Combining Advanced Networked Technology and Pedagogical Methods to Improve Collaborative Distance Learning

Pascal Staccini [a], **Jean-Charles Dufour** [b], **Hervé Raps** [a], **Marius Fieschi** [b]

[a]*Département STIC Santé, UFR Médecine, Université Nice-Sophia Antipolis, France*
[b]*LERTIM, UFR Médecine, Université de la Méditerrannée, France*

Abstract

Making educational material be available on a network cannot be reduced to merely implementing hypermedia and interactive resources on a server. A pedagogical schema has to be defined to guide students for learning and to provide teachers with guidelines to prepare valuable and upgradeable resources. Components of a learning environment, as well as interactions between students and other roles such as author, tutor and manager, can be deduced from cognitive foundations of learning, such as the constructivist approach. Scripting the way a student will to navigate among information nodes and interact with tools to build his/her own knowledge can be a good way of deducing the features of the graphic interface related to the management of the objects. We defined a typology of pedagogical resources, their data model and their logic of use. We implemented a generic and web-based authoring and publishing platform (called J@LON for Join And Learn On the Net) within an object-oriented and open-source programming environment (called Zope) embedding a content management system (called Plone). Workflow features have been used to mark the progress of students and to trace the life cycle of resources shared by the teaching staff. The platform integrated advanced on line authoring features to create interactive exercises and support live courses diffusion. The platform engine has been generalized to the whole curriculum of medical studies in our faculty; it also supports an international master of risk management in health care and will be extent to all other continuous training diploma.

Keywords:
Learning; Education, Distance; Models, Educational; Computer systems; Internet; Health Education

1. Introduction

Distance learning has become a topic of intense interest. Since 2000, the French Ministry of Higher Education and Research has issued numerous calls for projects in order to encourage universities and teachers to publish French academic resources on the web. Among the projects that have been granted, three categories can be identified [1]: production of high quality hypermedia resources, implementation of web services to distribute pedagogical resources, and distance learning applied research projects. The Information Technology Department of the School of Medicine of Nice submitted a project called "ESSQU@D" (Enseignement Santé, Sécurité et Qualité à Distance). It also joined the French Virtual Medical University team project (UMVF), in connection with the Medical Information Research Laboratory of the School of Medicine of Marseille. The purpose of "ESSQU@D" was to offer a master degree in the area of quality improvement and risk management in

health care services. The aim of our involvement into the French virtual medical university was to develop a remote control prototype for live course acquisition and publishing through the Internet. In order to combine these objectives and integrate a web-based authoring tool to support the creation of pedagogical material, we concentrated on pedagogical methods, and problems that may occur, when using distance learning technologies [2,3,4]. Some issues were highlighted: How can one assist teachers to create modular and reusable training schemes? How can one motivate students to use on line resources to learn? How can one guarantee them the effectiveness of distance training as compared to the traditional teaching process, and what could be the importance of a collaborative approach to support web mediation? On the basis of this analysis, the project consisted of: 1) integrating constructivist principles and teaching engineering in order to provide users with efficient collaborative tools; 2) analysing and offering a tutoring model; 3) analysing and implementing techniques for the acquisition and publishing of course contents, while using open source standards. The aims of this paper are: 1) to detail and discuss the lesson data model we deduced from the study of educational methods and 2) to analyse the way we implemented this model in a web-based collaborative and object-oriented programming environment (platform J@LON : Join And Learn On the Net).

2. Materials and Methods

Building a course requires teachers to adapt to the specificities of a heterogeneous audience. Teachers ask questions, invite students to contribute, and provide them with handouts. They encourage students to work together, or have them perform self-assessment. It can be argued that any live lesson is based on a scenario that teacher adapts according to the audience. As regards student learning processes, teachers do not convey knowledge. Rather, they deliver, in a pedagogically relevant way, sets of information, through situations and activities with which students will build up their own knowledge according to their own mode of training [5]. Students organize their paths of learning according to their own mind-frame. The individual student is the centre of the learning process. The ways information is organized and the sample situations submitted to him/her are key elements. An effective training situation must be organized in the context of the target environments, namely, those in which student will later have problems to solve [6,7]. The design of a lesson must observe some key principles [8,9]: 1) the understanding of a concept requires the gathering and organization of information; 2) cognitive skills require the resolution of problem and critical appraisal; 3) psychomotor skills require real practice and experience; 4) changes of attitude require role games. Thus, the teaching scenario will endeavour to combine the trainings to be acquired with activities, at least those available on Internet [10]: 1) the reading of and active listening to multimedia documents, more or less enriched with hypertext links for explanatory matter or for further inquiry; 2) interactive analysis of iconographic items; 3) creative activities involving the writing of notes, solving exercises, answering a set of questions; 4) experimental trial and error activities; 5) simulation and, 6) self-evaluation or tutor-based evaluation. As regards the scenarisation of contents, the model must achieve a compromise between the use of the main teaching modes and functional screen ergonomics. We defined a minimum model to answer the main teaching modalities (deductive, inductive, procedural and meta-cognitive modes of learning). We analysed the part of collaborative features for each teaching modalities and defined the ways students and teachers could view their use of the platform and their progress.

Connecting Medical Informatics and Bio-Informatics
R. Engelbrecht et al. (Eds.)
ENMI, 2005

275

3. Results

Based on the analysis of pedagogical requirements needed to provide students with a structured and consistent method to access digital resources, we defined the object model of the components the environment (figure 1) [11]. The main object class is a lesson offering a synthesis of six components: objective, sequence, download, "know more", a glossary and a quiz. A lesson forms part of a learning unit. A curriculum is hierarchically composed of specific lessons and learning units. The sequence component can display the content of a local stored file or the content of a remote resource (URL). Sequences can be arranged in order to guide the student's progression. The glossary and the quiz components comprise a set of terms or questions.
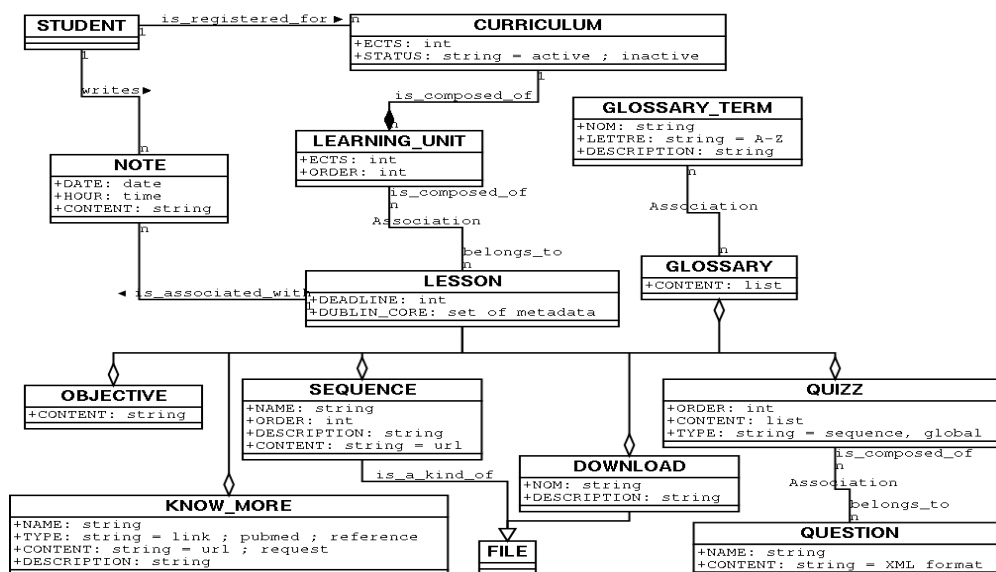

Figure 1 – The components of the lesson data model

We identified the roles and their associated work spaces (figure 2). A private directory is available for each user and sharable spaces can be browsed such as: news, diary, history of updates, glossary, and comments per lesson. Discussion tools have been designed to allow global or specific exchanges between users.
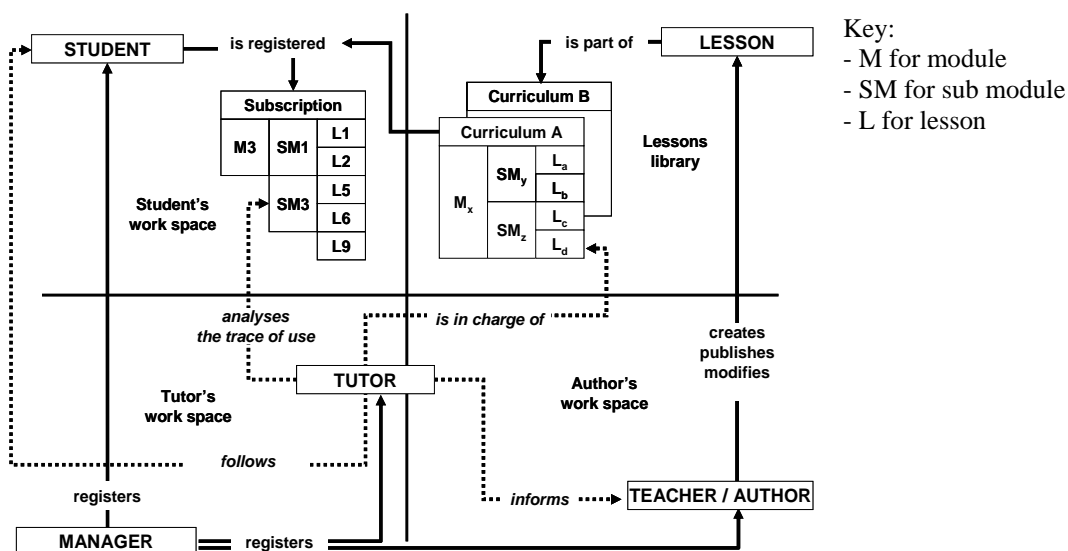

Figure 2 – Interrelations between roles and objects: the central position of the tutor

Connecting Medical Informatics and Bio-Informatics
R. Engelbrecht et al. (Eds.)
ENMI, 2005

276

We wanted students to be guided to "read" lesson content, but they may choose other paths, for example, direct access to the global self-assessment part of the lesson. However, within a lesson, one node is systematically displayed before any action, the "home page" of a lesson with a reminder of the learning objectives defined by the teacher. This navigation logic is closely related to the level of granularity a teacher wants to give to a lesson. Each sequence follows a structure with a set of explanatory pages ending with a summary page and a short self-assessment quiz. Cases can also form part of a lesson and are considered as specific sequences. These are built in order to introduce the subject of the lesson to the student using a short practical example to illustrate to him/her why the subject has been selected.

The method of implementation of the platform consisted of three steps: 1) the programming of the lesson components and its workflow characteristics (published, retracted, read); 2) the programming of the databases to store the description and the composition of curricula, and the tracking students' data; 3) the customisation of the learning space according to the roles. An object-oriented Content Management System (CMS) has been chosen which combines the Zope platform [12] and a workflow generic product named Plone [13], full Dublin core compliant [14] and providing RSS feeds. The architecture of the system is composed of four parts: 1) a library of components (lessons, questions, cases, glossary terms) stored in the Zope object-oriented database; 2) relational tables to store the hierarchy of curricula and students' data (PostgreSQL database management system); 3) a user interface layer to access the data/objects management functions; 4) a portal customisation layer which is based on the Plone product. A specific tool has been included to allow the creation of interactive questions (simple/multiple choice questions, questions using clicking or 'drag and drop' areas); questions can also be imported into the platform using an XML grammar [11,15]. External libraries are available, for example, a video library containing movies of the original courses (Real format) and "rich media" courses (Smile standard).
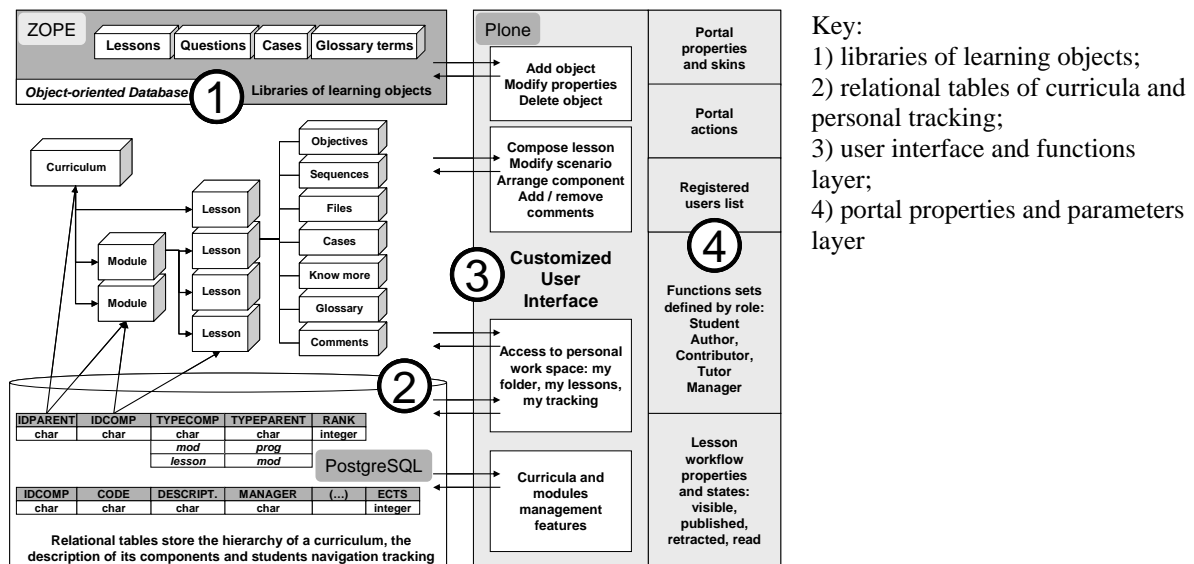

Figure 3 – Technical architecture of the platform

A specific workflow has been implemented to trace the different states of a lesson. A lesson is created by the author in his/her private space. When it is published, the lesson object is physically moved to a public space. When reading a lesson, students can add a short comment and indicate for themselves that they have completed it (workflow state attribute). This information is stored in the student's tracking table. Viewing features of this table have been implemented in order to provide students with individual feedback. When needed, an author can retract a lesson from the published lessons folder, modify it and publish it again.

For each lesson, the whole history of the publishing process can be read. Students access the lessons they are registered for by choosing one in a hierarchical list. Authors access the lessons they have created by choosing in a list that distinguishes between published lessons, "in process" lessons and co-authoring ones. Students and authors can read global and role-related news. Each author can complete and publish a "personal home page" that students can access when reading their lesson or browsing other libraries of pedagogical resources. Dialog between users is available by means of a forum and a private chat channel.

5. Discussion

While normative approaches and standards are emerging to structure pedagogical resources [15], we only used the Dublin Core metadata set [14]. We looked forward to complying with national principles edited by the referencing working group of the UMVF [16]. We focused the project on integrating a true pedagogical method to help teachers to build and organize materials. We wanted them first to think about the quality of the selection, the description and the arrangement of the resources. A specific training-course was organized to help them understand constructivist learning principles, to allow them to comply with the pedagogical working framework and to show them how to design a lesson bearing in mind that emphasis. This method also provides students with relevant, selected and classified learning materials, combining traditional text-based documents, annotated images, and appropriate keywords or links to find other resources available on Internet. The strength of this model and this collaborative approach lies in the fact that, whatever the teacher, whatever the content of a lesson, a same navigational pattern is offered to the students while bearing in mind pedagogical imperatives [17]. While the efficacy of such techniques of knowledge acquisition remains difficult to measure, we anticipate that this kind of pedagogical ergonomics will enable teachers to improve content quality and students to avoid wasting seeking unhelpful information [18]. Our project addresses the challenges of high-performance web-site development and maintenance. Among the current available content management products, Zope has been chosen. This development framework controls the construction of objects to enforce consistency across an entire site. Zope implements a comprehensive system of permissions and roles to ensure that projects develop in harmony. The Plone layer reinforces these basic features and brings additional ones such as object workflow, new data objects indexing and management functions, and members' work spaces. The content lesson product we implemented (in Python language) acquires basic properties from the Plone layer (Dublin Core metadata set) and encapsulates its own methods (such as add/modify/view methods, combine/remove sub-components and workflow states). The modular architecture allows direct access to objects in libraries and answers the problem of creating modular curricula. The design of this lesson object according to the data model is generic enough to allow the integration of new kinds of resources. In fact, a sequence is a link to a single local file (doc, xls, pdf, swf, ppt, etc.) or a link to a remote resource (especially streaming video resources). The way the user navigates through resources is partially traced but the system does not store the complete student's profile in order to provide him/her with adaptive learning features. From a pedagogical point of view, this tool can be considered to be the first step to preparing students and teachers to work, learn and teach within virtual, collaborative environments. This tool supports the entire program of medical curriculum in our faculty in order to prepare the national pre-residency exam. All teachers can access the platform to upload files or create quizzes and cases on line by their own. They are invited to describe the modifications they made before publishing a lesson. The whole glossary is available and teachers can read the definitions and their author. The same feature has been set up for questions and any teacher may use one or more in his own lessons. We intented to

Connecting Medical Informatics and Bio-Informatics
R. Engelbrecht et al. (Eds.)
ENMI, 2005

278

promote collaborative interactions between teachers in order to improve the quality of resources they provided to students. Two implementations of the J@LON platform can be reached at: http://www.essquad.org and http://www.internatice.org.

6. Acknowledgements

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8. Address for correspondence

Pascal Staccini
Département STIC-NTIC Santé – UFR Médecine – 28 av. de Valombrose – 06107 Nice cedex 2 – France
email: pascal.staccini@unice.fr
url: http://wwwmed.unice.fr – url: http://www.essquad.org – url: http://www.internatice.org