Chapter XIV
An Adaptive E-Learning Platform for Personalized Course Generation

Enver Sangineto
University of Rome "La Sapienza," Italy

ABSTRACT

In this chapter we show the technical and methodological aspects of an e-learning platform for automatic course personalization built during the European funded project Diogene. The system we propose is composed of different knowledge modules and some inference tools. The knowledge modules represent the system's information about both the domain-specific didactic material and the student model. By exploiting such information, the system automatically builds courses whose didactic material is customized to meet the current student's degree of knowledge and her/his learning preferences. Concerning the latter, we have adopted the Felder and Silverman pedagogical approach in order to match the student's learning styles with the system learning objects' types. Finally, we take care to describe the system's didactic material by means of some present standards for e-learning in order to allow knowledge sharing with other e-learning platforms and knowledge searching by means of possible Semantic Web information retrieval facilities.

MOTIVATIONS AND GOALS

The aim of this chapter is to present the "intelligent" facilities of the *Diogene* platform, built during the European funded projects *Diogene* (IST-2001-33358) (Diogene, 2005). Diogene is a Learning Management System (LMS) able to automatically generate personalized courses by assembling learning material using both static and statistic knowledge.

Static knowledge includes information concerning the available learning material (which in turn is composed of a set of atomic learning objects, *LOs*), as well as an ontology-based de-

scription of the didactic relationships holding among the concepts of the specific domain (called domain concepts, *DCs*,). Statistic information is collected by the system during the learning sessions and represents both the student's knowledge about the DCs and the student's preferred learning modalities. The latter include preferences concerning the LOs' type (e.g., visual versus verbal, intuitive versus concrete, etc.). The way in which such preferences are taken into account in the course generation process follows the pedagogical theory proposed by Felder and Silverman in (Felder & Silverman, 1988) (see section "The Learning Preferences and the Felder and Silverman Pedagogical Theory").

The novelties of our approach with respect to other course generation/personalization systems can be summarized as follows.

- Didactic information concerning a specific domain (e.g., "Euclidean Geometry," "Object Oriented Programming Languages," etc.) is explicitly represented using an ontology. Such description is not dependent on the specific LOs currently available to the system but it is an *abstract* representation of the didactic relationships holding among the main concepts the domain is composed of. The possible relationships are: prerequisite, ordering and hierarchical relations. We will show how our proposed simple knowledge representation structure can be very efficiently exploited for course generation purposes as well as its ability to describe the most important didactic information. The knowledge representation framework we propose is domain independent.
- Statistic information is collected by the system by means of a continuous monitoring of the learner's successes and failures obtained during the interactive test activities (executed at the end of each learning session). Such information is used in order to

personalize the courses of the subsequent learning sessions.
- The Felder and Silverman pedagogical approach, based on the correspondence between teaching styles and learning styles, is concretely adopted by Diogene. This is done in three steps. First, when a given LO *l* is stored in the system's database we automatically classify *l* using Felder and Silverman's teaching styles and a mapping function based on the *l*'s resource type. Second, we use a test proposed in (Felder and Soloman) to classify the student's learning styles. Finally, for each learner's didactic query we select the most suitable LOs by matching the learning and the teaching styles.

RELATED WORKS

In this section of the chapter we provide an overview of the existing course generation platforms and adaptive LMS, comparing them with the Diogene characteristics.

We underline that Diogene is an intelligent and adaptive platform which *actively* participates in the learning process, as opposed to most of the common e-learning platforms which usually play only the *passive* role of LOs' containers. For instance, the well known Ariadne platform (Duval et al., 2001) is based on a digital library of LOs which are indexed using educational metadata standards. Nevertheless, the Ariadne platform only aims at building a library of reusable learning components for the sharing of such components among different (human) teachers. The library is then a *passive* repository and there is no automatic building of courses nor any adaptation on the user profile.

This situation is very common in the new generation of Web-based learning platforms, especially in the commercial systems (e.g., Black-

Related Content

Using Portable DVD Players to Deliver Interactive Simulations for Training Health Care Workers in Kenya

Wallace Hannum (2010). *Cases on Technological Adaptability and Transnational Learning: Issues and Challenges (pp. 87-102).*

www.irma-international.org/chapter/using-portable-dvd-players-deliver/42428

Math Learning Environment with Game-Like Elements: An Experimental Framework

Dovan Raiand Joseph E. Beck (2012). *International Journal of Game-Based Learning (pp. 90-110).*

www.irma-international.org/article/math-learning-environment-game-like/66883

Do Technologies Support the Implementation of the Common Core State Standards in Mathematics of High School Probability and Statistics?

Woong Limand Dong-Gook Kim (2013). *Common Core Mathematics Standards and Implementing Digital Technologies (pp. 168-183).*

www.irma-international.org/chapter/technologies-support-implementation-common-core/77481

The Quest for Motivation: Tabletop Role Playing Games in the Educational Arena

Arpit Bawa (2022). *International Journal of Game-Based Learning (pp. 1-12).*

www.irma-international.org/article/the-quest-for-motivation/287825

EPICT: Transnational Teacher Development through Blended Learning

Katalin Csoma (2010). *Cases on Technological Adaptability and Transnational Learning: Issues and Challenges (pp. 147-161).*

www.irma-international.org/chapter/epict-transnational-teacher-development-through/42431