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Learning Roadmap Studio

eLearning 2.0 based web platform for deploying and editing learning roadmaps

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Abstract— **Technologies and learning platforms approaches are changing each day, one of the reasons for it is that organizations, enterprises and institutions are growing and producing more knowledge, whereas workers are becoming knowledge workers and need to be adapted for the fast change and share of information.**

From past experience, it has been denoted that strategies and pedagogical processes are tasks that can be created, enriched and boosted by actors who participate in learning and training processes: course managers, teachers and students. The challenge posed to the different actors involved also accelerates the changes that have been happening in education and training, empowering a society based on knowledge. Thus, it has been developed a new platform, Learning Roadmap Studio, which powers eLearning 2.0 concepts, that tends to promote more efficient learning and training. For teachers and course managers, it enables the creation, edition and deployment of learning roadmaps, that can be edit by students in order to communicate and share their knowledge among the learning community. 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.

It is not intended to create new learning management systems. Instead, it is presented as an application that enables the edition and creation of learning processes and strategies, giving primary relevance to teachers, instead of focusing on tools, features and contents.

eLearning 2.0, Pedagogy, Strategies, Paradigm, Platform, Learning Roadmaps

I. INTRODUCTION

This project has started to respond the needs of new target audiences that have been growing each year in the University of Aveiro. Very heterogeneous public where different variables are now set and become part of the learning process. The dissemination of knowledge, supported by technology; different schedules for learning and training by students, where self-study is being promoted; assorted outcomes according with the course and knowledge that is needed to be achieved. Beyond these issues, it has been accepted that, the more information sharing and communication between all involved actors in the learning process, more efficient are the reached outcomes and successful are the assessment issues. Thus, on a isolated experience in technical courses undergraduate disciplines like project, has been delivered to students the first embryonic learning roadmap, a dynamic document with orientation guidelines, proposed outcomes and assessments, learning objects, Uniform Resource Locator (URL) and other components that compose the learning process. As the students were involved, more efficient respond was needed to turn the process better. Due to this, it has been developed a Web platform, Learning Roadmap Studio (LRS), which looks toward to support students and tends to become a knowledge and learning sharing application for those involved. The above sections present the target audience that is being involved, user policies available on platform, concepts behind platform, surveys by students, conclusions and further work being conceived and developed.

II. TARGET AUDICENCE

As mentioned above, LRS tends to promote self-study, the share of knowledge, and to power learning support for heterogeneous groups. It has been identified three main groups, on which their importance has become relevant from a couple of years to the present moment: Continuing students, who ended the high-school and want to choose one the following tracks: to get a Technological and Specialization Diploma, enabling short-term access on labor market, or an undergraduate course, entering later in the work market; Workers seeking for training and learning in order to improve their skills at work, due to technological and organizational changes at work. Nevertheless, these workers usually don't have much spare time to learn although their high motivation, and frequently happen problems at work where their physical presence is need. Related with these circumstances, absence rates from workers are significant although doesn't reflect lack of interest from the workers; Unemployed, people who search for training and learning. The ones who already worked and, due to several reasons, want to start again where the opportunity can be more easier by getting specialized

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training in areas where the economy is growing. The other group of unemployed is people who are trying to search for the first occupation. Usually these students are looking for training in order to get skills and specialization to enter soon in the labor market. Usually, unemployed seek for the Technological Specialization Courses.

III. UNDERSTANDING LEARNING ROADMAPS

Learning roadmaps are conceived with different approaches, methodologies and definitions, according with who is creating it 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 for this dissertation, it is important to clarify and specify what the meaning of a Learning Roadmap is. First, it will be described what should be our personal understanding of Learning Roadmaps. Thus, it is intended to clarify and standardize the concept of Learning Roadmap for the context of Higher Education in the University of Aveiro. Also, and from the result of analysis of the ID model, Concept Maps and education principles, it is proposed a methodology for the conception of a Learning Roadmap.

A. Learning roadmap definition

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. Thus, it has been developed a tool, to ensure learning and educational strategies delivered for students and trainees, in order to promote and acquire pedagogical processes in a successful way.

Assuming and promoting the principles of free navigation, Learning Roadmaps is based using the approach of creation supported by knowledge. The system should be able to associate contents, issues and subjects, with different layers of granularity, from simple and small definitions or concepts (reflecting the interest of student for a subject of high specification) to a collection of modules or courses (relevants for a desired thematic).

This granularity traduces in the creation of learning objects ontology, featuring mechanisms for association, linking and contextualization, capable to catalyze the learning and training process.

B. LRS main concept

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 research and analysis that made are according to the European school system for academic, polytechnic and post-secondary education under the Bologna Process[1].

The core of LRS is focused in the learning and training roadmap. 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 and course managers, it aims at becoming learning and training 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 and training 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:

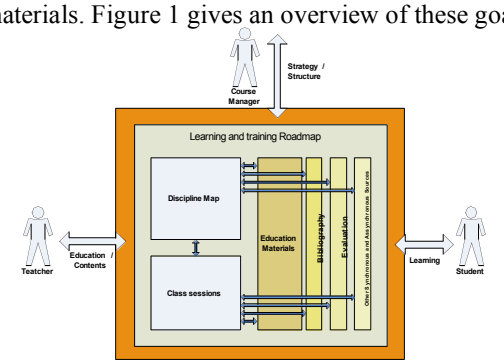

Figure 1. LRS General Schema

A learning roadmap congregates several learning metadata for milestones association and indexation like learning objects, course and structure, thematic class, and other relevant data.

IV. LRS USER POLICIES

To operate with the LRS, users must ask, when register, what they want or need to be to interact with the system. Students are users who tend to view learning roadmaps, analyzing information and knowledge, created or deployed by Tutors. Moreover, Tutors depend on the course creation and structure organization made by the Course Managers. Finally, Administrators are a special group of users with special features for platform management, that don't interfere with the learning process.

To avoid any doubt between learning and training it is imperative to define a convention about the actors involved in the pedagogical process:

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 can also 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.

In order to present permissions and policies allowed for the user profiles, presented above, the next table I shows what features and functionalities are available:

	Administrator	Course manager	Teacher	Student	Anonymous
Register pendant subscription					x
User subscription approval	x				
User permissions and profile definition	x				
Course pendant subscription registration				x	
Course subscription approval		x			
Create, edit and manage learning objects		x	x	x	
View and navigate learning objects		x	x	x	
Create, edit and manage thematic classes		x	x		
View and navigate thematic classes		x	x	x	
Create, edit and manage courses		x			
Create, edit and manage course structure components		x			
Assign course teatchers		x			
View and navigate course and course structures		x	x	x	
Create learning roadmaps			x		
View learning roadmaps			x	x	
Searches		x	x	x	

TABLE I. LRS USER POLICIES TABLE

V. LRS DEFINITIONS

A. User interface

3 groups compose LRS user interface: Main window, which includes menu window and action window. Action window provides the horizontal bar options, described later in this document.

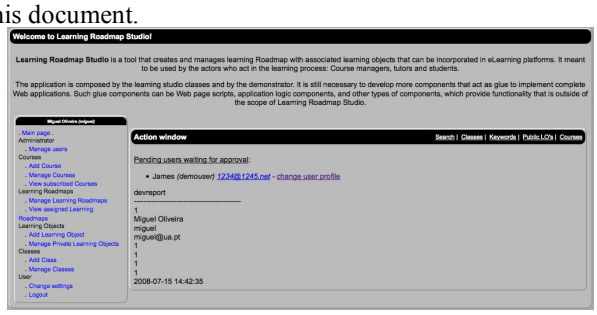

Figure 2. LRS user interface

B. Learning objects

The components of eLearning can be grouped into two categories. One of the two categories contains components designated as physical. These components have a physical existence, such as learning content files, management software and databases. The second category has conceptual components such as courses and classes [2].

A learning object (LO) is the smaller piece that acts as a significant learning unit. [3] [4] Although its size can vary, a learning object must be mapped for only one unique purpose or concept, independently of the context or any other learning piece, enabling it's reuse, trace and management. Basically, think in a LO as a supported MIME-Type content, like PPT, PDF, DOC, etc., with associated metadata.

Excluding Administrators, all user profiles may add LOs to LRS database. Those LOs may then be public, available to be reusable by others, or private, used only by the creator.

When inserting a LO, users must define several data like Name, Description, Outcomes, Skills, URL (in future, embedded URL will be possible) and Private/Public use.

C. Courses

A course is an education imparted in a series of lessons, topics or meetings. Logic units or parts, with a clear organization and structure, can divide it. LRS requests as main course metadata the fields: Name, Description, Pre-requisites, Target Audience, Outcomes, Skills, Estimated Learning Time and General Activities.

Course Managers, the ones who create courses, should also define Keywords, for searches, linking and navigation. The course can also be associated with a Thematic Class (or Topic), also to enable better searches and navigation. Each course should have a Tutor assigned for.

Each course should have a content structure, defined by Course Managers. The structure is created regarding to the parent content item, order sequence and a name, description and estimated learning time should be defined.

Course structures are not mandatory for course creation but Course Managers are invited to create them because they may be useful for Tutors index learning marks of learning roadmaps, enriching knowledge that should be achieved or targeted for students.

D. Learning roadmaps

As described before, a Learning Roadmap is a detailed description of the life cycle of a discipline, comprehending contents, LOs and associated events or activities that conduce to the goal of a thematic issue. To trace the life cycle of a discipline, each thematic issue is indexed with each learning mark that can be Tasks, Exercises, Activities, Exams or Tests. LRS learning mark can also be updated with other types of actions, if needed.

Only Tutors can create Learning Roadmaps, after being assigned as Tutors by the Course Manager. This means that a Course may have only one Learning Roadmap and that Learning Roadmap cannot be associated with other course.

A Learning Roadmap is fed by learning marks, which for its part, needs to be created using several components like sequence and order of a learning mark, action type, associated LO (private or public), course structure component, estimated learning time and URL (like LOs, (embedded URL will be possible in future). You can add more learning marks, as much as you need.

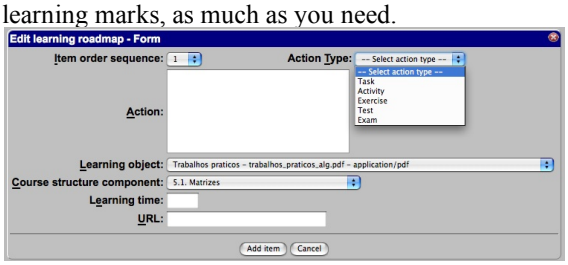

Figure 3. Learning roadmap edition

In the end, the complete Learning Roadmap will be available for students subscribed and approved for the course where the Learning Roadmap was created. (Figure 4) Thus, Students may use it for achieving knowledge and information, and the learning process tends to be easier, more organized and successful.

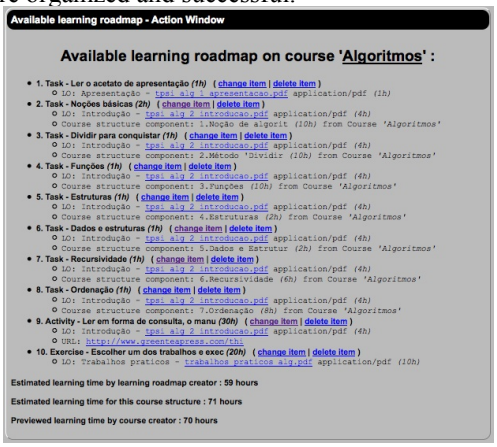

Figure 4. Learning roadmap generation

VI. LRS, FROM TEACHERS DEPLOYMENT TO STUDENTS EDITION, PROMOTING ELEARNING 2.0

Web 2.0 is here today—and yet its vast and disruptive impact is just beginning. More than just the latest technology buzzword, it's a transformative force that's propelling companies across all industries towards a new way of doing business characterized by user participation, openness, and network effects. [5]

Web 1.0 was meant to be read-only web, which is content produced by expert authors and published on the web to be read by consumers. The Web 2.0 is defined as the read-write web, i.e., all the services and applications are provided to allow individuals to co-create or add content, collaborate and share it with others. Also, Web 2.0 supports user-generated content, which is created by common "users", rather than specialist authors or publishers using a variety of affordable technologies like *blogs*, *podcasts* and *wikis*, encouraging the social aspect of the Web, likes, for example, *social bookmarking* tools and social networks.

eLearning 1.0 and eLearning 2.0 shares the same definitions: While eLearning 1.0 was mainly about delivering content, primarily in the form of online courses and produced by experts, i.e. teachers or subject matter experts, eLearning 2.0 powers the information and knowledge creation and sharing with others like *blogs*, *wikis*, *social bookmarking* and social networks within an educational or training context to support a new collaborative approach to learning.

Based on these definitions, it is assumed in a general context, Web 1.0/eLearning 1.0 is content-oriented and Web 2.0/eLearning 2.is people-oriented, often referred to as Social Learning.

The developments made in the applications, were made, having in mind these assumptions: Teachers produce the Learning Roadmaps, deploying it in LMS applications and enable students to edit the teacher's default Learning Roadmaps, adding personal data, which could be used to share it through social learning tools. In order to clear the knowledge and information flow, Figure 5 shows how should be produced and deployed by teachers, allowing edition and information aggregation to feed social and collaborative tools.

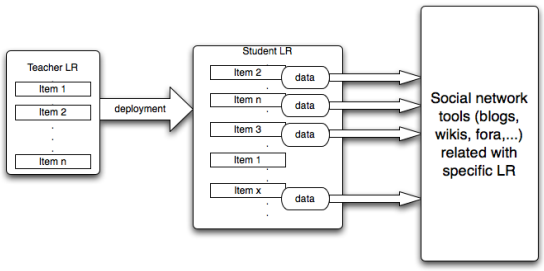

Figure 5. eLearning 2.0 based Learning Roadmap schema

VII. PLATFORM USE AND VALIDATION (CASE STUDY)

Besides the platform was used as a prototype for demo use to another relevant project for this work, described forward, LRS was used for an experiment and indoor validation at the University of Aveiro.

It was selected the discipline of 'Information Systems Project' from the Technological and Specialization Course of 'Technologies and Programming of Information Systems'. The discipline is assigned to end-course students before they enter on a 540 hours training period (about 1 semester), inside a company or institution, in work context. The discipline comprehends autonomous work from students, aiming to create and materialize a project at the end of. The group was formed with twenty students, being invited to register and, further, to subscribe the discipline's learning roadmap in LRS.

The learning roadmap was conceived according with the standards and best practices of software engineering [6]. Theoretical issues like reading activities and research tasks were intercalated with practical activities in order to produce results for the individual projects. Students were invited to follow the learning roadmap until the end of the discipline, step by step, i.e., learning mark by learning mark.

Later, they were inquired about the relevance of the application to achieve results in the discipline. Some of the most important statements from students were:

- The application and thus, the learning roadmap, were useful to guide students during the discipline. It increased efficiency and productivity regarding the work on the project;
- It reduced the number of times that students spend with the teacher to clear doubts or less-relevant questions, powering the time spent with teacher for project supervision and for other more complex issues;
- Because the application was available for Web environment, it enabled the students to guide themselves outside the learning classes, promoting autonomous work;
- Due to the reutilization of learning contents, students suggested the teacher to create another learning

roadmap for the training period, embedding selected contents from the previous discipline. They appreciated the application and felt it would be useful in guidance for the training stage, in order to achieve results in a enterprise based context;

- The student's profile of LRS enables the upload of learning objects. It allowed students to upload relevant content for the project and to share it with others. The teacher also included in the learning roadmap some of students uploaded learning objects, feeding the resources of some specific steps or learning marks.

Also, the students suggested several improvements and features for LRS:

- The application could allow users to track/check steps, learning marks and to insert notations in those items;
- The application could also enable another learning mark for uploading scheduled deliverables, reports or other relevant work for teacher supervision;
- It would be interesting if the application aggregate other collaborative tools like discussion *fora* or *blogs*;
- More intuitive and user-friendly user interface is desired for the system;
- Exporting tool for learning roadmaps could be useful for students in order to use learning roadmap as a standalone document, when the Web is not available.

All the suggestions were identified and will be developed in future versions of the application.

VIII. Conclusion and Further Work

The main contribution has been the development of a prototype, LRS, for creation, edition and deployment of learning roadmaps for higher education, which attempt to guide students, congregating several learning components, from the learning process, that composes learning roadmaps, according to the definition presented in this dissertation: courses, structures that composes courses, learning objects and pedagogic and learning marks. The prototype encourages students to participate in the learning process, supplying additional tools for personal edition, enabling customization from teacher's strategies to their own learning rhythm and acknowledgement methodologies.

The contribution for software engineering development has been made in order to enable data deployment for social networks and tools, like *blog's*, *wiki's*, *fora*, and other collaborative environments. This is possible due to data structures abstraction, which allows several possible configurations of utilization of the prototype. Because of the use of a middle layer in the system architecture, using an object-relational mapping (ORM) as a software approach to treat data stored in relational (SQL) database table records as if they were objects [7], the prototype can be use as an online learning roadmap manager, but also can be integrated in LMS, treating and filtering the relevant data, from LMS to learning roadmaps creation and deployment. The ORM also enables the use of different relational databases, according with different choices due to different reasons. In addiction, due to this abstraction, the students edition of learning roadmaps can be used, separated from the rest of the prototype, and be included in other learning environments to enable student's pro-activity and participation in knowledge creation and sharing.

Moreover, it is our assumption that the future of learning, looking for the current learning theories, knowledge construction, policies being made and current social contexts, endorse the development of systems, applications and tools for more and better involvement of all actors inside the learning process, encouraging pro-activity among learning environments.

The contributions are also specific because it has been possible to gather learning and training experience in higher education with emergent theories, concepts and technologies that support new ways of learning and achieve knowledge.

At last, our personal conviction looks forward to make available, for large-scale use, the prototype in the Web. Although the system is online, it is needed to adjust several technical issues that limited the project, like available bandwidth and physical space enabled by the host, which prevents the content and users growing of the application. Thus, future developments and directions will be made in order to equip the system with features and functionalities to encourage the use of learning roadmaps, summarized bellow:

- User interface, usability and accessibility
- More collaborative tools to gather student's data
- Learning times management and validation functionality
- Tracking system for tutors
- One course, several tutors
- SCORM compliant feature [8]
- Localization files for different languages

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