

Learning roadmap studio: new approaches and strategies for efficient learning and training processes

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Executive summary

Learning systems have emerged in a set of different information systems, oriented for different kinds of organizations and institutions, such as learning management systems, knowledge management systems and learning content management systems, which can be integrated or merged with others.

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. Initiatives such as eLearning (EU Commission 2000), eLearningEurope, eTwinning and Education Observatories are an evidence of this challenge. Platforms, applications, tools and systems must respond to challenges that those actors face nowadays: heterogeneous target audiences, in terms of student profiles, number of participants, differentiated contents and schedules to achieve knowledge, outcomes and competences. Thus, a prototype application, named Learning Roadmap Studio (LRMS), has been developed and deployed at Aveiro Norte Polytechnic School of the University of Aveiro, in order to suppress gaps in learning processes and to power better learning and training. It represents a new challenge for the University of Aveiro for higher education and is already being tested. 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.

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.

Keywords

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

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 unanimous, 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.

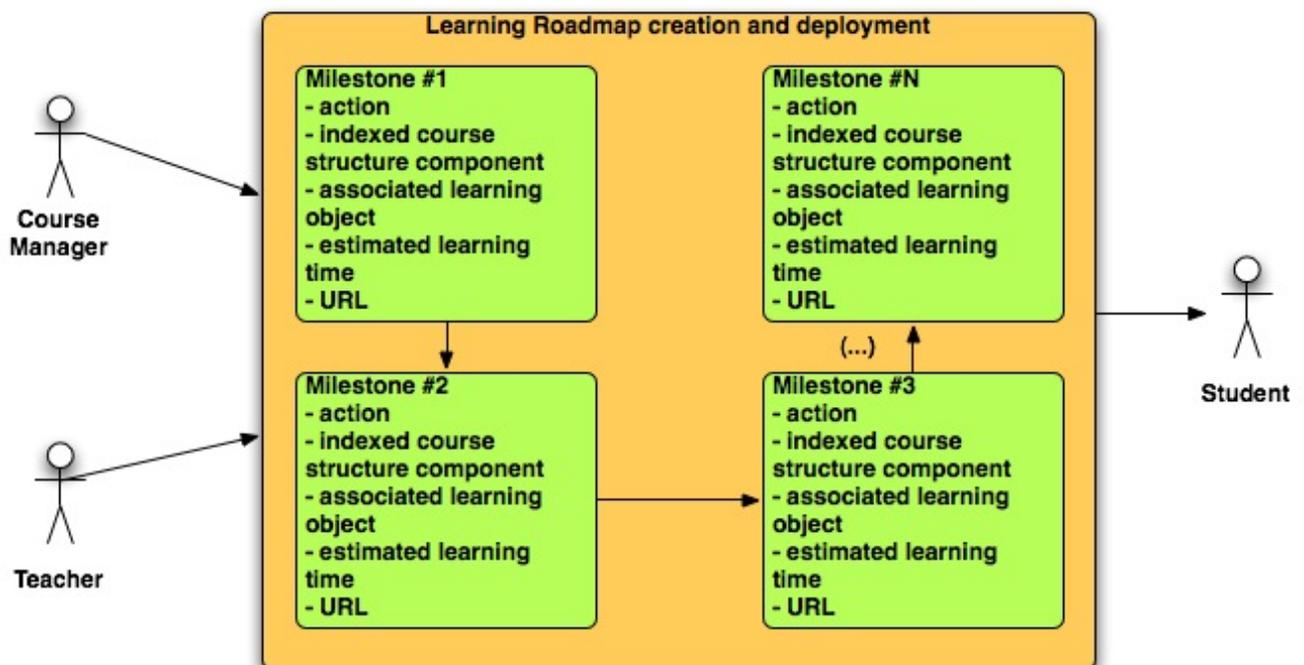
It is also important to clarify that learning and training roadmaps will attend to predefined contents of courses, disciplines and subjects. It is not intention of this project to enable features for self creation of education curricula and materials.

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 is important to explain.

LRMS aim at composing learning and training roadmaps that act upon two fundamental axes: education and learning. For teachers, it aims at becoming a self-supporting tool that stimulates the organization and management of the education materials, including useful functionality and not only another technological innovation framework without advantages for the actors.

For students, the learning roadmap aims at promoting self-study and supervised study, endowing 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.



Players and roles

First, 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 shows what features and functionalities are available:

	Course manager	Teacher	Student
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 teachers	X		
View and navigate course and course structures	X	X	X
Create learning roadmaps		X	
View learning roadmaps		X	X
Searches	X	X	X

Learning roadmap studio main features

As described in the previous section *Understanding learning roadmaps*, a learning roadmap congregates several learning metadata for milestones association and indexation like learning objects, course and structure, thematic class, etc.. The project emerged according with the conception and development of features, mandatory for learning roadmap creation:

Learning objects

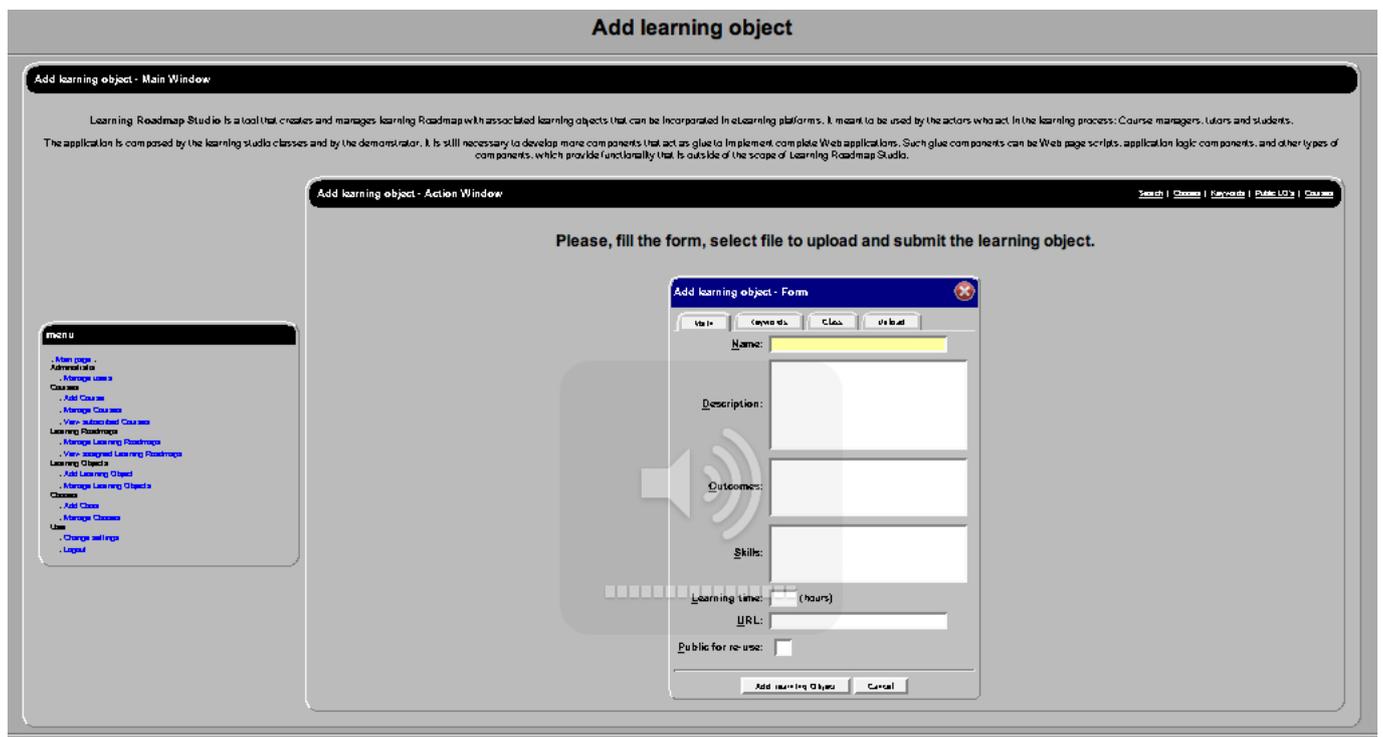
The components of eLearning can be grouped into two categories. One of the two categories contains components designated as physical. These components have a physical existence, such as learning content files, management software and databases. The second category has conceptual components such as courses and classes (C. Fallon et al, 2003).

A learning object (LO) is the smaller piece that acts as a significant learning unit. 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 its reuse, trace and management.

A LO can be any type of media supported in web: documents, presentations, sounds, movies, charts, etc.. To create a learning object it is needed to associate several metadata, that characterizes the LO:

- Unique name of LO;
- Detailed or small description;
- Outcomes;
- Skills to achieve;
- Estimated learning time for specific LO;
- URL if, any, can be and embed URL for online media;
- Keywords indexed with the LO (for searches or future features);
- Thematic class association;
- Set if the LO is public for being reused by others;
- Upload media content (content type, size and other file data).

In terms of application logic and policies, all registered users can create learning objects, private, for private use, or public, allowing teachers to point or associate LOs to their learning roadmaps. Next picture shows the creation of a new LO, where metadata is organized in tabs: *Main, Keywords, Class and Upload*.



Courses

Course managers can create and manage courses, inserting several metadata, to characterize it:

- Name;
- Description;
- Pre-requisites, if any;
- Target audience;
- Outcomes;
- Skills;
- Estimated course learning time;
- Activities plan;
- Keywords indexed with the LO (for searches or future features);

- Thematic class association;
- Assigned tutor.

These courses can be defined, either a small group of subjects and issues or, a complex and modular set of different subjects and issues.

Please, fill the form and submit the course.

The screenshot shows a web interface for adding a course. On the left is a sidebar menu with the following items: Main page, Administrator, Manage users, Courses (Add Course, Manage Courses, View subscribed Courses), Learning Roadmaps (Manage Learning Roadmaps, View assigned Learning Roadmaps), Learning Objects (Add Learning Object, Manage Learning Objects), Classes (Add Class, Manage Classes), User (Change settings, Logout). The main content area is titled 'Add course - Form' and contains four tabs: 'Main', 'Keywords', 'Class', and 'Tutor'. The 'Main' tab is selected and contains the following fields: 'Name' (a text input field), 'Description' (a large text area), 'Pre-requisites' (a text area), 'Target audience' (a text area), and 'Outcomes' (a text area).

The previous picture presents course creation metadata organized in tabs: *Main*, *Keywords*, *Class* and *Tutor*.

Course managers, past course creation, may create a simple or complex sorted and hierarchical structure. Course structures, can be uses to index several activities to different course component structure, that 's is explained in sections ahead for learning roadmap creation. Each component of a course structure must have:

- Definition;
- Description;
- Estimated learning time for this component;
- Parent component or root for hierarchical association;
- Order sequence.

After creating a course, an associative structure can be edited, as shown in the next picture.

applications. Such glue components can be Web page scripts, application logic components, and other types of components, which provide functionality that is outside of the scope of Learning Roadmap Studio.

Edit course structure - Action Window Search | Classes | Keywords | Public LO's | Courses

Available course structure - Action Window

Available course structure:

- 1.pre-intro ([change item](#) | [delete item](#))
ewq (1h)
- 2.intro ([change item](#) | [delete item](#))
qwwq (1h)
 - 2.1.intro 21 ([change item](#) | [delete item](#))
wq (1h)
 - 2.2.intro 22 ([change item](#) | [delete item](#))
s (1h)
 - 2.3.intro 23 ([change item](#) | [delete item](#))
eqw (1h)
 - 2.4.intro 24 ([change item](#) | [delete item](#))
ewq (1h)
 - 2.4.1.pre-def section ([change item](#) | [delete item](#))
ds (1h)
 - 2.4.2.another section ([change item](#) | [delete item](#))
swr (1h)
 - 2.5.intro 25 ([change item](#) | [delete item](#))
weq (1h)
 - 2.6.intro 26 ([change item](#) | [delete item](#))
asfkphats (2h)
- 3.development ([change item](#) | [delete item](#))
llfdkjs (1h)
- 4.conclusions ([change item](#) | [delete item](#))
wqweq (1h)

Estimated learning time for this course structure : 13 hours
Previewed learning time by course creator : 1 hours

You have edited the course structure.

Do you want to add another item to the course structure? ([add another item](#))

Thus, it can be used to create simple or complex course structures, whether subjects and issues granularity are set by course manager. This dynamic feature for course structure creation was developed in order to respond to a gap in eLearning platforms – heterogeneous courses – you may adapt courses to platforms but the opposite is not so quite easy to do it. Course creation and structure tool minimizes the work for embedding courses in eLearning platforms.

Thematic classes

Thematic classes are classification areas, organized in the form of a hierarchical tree, to enable courses and learning objects being classified under available class tree or, the user can create new ones on the root, or under other parent class. This powers searches and navigation by classes by all registered users. Next pictures show the class creation interface and the navigation by class, respectively.

Add class category

Add class category - Main Window

Learning Roadmap Studio is a tool that creates and manages learning Roadmap with associated learning objects that can be incorporated in eLearning platforms. It meant to be used by the actors who act in the learning process: Course managers, tutors and students.

The application is composed by the learning studio classes and by the demonstrator. It is still necessary to develop more components that act as glue to implement complete Web applications. Such glue components can be Web page scripts, application logic components, and other types of components, which provide functionality that is outside of the scope of Learning Roadmap Studio.

Add class category - Action Window Search | Classes | Keywords | Public LO's | Courses

Please, add a new class category. You can also defined class hierarchies.

Add class category - Form

Name: WCT 2007-2008
Description: WCT champinoship
Parent hierarchy: Sports/Surf/KellySlater

Add class Cancel

Navigate by classes

Navigate by classes - Main Window

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menu

- . Main page
- . Administrator
- . Manage users
- Courses
 - . Add Course
 - . Manage Courses
 - . View subscribed Courses
- Learning Roadmaps
 - . Manage Learning Roadmaps
 - . View assigned Learning Roadmaps
- Learning Objects
 - . Add Learning Object
 - . Manage Learning Objects
- Classes
 - . Add Class
 - . Manage Classes
- User
 - . Change settings
 - . Logout

Navigate by classes - Action Window

Search | Classes | Keywords | Public LO's | Courses

Available classes.

1-5 / 10

ID	Name	Description	No.Children	Hierarchy	Creator	View
1	Sports	Sports	2	--No parent--	1	view
2	Surf	Surf	2	/Sports	1	view
3	Arts	Arts & Humanities	0	--No parent--	1	view
4	KellySlater	KellySlater	0	/Sports/Surf	2	view
5	Esoteric	Esoteric issues	0	--No parent--	2	view

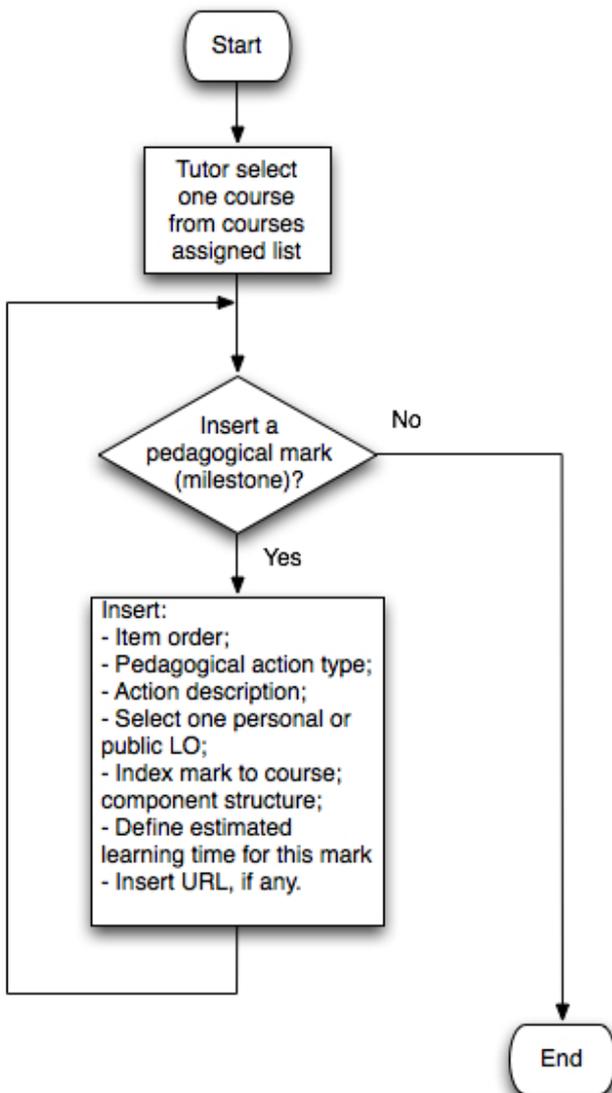
1-5 | [Last >>](#)

Learning roadmaps

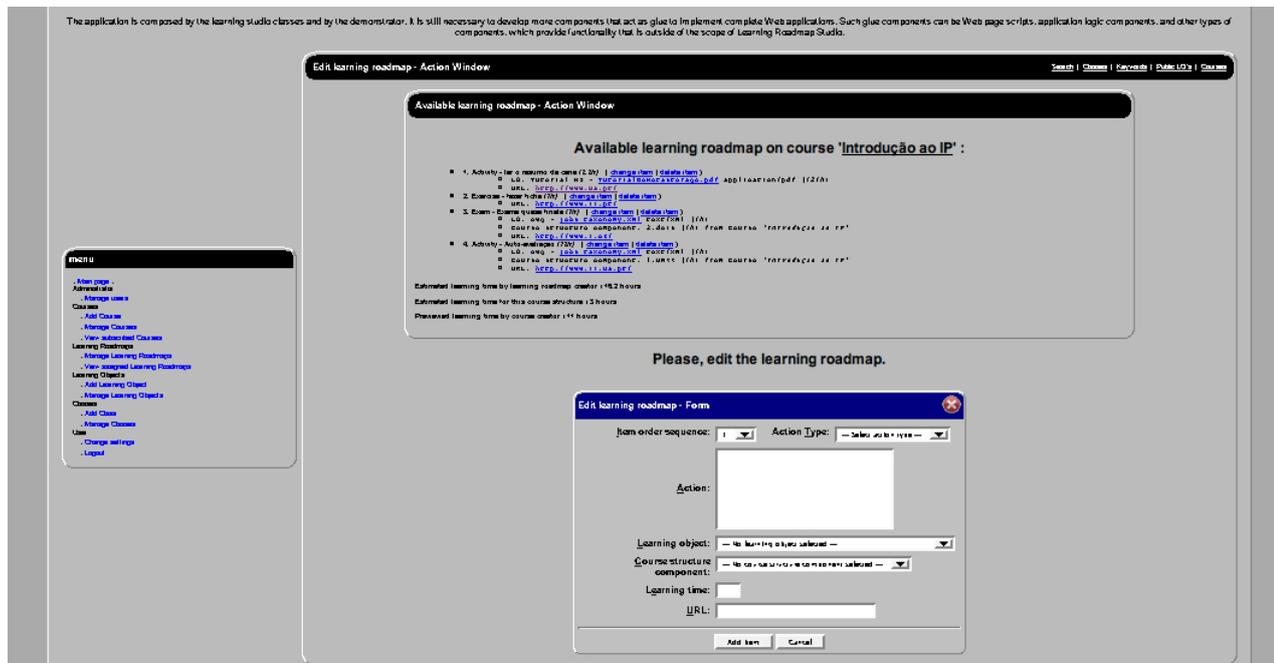
Creating a learning roadmap is an easy task in terms of its conception because, most of our metadata components are already created and edited: Courses, structures and learning objects.

Thus, the conception of a learning roadmap is the conception of a 'tutor suggested' pedagogical strategy, which involves, primarily, the congregation of reusable data and metadata associated with pedagogical and learning marks (activities, events, exercises, lectures, etc.), sorted in tutor defined sequence for achieving knowledge.

Next graph presents the flow of events and data needed for creating a learning roadmap.



The application for creating learning roadmaps is simple and small data is inserted in database because most of metadata is already there. Tutors need to plan what they want to do to power learning and map it in the application. Basically, a strategy needs to be defined, without needing to adjust to specific eLearning platforms. Next figure shows the edition of a learning roadmap for a specific course.



The process is simple: Tutors select action type, sequence order, associate course structure components, LO and other data. After inserting another pedagogical/learning mark, the system is clever enough to rearrange sequence of marks according to its previous sequence with new or edited pedagogical marks. Also, the type of actions can be defined anytime because the application is dynamic and scalable. Currently, system supports several pedagogical actions and activities like activities, events, exercises, lectures, etc, but others can be incorporated anytime.

Future Work

LRMS has been developed according to software engineering principles and methodologies for web-based applications. Such orientation guidelines were mandatory to develop scalable and modular applications, enabling to expand tools and features, promoting better learning and education through Information and Communication Technologies.

The application tends to promote integration or migration of principles, use cases and functionalities of LRMS. The sections bellow present what is being planned for future work.

Embedding LRMS in eLearning Platforms

Although the application prototype can be used as a separated tool from eLearning platforms, it can also be embedded in other systems. The application was developed under a Linux-Apache-PHP-MySQL environment, and used a persistent layer generator application, MetaStorage (Lemos 2004), capable of generating the necessary software components to implement a persistence layer API from a description in a format based on XML, named Component Persistence Markup Language (CPML). Using the same format (CPML), it is possible to dump existing databases from other systems, like eLearning platforms, in order to create a common data layer between the LRMS and the other systems, enabling data integrity and flow, connecting and merging available learning contents and metadata.

Scorm compliant feature

LRMS was created as an independent application or integrated in other learning management system (LMS). In both cases, it can be helpful when it is needed to migrate contents and metadata to other systems, and the standard way to do it is using SCORM specification. Most of known and used LMS are SCORM compliant, i.e., all learning and pedagogical content can be exported using this specification (ADL 2004). Due to the data model used, exporting SCORM

data tends to be a useful feature, attending to deliver SCORM files, manifest and package to other platforms.

User interface

Native XHTML and CSS were used to develop the user interface, giving emphasis to accessibility and usability issues. The prototype user interface can be improved without the need to access code, due to physical and conceptual model. Web designers only need to access the templates and CSS directories to get things done.

Emergent technologies for graphical environments are being tested with the purpose to generate better graphical user interface for students using learning roadmaps. Such emergent technologies like AJAX, are capable to provide a more friendly use of LRMS.

Conclusions

This project started with simple issues in mind. After the *democratization of eLearning platforms*, accessible to most organizations and institutions, eLearning has become the *swiss army knife* for the ones who teaches and for those who learn. Since the end of the 90's, these platforms became friendly and focused their features on contents, users and policies. Even then, teachers still needed to adapt their learning strategies to platform requirements, in order to get the best of the two worlds. The project and application presented in this article aims at fulfilling these gaps. There is no big technological complexity in developing a learning roadmap. Instead, learning roadmap creation and deployment for learners depends more on what metadata is stored, rather than creating it from scratch. Reutilization and modularity are touchstones needed to be arranged and to create more intuitive and friendly tools and interfaces for pedagogical challenges and strategies.

It is not intended to create another eLearning platform. The presented prototype, more than another web-based learning application, intends to put on the table the discussion of new strategies and learning processes, showing how they can help achieving knowledge and promoting better learning and education.

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