E-Cubed Project

Safety in Construction

Learning Objects Descriptions, Application and Evaluation

The Learning Objects "Safety in Construction" addresses the issue of safety on construction sites. It uses two different approaches, one for engineers and another one for foremen. The first approach addresses the safety using text based materials like papers, presentations and interactive quizzes. The learning objectives of this LO are:

- Understand decision Theory applied to Safety in Construction
- Understand the importance of ICT applied to Safety in Construction
- Understand the process of accidents investigation in Construction

The second approach uses a rich interface, animations and simulations to illustrate the risks and hazards present on construction sites. It also includes safety precaution measures, safety checks and First Aid procedures. The learning objectives are:

- recognize hazardous procedures
- understand the importance of precaution measure
- identify protective equipment
- apply correctly precaution measures

Implementation of the Learning Object

This LO was developed considering two very distinctive target audiences: engineers and foremen. These two groups are very different in the way they learn and also in the way they relate to the computers. The particularities of each group were considered very carefully during the development phases and resulted on two different approaches of the same subject.

Safety in Construction for engineers

The LOs developed for the engineers consisted essentially on text based LOs (PowerPoint presentations, Word Documents, and PDFs) developed with a previously defined structure that matched the pedagogical approach chosen for the evaluation of the LOs: Pre/post test. Each LO included three components: the pre-test (a quiz), the content (several text based objects) and a post-test (a quiz).

These LOs were integrated and tested on two editions of a Post-Graduated course at the School of Engineering of Universidade do Porto.

The LOs were included in an e-learning management system – LUVIT—that allowed not only the controlled distribution of the courseware but also provided tools for the development of some components for the assessment and evaluation processes (quizzes, evaluation questionnaire, usage statistics). The LOs were made available on-line for the students gradually, first the pre-test (class-room), followed by the content (distance) and finally, one week later, the post-test (class-room).

This approach was considered adequate considering that the target-audience, post-graduate students, is highly literate and have the necessary computer skills to perform the tasks. Also, the nature of this content, which consisted on legislation, best-practices, papers, etc. adapts easily to the type of structure adopted.

The implementation of these LOS was included as a case study for another project concerning the evaluation of LOs "Benchmarking of LOs" presented on the EDEN 2004 ANNUAL CONFERENCE.

Safety in Construction for foremen

The development process of the LOs for the foremen was very complex and went through different stages and approaches. This complexity reflects the complexity of the problem that had to be solved to deliver this particular content to this target audience:

- The content is critical for the target audience and we had to ensure that it was passed on very clearly.
- The content has a high level of semantic density and the target audience has a low level of literacy and computer skills

The first approach included essentially HTML pages with short texts and images. From this approach the process evolved gradually to the final version of the LOs that is a Multimedia CD-ROM developed using Macromedia Flash. This CD was designed considering the low computer skills of the target audience and allows an autonomous use of the contents. Also, complex content was broken apart and made more accessible with the support of animation, images and audio.

This LO was used and tested with foreman working in construction companies.

Safety in Construction – the E-book

The final stage of this process was the development of an E-book about Safety in Construction that aggregates contents from the two families of LOs described above and also contents developed specifically for this project. The E-book includes several text-based contents and animations and also an on-line component.

This project alone is a good example of the reutilization potential of LOs.

Evaluation of the Learning Onjects

Safety in Construction – Engineers

These three LOs were developed by UP. The LOs are available on-line, included in an e-learning platform called WEBCT.
The LOs were tested by Universidade do Porto, using a benchmarking evaluation system and were also evaluated by students.

The final results of the benchmarking evaluation are as follows:

	LO1		LO2		LO3			
	Efficiency	effectiveness	efficiency	effectiveness	efficiency	effectiveness	Max	Max
Educational aspects	23	22	21	21	21	21	48	46
Structural aspects	12	4	12	4	12	4	32	12
Technical aspects	16	7	16	7	16	7	34	10
Logistical aspects	10	0	10	0	10	0	22	0

Safety in Construction – Foremen

This LO had three different evaluation events:

- It was evaluated by the Cranfield Partner (see document safetyobjectevaluation.doc)
- It was evaluated by a Multimedia Specialist (see document UPLO_multimediaspecialist.doc)
- It was evaluated by real users in Construction Companies (see document CEEasWBL.doc)

E-CUBED PROJECT

TEACHING GUIDELINES

Universidade do Porto

SAFETY IN CONSTRUCTION FOR FOREMEN

Objectives

The learning objectives of this LO are:

- recognize hazardous procedures
- understand the importance of precaution measure
- identify protective equipment
- apply correctly precaution measures

End users

Life long learners

Difficulty

Easy

Typical learning time

0,5 hours per module (x9) – 4,5 hours

Description

The development process of the LOs for the foreman was very complex and went through different stages and approaches. This complexity reflects the complexity of the problem that had to be solved to deliver this particular content to this target audience:

- The content is critical for the target audience and we had to ensure that it was passed on very clearly.
- The content has a high level of semantic density and the target audience has a low level of literacy and computer skills

This CD was designed considering the low computer skills of the target audience and allows an autonomous use of the contents. Also, complex content was broken apart and made more accessible with the support of animation, images and audio.
This LO was used and tested with foreman working in construction companies.

Structure

This Learning Object consists on an interactive CD-ROM developed with Macromedia Flash. The main objective of the LO is to introduce and explain several issues concerning Safety in Construction for foreman. The CD-ROM is self exploratory, very simple to use and intuitive aiming for an audience that has low computer skills.

It contains a total of nine modules that represent key areas of safety in construction.

Methodology

The LO consists of nine modules, completely independent. The CD is self-exploratory. It is very simple to use and it was designed for users with low computer skills. However, some initial guidance is recommended.
All modules are equally important and should be completed by all foremen.

E-CUBED PROJECT

TECHNOLOGY GUIDELINES

Universidade do Porto

LO1 – SAFETY IN CONSTRUCTION FOR FOREMAN

Overview

The first version of this LO was developed using HTML pages and animated GIF images. However, soon after starting the development of the LO, we realized that the approach was inadequate for the target audience (low computer skill, low education) because it had too much text and demanded attention for long periods.

The second version of the LO was developed using MACROMEDIA FLASH. It had a rich graphic interface, some interactivity, audio and animation.

The last version was an upgrade of the second version. Still using Flash, it has an improved interface, uses less text and more audio and interactivity.

The technology

Macromedia Flash is a very powerful tool because it integrates drawing, programming and animation/video/audio tools. So, we can develop a full multimedia application, with drawing, image, video, animation simulation, interaction, audio, etc., using only one program.

The latest versions of this software have specific tools to develop e-learning materials, some specifically to develop LOs and to communicate with e-learning platforms. Also, this tools has additional plug-ins that allow to develop LOs compliant with the latest standards, like SCORM.

However, this tool needs quite a bit of training to take full advantage of all the functionalities.

LO1 – SAFETY IN CONSTRUCTION FOR ENGINEERS

Overview

This LO includes three smaller LOs that share a similar structure: Pre-test, content and post test. The content of the LOs is text based (MS Word and PDFs).
The LOs were deployed to students through an e-learning platform.

Technology

The platforms are Learning Management Systems that can be used in all stages of e-learning deployment. They include a complete set of tools for course preparation, delivery, and management - resulting in an e-learning system that is easy to use and reliable. Seveal information about LMSs can be found on-line. A good starting-point is the website http://www.edutech.ch/lms/ev2.php that includes a comparison between several systems.

The first two times these LOs were used in a course the platform used was LUVIT (http://www.luvit.se).

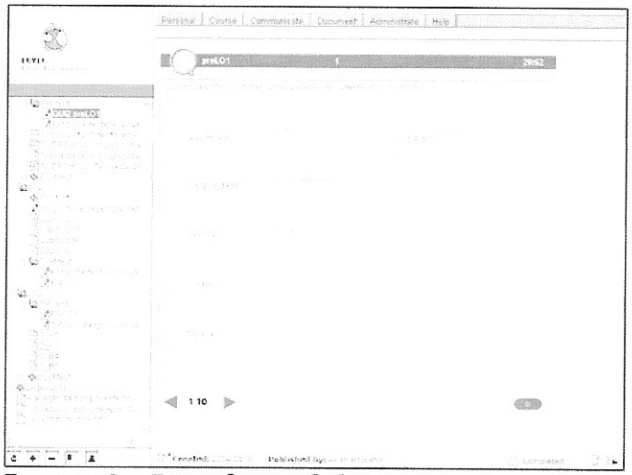


Image 1 - Interface of the course in LUVIT

The third time, another e-learning platform was used, WEBCT (http://www.webct.com).

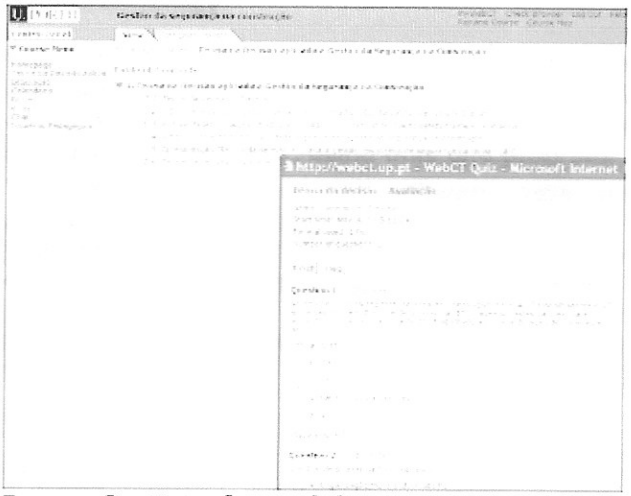


Image 2 - Interface of the course in WEBCT

In both situations, the interactive part of the LOs (quizzes) was developed using the specific tools of the platforms.

In spite of the use of the platforms, there were some problems when transferring the contents from one to the other, specially the quizzes. However, as platforms evolve these problems become less important.

Both platforms are IMS compatible and LUVIT has some compatibility with SCORM. More recent version of these e-learning platforms have larger degree of compatibility with standards.

For these LOs, the rest of the technology used is a lot more usual: Microsoft Word and Adobe Acrobat for PDF making.

E-CUBED PROJECT

TEACHING GUIDELINES

Universidade do Porto

SAFETY IN CONSTRUCTION FOR ENGINEERS

Objectives

The learning objectives of this LO are:

- Understand decision Theory applied to Safety in Construction
- Understand the importance of ICT applied to Safety in Construction
- Understand the process of accidents investigation in Construction

End users

Life long learners

Difficulty

Easy / Medium

Typical learning time

2 hours (x3)

Description

The LOs developed for the engineers consisted essentially on text based LOs (PowerPoint presentations, Word Documents, and PDFs) developed with a previously defined structure that matched the pedagogical approach chosen for the evaluation of the LOs: Pre/post test. Each LO included three components: the pre-test (a quiz), the content (several text based objects) and a post-test (a quiz).
These LOs were integrated and tested on three editions of a Post-Graduated course at the School of Engineering of Universidade do Porto.
The LOs were included in an e-learning management system that allowed not only the controlled distribution of the courseware but also provided tools for the development of some components for the assessment and evaluation processes (quizzes, evaluation questionnaire, usage statistics). The LOs were made available on-line for the students gradually, first the pre-test (class-room), followed by the content (distance) and finally, one week later, the post-test (class-room).
This approach was considered adequate considering that the target-audience, post-graduate students, is highly literate and have the necessary computer skills to perform the tasks. Also, the nature of this content, which consisted on legislation, best-practices, papers, etc. adapts easily to the type of structure adopted.

Structure

This Learning Object consists on three smaller LOs. The main theme is Safety in Construction. The smaller LOs are about:

- LO1: Decision Theory applied to Safety in Construction
- LO2: ICT applied to Safety in Construction
- LO3: Accidents in Construction

The structure of the 3 LOs is similar and consisted on: pre-test/content/post-test. The LOs were made available to students through an e-learning platform (Luvit / WebCT).

This LO includes three smaller LOs that share a similar structure: Pre-test, content and post test. The content of the LOs is text based (MS Word and PDFs). The pre and post test of the three LOs also share a similar structures: 10 question ("multiple choice", "fill-in the blank", "match") and two short answer questions.

The LOs were deployed to students through an e-learning platform.

Methodology

In traditional learning the Learning Workflow is:

- Pre-test (30 minutes)
- 2/2,5 hours "exposure" to content
- Post-test (30 minutes)

Alternatively, the workflow can be:

- pre-test (30 minutes)
- content available on-line for one week (self learning)
- post test (30 minutes)

In both types of learning, we recommend that the post-test is made in a class-room and should only be available for a short period.