Learning Roadmaps for Higher Education

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***Abstract* - An integrated platform for the support of teaching activities as been developed and deployed at the Aveiro Norte Polytechnic School of the University of Aveiro. In this paper we present an approach to Learning Roadmaps for Higher Education based on this platform. The aprend.e platform – Electronic Integrated System for Learning and Training - has at its core a Learning Management System with a number of plug-ins. It represents a new challenge for the University of Aveiro for higher education and is already being at its core is the concept of learning roadmaps that act upon two fundamental axes: education and learning. For the teachers, it aims at becoming a self-supporting tool that stimulates the organization and management of the course materials (lectures, presentations, multimedia content, and evaluation materials, amongst others). For the students, the learning roadmap aims at promoting self-study and supervised study, endowing the pupil with the capabilities to find the relevant information and to capture the concepts in the study materials. The outcome will be a stimulating learning process together with an organized management of those materials.**

Index Terms – e-Learning, Higher Education, Learning Roadmaps, Lifelong Learning

INTRODUCTION

The work developed in the project herein presented rests on the following guidelines:

- Elaboration of the discipline map, where a general planning is described following previously normalized models within the teaching institution (the University of Aveiro in our case);
- Conception of a learning roadmap for academic, polytechnic and post-secondary education, acting as a learning agent. This learning roadmap is aimed at incorporating and establishing connections between existing applications, components and features of a LMS (Learning Management Systems) and LMCS (Learning Content Management Systems).
- Developing mechanisms that render the classification and indexation for didactic and pedagogical content easy, using existing standards.

TARGET AUDIENCE

This work will be useful for a large group of learning communities. Although these students have very different learning profiles, the project focuses on lifelong learning philosophy, i.e., allowing the target audiences to achieve knowledge and to acquire new abilities using IT (Information Technologies). Three types of students can be identified: continuing students, regular students looking forward to undergraduate academic or technical course; unemployed seeking for first job or ex-workers and workers improving their competences at work.

UNDERSTANDING LEARNING ROADMAPS

Learning roadmaps are conceived with different approaches, methodologies and definitions, according with who is creating them and for whom the education is targeted. The available literature is not consensual, and several companies or institutions that produce learning contents use their own methodology plan. To proceed with research, it is important to clarify and specify what the meaning of a Learning Roadmap is.

It is important to clarify that the discipline map and the learning and training roadmap will attend to predefined contents of courses, disciplines and subjects. It is not intention of this project to enable features for self creation of education curricula and materials.

The following definition provides an understanding of its meaning for the context of this work.

Having in mind the semantic framing of words and goals of this project, it is proposed the following definition for Learning Roadmap: *Detailed description of the life-cycle of a discipline. It comprehends all contents and associated events and activities that conduce to the goal of a thematic issue. Each thematic issue is indexed with each learning mark.*

This simple definition comprehends a set of elements, entities and characteristics, which important to explain.

The core of the project is focused in the learning roadmap. It is intended to achieve knowledge in emergent technologies that represents data in a visual and graphical way. The approach to do this is to understand how those technologies work and, giving the present experience with learning systems, to achieve what is useful and important to the learning and training process.

These goals aim to compose learning and training roadmap that acts upon two fundamental axes: education and learning. For teachers, it aims at becoming learning roadmap, a self-supporting tool that stimulates the organization and management of the education materials, as well as a useful functionality and not only another technological innovation framework without advantages for the actors.

For students, the learning roadmap aims to promote self-study and supervised study, allowing to endow the pupil with the functionality to find and to perceive the meaning of the study materials, stimulating, in the optics of the pupil, the organization and management of those materials. Figure 1 gives an overview of these goals:

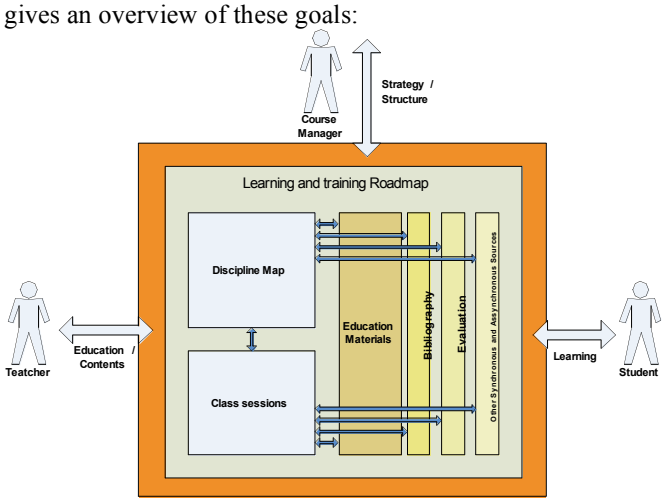

FIGURE 1
LEARNING ROADMAPS GENERAL SCHEMA

First, to avoid any doubt between learning and training it is imperative to define a convention about the actors and education materials:

- Teacher: The teacher can be anyone who teaches. Can be an institutional teacher, from a university or high-school, but can also be a trainer of an organization, company or enterprise;
- Student: The student is the actor that needs to acquire knowledge in a specific area. Can be an institutional student, but also can be a trainee from an organization, company or enterprise;
- Course Manager: The course manager is the actor whose main task is to manage the course or training. It can be the director of institutional courses from universities or colleges, or can be an executive coordinator, the overall responsible for the training in the organization, company or enterprise;
- Education materials: Contents that are made available for education and training.

According with the figure, one of the core tasks of this research is the integration of mechanisms and actors: Customization of the learning and training roadmap in different views, for different actors; Flexible management of contents and disciplines, enabling users to organize their learning roadmap based on suggested learning marks or even with alternative learning marks.

In future, it is intended to make available features to promote the easy creation of module-based training courses, where the described actors can make the course planning by picking modules available in the system. These components could help to conceive learning and training programs, even if they were created from different roadmaps. A new strategy to standardize these learning and training components enable these goals. Modularity of education materials is a very important topic as it promotes reusability of course contents.

It is not an objective of this project the creation of new course curricula. The research and analisys that will be made are according to the European school system for academic, polytechnic and post-secondary education under the Bologna Process[1]. Also, Figure 1 real settings case studies on enterprise training programs are envisaged within this project..

LEARNING ROADMAP PRACTICAL APPROACH

An attempt has been made in order to create a first prototype of a learning roadmap. The following items compose the main structure:

- Approach used to elaborate the Learning Roadmap;
- Education and Learning theory used;
- Targets and Goals of the Learning Roadmap;
- Modular Organization;
- Discipline General Plan;
- Methodology and Evaluation issues;
- Education materials and content organization.

The Approach used to elaborate the Learning Roadmap is based on blended learning, appealing to conceptualization of several units or modules, through learning marks, disposed according a pedagogical order that tries to relate thematic issues for them to be achieved with success.

The Education and Learning theory behind the pedagogical model is grounded on the modern constructivism theory. The learning is seen as a process where students are actively enrolled within. *This theory also bases that students have the capacity to build knowledge through discovery and problem solving actions. The alternatives exploration for problem solving and the creation of curricula may allow the student for different levels and depths of knowledge*[2].

Targets and Goals intend to describe the purpose of the discipline for the student, and what is expected from him at the end of the discipline and learning roadmap.

Modular Organization tends to present and explain the content divisions in units and modules that can be achieved and evaluated in a way were the learning is centered in the student and powers his academic and professional success. It fits in the Learning Object definition: *The main idea of 'learning objects' is to break educational content down into small chunks that can be reused in various learning environments, in the spirit of object-oriented programming*[3].

Learning Objects are defined here as any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning. Examples of technology supported learning include computer-based training systems, interactive learning environments, intelligent computer-aided instruction systems, distance learning systems, and collaborative learning environments. Examples of Learning Objects include multimedia content, instructional content, learning objectives, instructional software and software tools, and persons, organizations, or events referenced during technology supported learning [4].

The main idea of 'learning objects' is to break educational content down into small chunks that can be reused in various learning environments, in the spirit of object-oriented programming [3].

Any entity, digital or non-digital, that may be used for learning, education or training[5].

A module can be defined as a learning unit of short term that vises the acquisition of conceptual contents, procedings and actions, for the development of transversal and specific skills needed for scholar and professional skills[6].

Despites the diversity definitions of Learning Objects, it is consensual that learning autonomous units contains always one content item and one evaluation item, digital or not. Can be text, images, animation, etc.

Discipline General Plan presents the discipline main and formal program where the learning roadmap should follow ands accomplish.

Methodology and Evaluation issues recommends how should be centered in the student the education and learning process, appealing to his cognitive background and past experiences. It instances the learning by promoting autonomous study with research to materials enabled by the teacher or available in the Internet, adding tutorial privileges for students. Issues are suggested and identified in the Roadmap, having in background the competences to be achieved. Evaluation should be comprehended as a component of the learning and education process, where a permanent and continuous presence is desired, acknowledging the student performance. Also, Evaluation comprehends the summative method, where each learning mark or issue should count for the final evaluation.

Education materials and content organization acts as a simple 'readme.first' or 'howto-use-roadmap'. This section is more descriptive giving the touchstone for the student starts to use de Learning Roadmap.

LEARNING ROADMAP OUTCOMES

Learning Roadmaps for teachers and trainers tends to be a tool that stimulates the management and organization of disciplines and modules, supporting pro-active didactics and pedagogical issues, curricular structures and learning contents that acts more close to the competence and skills profiles of target audiences.

For students, the Learning Roadmaps primary goal is that it constitutes an instrument to make easier the autonomous study and construction of knowledge, making available means to search, to analyze, comprehend, organize and to value study manterials.

Although it is not, at the present moment, the main target of this project, Learning Roadmaps intend to contribute for the development of a embryonic system for training profile and acquired competences. This objective reflects an effort that is currently being made in several contexts in order to value formal and non-formal compentences and the growing need to promote lifelong learning activities.

PRESENT AND FUTURE WORK

Currently, the project is being designed as a Word document with encapsulated objects. It is instanced for different disciplines for Technological Specialization Courses and for the Undergraduate courses for the University of Aveiro.

In near future, the second prototype will be used in different LMS and LCMS –*aprend.e* from University of Aveiro and *Formare* from Portugal Telecom Innovation.

At this point it is realized that each LMS has his own structure for pedagogical strategy. Thus, information systems, databases and interfaces are designed different for each LMS learning process. To standandardize the different components and participants of learning processes, IMS Global Learning Consortium made a specification of a generic and formal standard to reference learning processes.

The IMS Learning Design specification supports the use of a wide range of pedagogies in online learning. Rather than attempting to capture the specifics of many pedagogies, it does this by providing a generic and flexible language. This language is designed to enable many different pedagogies to be expressed. The approach has the advantage over alternatives in that only one set of learning design and runtime tools then need to be implemented in order to support the desired wide range of pedagogies. [8]

Also, each LMS, enterprises or companies who needs to train audiences using eLearning technologies has their learning object strategy or technology.

Due to these considerations, it is clear that a standardization of several technology instruments is a demand for future in order to promote the learning process, instead of promoting technologies. In order to fulfill these gaps, instruments for learning objects and learning roadmaps need to be done using current and emergent technologies:

1. Learning Object Application

It is intended to create a Web application that allows creating and integrating learning objects in a dynamic mode. This

means a dynamic application that enables course managers defining brand new or used learning object strutuctures and to insert in a database content and metadata according to previous created learning object structures.

2. Learning Roadmap Application

A Learning Roadmap application should include an IMS-LD parser, enabling to create any learning process or import from any LMS IMS-LD compliant learning process. Also, the application should enable to export metada and contents from learning processes.

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