and achievement of academically less able students, and can increase self-esteem.

CSCL studies how computer science can support the learning processes promoted by the Collaborative efforts of students working at a given task. CSCL can supply different kinds of Collaborative learning activities. A current approach used both at school and at organization is project-based learning (PBL). PBL proposes to work with solutions for real world problems, using several educational practices, besides activities in the laboratory (Killpatrick, 1926). The method of projects was reinforced by the ideas of Dewey (1966), for whom the education depends on action and the knowledge emerges out of situations in which the students have to learn from experiences that make sense and have importance for them. These situations should be proposed within a social context, such as a classroom, a course or a training, where the students collect and manipulate several materials, creating an apprenticeship community that builds knowledge collectively.

In a project, the learning happens by interaction and articulation among different knowledge areas in order to favor the construction of the autonomy and the self-discipline; and develop abilities for the work in team, such as decision making, communication easiness, problem formulation and solving. The definition of the activities in a project is extremely important to the positive interdependence required to stimulate the collaboration. In a collaborative environment, the teacher and the apprentices should have means to define educational processes, to configure different sceneries and projects, and to obtain support, through the available tools, in the accomplishment of their tasks. A project can be described as a process, divided in stages that are related to each other forming a flow of work. Each stage is summed up through the performance of one or more activities, which owns specific objectives and generates some kind of product. These activities should stimulate information sharing and knowledge building.

Many CSCL researches present systems that provide the project-based learning approach. Analyzing these systems, we observed that several support the execution of specific tasks in the context of a project, others support a series of activities, although the definition and the accompaniment of its goals should be done out of the environment, and in other ones, the process

is explicitly defined, being, however, fixed. Generally, it was observed that the environments do not provide support to the definition of collaborative processes, neither support the stages for a project development, although the importance of this question is pointed out many times. Planning the interactions and the process in a group project could be a way to stimulate people to collaborate, promoting interdependency and commitment among their work.

In this article, we discuss the importance of an explicit work process along the Collaborative activities, supported by a workflow system. From the belief on the importance of explicit work processes as way to improve collaboration, we develop an infrastructure, called COPLE (Collaborative Project-Based Learning Environment), whose core is COPE, a collaborative process editor. COPE (Collaborative Process Editor) plays the role of an educational workflow system. In the next sections, we discuss workflow systems and its uses in CSCL environments; describe our solution to provide support to the collaborative process and present preliminary results with the COPLE environment. The last section offers the conclusions and points our future work.

PLANNING ACTIVITIES IN E-LEARNING ENVIRONMENTS

Workflow is an information technology which uses electronic systems to manage and monitor business processes. It allows the flow of work between individuals and/or departments to be defined and tracked. The operational level of workflow deal with: how tasks are structured, who performs them, what their relative order is, how they are synchronized, how information flows to support the tasks and how tasks are being tracked. While the concept of workflow is not specific to information technology, support for workflow is an integral part of groupware software.

The structure and the coordination of learning activities can be seen as a process-oriented view. Some authors speak about this kind of process as a learning process. In the domain fields, the description and enactment of coordinated activities is done by workflows system. According to Wang, Haake, Rubart and Tietze (2000), a work procedure in a workflow system is defined by a workflow model composed of a set of discrete work steps with explicit specifications of how a unit of work

flows among the different steps. In general, a workflow coordination model can be defined as a directed graph, (N, L), with a node set N representing individual steps in the procedure and an edge set L representing the coordination structure among the tasks.

Workflow is an important element in e-learning systems because collaboration represents a set of relationships among behaviors and its consequences. A collaborative activity exists in three hierarchical levels: co-ordinate, co-operative, and co-constructive (Engeström, 1987; Bardram, 1998). Co-ordination represents the interaction flow and guarantees that an activity is executed in harmony. Co-operation means that the actors are not simply focused in their own tasks according to pre-defined roles, but also in common and shared goal. Therefore, a higher interaction level exists. Co-construction implies in interactions where the actors establish their concepts continually, building the shared goal collectively. The collaboration assigned to these levels should be supported in the context of the computational environments, besides propitiating the group to evaluate them.

An educational project requires a certain time dedicated to planning and management. For George and Leroux (2001), a project should be structured in time and partitioned in successive stages, forming an action plan. The careful planning of the activities is necessary to provide the project with a temporary structure. The description of human activities as actions performed by the use of operations help understanding the fundamental role that the planning plays in human cognition. Previous experiences advance the possible results of future actions; even so these anticipations should be implemented and adjusted in agreement with the conditions of the real contextualized situation. Therefore, the definition of the activities and their execution flow allows configuring the interaction forms and the products within the development of the project. Besides, it allows the teacher to understand the process and to help the apprentices.

Similar to the approach discussed here is the Instructional Design (ID), if we treat the instruction in a macro-level considering it as a project. ID has been pointed as one of the most important elements in the e-learning process (Winer and Váquez-Abad, 1995). Collaborative e-learning projects aiming at collective knowledge building can make use of design as a cognitive tool. ID can be defined as a cycle of activities, including sequence and structure, the main methods

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