Chapter 9
Enhancement of Adaptation and Monitoring in Game-Based Learning Environments

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ABSTRACT

This chapter deals with the development of new learning environments, particularly the different aspects linked to users' collaboration in these environments. The authors believe that game-based learning can significantly enhance learning. The emergence of online multiplayer games led them to apply the metaphor of exploring a virtual 3D world, where each student embarks on a quest in order to collect knowledge related to a learning activity. In the environment, each part of the world represents a place, sometimes a collaborative place, where students are supposed to acquire a particular concept.

This new way of learning changes habits, offers new opportunities to use collaborative tools, allowing the students to co-construct knowledge efficiently. In this chapter, the authors describe an example of game-based environment that they have developed. They then give examples of uses of collaborative tools in this environment and give details on how to enhance them. The authors focus on two aspects: the monitoring of the collaborative activity, where the teacher applies his/her own strategies in order to monitor the collaborative activity; and the adaptation of the game according to the learners' profiles.

INTRODUCTION

Recent years have seen a rise in learning with Computer-Based Learning Environments. These environments provide functionalities that are recognized as being valuable, but students tend to consider them as unexciting. Observing the emergence and success of online multiplayer games with our students—the so-called "digital natives" (Rosenbloom, 2007; Purdy, 2008; Scott, 2007)—we decided to develop one as a support for our course. This led us to apply the metaphor

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of exploring a virtual world, called Learning Adventure, where each student collects knowledge related to a learning activity. It is our view that the way to acquire knowledge during a learning session is similar to the exploration of a virtual world, pursuing knowledge quests. This approach reveals advantages, such as a recreation-type process, a large usability of the tool, or its adaptation to the student's speed.

This new way of learning changes habits, offers new opportunities to use collaborative tools, allowing the students to co-construct knowledge efficiently (Lou, 2000). However, it is often difficult for users to know how to use these tools effectively, especially because the interactions take place in a social context (Hadwin, 2010). In this chapter, we describe an example of Game-Based environment that we have developed. We then give examples of uses of collaborative tools in this environment and give details on how to enhance them. We focus on two aspects: the monitoring of the collaborative activity, where the teacher applies his/her own strategies in order to monitor the collaborative activity; and the adaptation of the game according to the learners' profiles. We explain the way for obtaining factual indicators of collaboration that are useful for the monitoring process and how to fill and update the fields of the User Model for adaptation purpose. We illustrate these two issues through two experiments carried out in the Learning Adventure environment.

A Game-Based Learning Environment: Learning Adventure

In this section, we describe a Game-Based Learning Environment that we have developed. This environment will serve as an example for illustrating the ideas described later in the chapter. We explain the links between a learning session and the objects in the Game and we give details on the enactment of a learning session with students. We then describe how the collaboration takes place in Learning Adventure (LA).

LA is a Game-Based Learning Management System representing a 3D environment where the learning session takes place (see Figure 1). A particular map (environment with lakes, mountains, and hills) is dedicated to a particular learning activity, for a particular subject. Each part of the map represents the place where a given (sub) activity can be performed. The map topology represents the overall scenario of the learning session, i.e. the sequencing between activities. There are as many regions as actual activities, and the regions are linked together through paths and Non-Player Character (NPC) guards, showing the attainability of an activity from other ones. An example of a scenario seen as a map topology is presented in Figure 2. Similar models that link pedagogical issues with game elements can be found with a more general point of view in Amory (1999) and more precisely concerning this approach in Carron (2008).

The environment is generic in the sense that it is not dedicated to a particular teaching domain. With the help from a pedagogical engineer, the teacher adapts the environment before the session by setting pre-requisites between sub activities and by providing different resources (documents, videos, quizzes) linked to the course. Experiments have been set up for learning English as well as Project Management or Object Oriented Concepts in Computer Science.

Learning Adventure is based on a role-play approach (Baptista, 2008). Players (students or teachers) possibly represented by their own avatars, can move through the environment, performing a sequence of sub activities in order to acquire knowledge. Activities can be carried out in a personal or collaborative way (see Dillenbourg, 1996, for a list of cooperation abilities): one can access knowledge through objects available in the world, via help from the teachers, or from work with other students. In order to communicate with other players a chat tool is available. It is also possible to construct group knowledge with specific tools. We detail two examples of such