

## Open and Accessible Training

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The objective of the Open and Accessible Training project is to facilitate full participation of students with special needs in the opportunities offered by web-based education providing an open, accessible and standard-based approximation to e-learning in an adaptive way. aDeNu research group works focus on the development and customisation of dotLRN (an enterprise-class open source software for supporting e-learning communities) to provide an inclusive system based on standards that personalizes and adapts e-learning contents and activities, pedagogical models and learners' interactions to satisfy the particular needs and preferences of learners with functional diversity.

**Keywords** Inclusive Learning Management System, Pedagogical Models, Web accessibility, Special Needs, Educational standards.

### 1. Introduction

Open and Accessible Training (Formación Abierta y Accesible – FAA)<sup>1</sup> is a Research Project funded by the Xunta of Galicia (Spain) and coordinated by Soluziona Accessibility Unit. The objective of this project is to facilitate full participation of students with special needs in the opportunities offered by web-based education providing an open, accessible and standard-based approximation to e-learning in an adaptive way. The purpose of FAA is threefold:

- To provide accessible services, contents and activities adapted to the learners' needs.
- To support an effective achievement of learning objectives thanks to the implementation of advanced pedagogical models within the appropriate instructional design standards.
- To promote collaborative learning by fostering the participation, communication, sharing of knowledge and storing the common history.

Accessibility is not just a matter of contents (or even services), but it is strongly related to the learning models. It influences the whole life cycle of e-learning in the same way as adaptation does [1]. This means that the Design, Publication, Use and Auditing phases have to take into account the corresponding accessibility requirements.

Moreover, in FAA project, the training process is defined as follows:

- Centred on the user (the learner) and thus based on the users' preferences and learning styles.
- Supported by educational standards (SCORM<sup>2</sup>, IMS<sup>3</sup>).
- Intensive monitoring of learners' interactions.

The innovation of FAA project lies in considering the integration of educational standards (SCORM and IMS family) in a way in which contents, pedagogical models and interactions are personalised and adapted to satisfy the individual needs and preferences of the learners, fulfilling accessibility requirements in a broader sense than just contents accessibility and considering the full life cycle of eLearning.

aDeNu research group works focus on the development and customisation of dotLRN<sup>4</sup> open source software for supporting e-learning communities to provide an inclusive system based on standards,

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<sup>1</sup> <http://adenu.ia.uned.es/faa>

<sup>2</sup> <http://www.adlnet.gov/scorm/>

<sup>3</sup> <http://www.imsglobal.org/>

<sup>4</sup> <http://dotlrn.org>

which personalizes and adapts e-learning contents and activities, pedagogical models and learners' interactions to satisfy the particular needs and preferences of learners with functional diversity.

In the paper we describe the learning environment used to support our approach and how we are working on it to build an intelligent learning management system that supports both adaptation and accessibility. Finally, we outline the future works to be undertaken, with special emphasis on the evaluation works and the feedback to EU4ALL European project [3].

## 2. The Learning Environment

In order to deliver contents, activities and services following the appropriate instructional design and fostering collaboration, a learning environment that supports these wide range of functionalities is needed. Moreover, these functionalities have to be provided in an accessible and adaptive way. Since the current state of the art in learning environments shows that there is no environment that fulfil these requirements, in FAA project we looked for an open source learning environment that provides the basic functionality in terms of learning and collaboration services, and whose internal architecture and data model allows us to consider accessibility and adaptation.

We chose an enterprise-class software for supporting e-learning communities initially developed at the MIT and currently supported by dotLRN open source consortium. We based our selection in the fact that dotLRN is developed on top of OpenACS<sup>5</sup> toolkit for building scalable, community-oriented web applications (initially ArsDigita Community System – ACS). Hence, it provides the needed infrastructure for our developments. The functionality provided comprises, among others, the following: calendar, discussion forum, file storage, notifications of members' contributions, management of user preferences, user tracking of interactions, assessments in IMS-QTI standard, management of IMS-CP and SCORM based courses and IMS-LD pedagogical designs. Moreover, regarding the interface, it provides the Selva theme based on style sheets easily configurable to change the user interface according to the users' preferences.

As part of the works in FAA project, the aDeNu group has been involved in the dotLRN community to take accessibility requirements into account during the development of the 2.2.0 release. The status of accessibility in dotLRN is announced in a wiki page<sup>6</sup> and managed via three categories of bug types in the Bugtracker following the Web Content Accessibility Guidelines (WCAG) of the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C).

Therefore, FAA project is based on a learning environment that supports educational standards (IMS family and SCORM) and where usability and accessibility requirements are key in the development process. Moreover, it is developed by an open source community so it can evolve with new third party improvements.

## 3. Towards an Intelligent and Accessible Learning Management System

The aim of FAA is to offer an open and accessible approximation to e-learning based on standards, where the contents, pedagogical models and interactions are personalised and adapted to satisfy the individual needs and preferences of the learners, who may (or may not) have functional diversity. To achieve this goal, an intelligent learning management system is under construction extending dotLRN to support adaptation to learners' needs and to fulfil accessibility requirements (in a broader sense that the content accessibility fulfilment described in section 2).

The adaptation is considered along the four phases of full life cycle of eLearning: design, publication, use and auditing [1]. It takes as the starting point the design specified by the author. This design is complemented with the analysis of the interactions of the learners to show the learning resources and services in the most appropriate way for each user. For this, it considers the learning styles, preferences and skills of the learners. It applies the approach defined in aLFanet project (IST-2001-33288) [2] to manage adaptation in a widely used learning environment (i.e. dotLRN).

<sup>5</sup> <http://openacs.org>

<sup>6</sup> <http://openacs.org/xowiki/en/Accessibility>

Regarding accessibility, the WAI of the W3C provides accessibility guidelines for user interfaces. This means that any if a user interface complies with these guidelines, people with functional diversity can interact with them. However, the needs of people with functional diversity have also to be managed along the full life cycle of eLearning, starting with the design of learning materials, analysing their interactions to provide contextual recommendations on how to interact in the course and evaluating the knowledge acquired.

Therefore, the accessibility requirements for learners with special needs have implications in all the modules that make up the architecture of an adaptive learning management system. Apart from the guidelines for the user interface, the user model has to deal with the interaction features of the learners, the pedagogical model has to consider the appropriate learning strategies for each type of disability and the domain model has to include a variety of learning materials suitable for the different interaction needs of the learners. This redundancy of contents solves a set of accessibility requirements providing that these contents are properly characterized with metadata, and the system is able to match at run time the appropriate learning material to each particular learner taking into account the user's interaction features. Moreover, this redundancy is not just needed for the output channel (i.e. diversity in formats for the same content) but in the input channel being able to get data from the user through different channels, e.g. mouse, keyboard, voice recognition system, etc.

The accessibility specifications in learning systems consider disabilities as the discrepancy between the user needs and the functionalities the system offers. In this sense, accessibility is the capacity that has the learning environment to adjust to the learners' needs. Therefore, the accessibility in learning environments is determined by the flexibility of the environment regarding presentation, control methods, ways of access, support to learners and the availability of alternative but equivalent contents and activities to address the different learners' needs and preferences. These needs and preferences can relate to the environment, the previous knowledge, the tools and devices or the functional diversity. An intelligent and accessible learning management system should select the appropriate contents and services and adjust the user interface so that the learners' needs and preferences are satisfied.

A multi-agent architecture has been designed to support the adaptive behaviour to the learning and special needs. It consists of a recommendation agent, a set of model agents and a modelling subsystem, following a similar architecture as the one described elsewhere [4]. Since automated responses to the accessibility needs of individual students are to be made, the system requires information about each individual, (including records on their needs, preferences, learning styles, etc.). To this, an effective way of modelling the user in terms of their access requirements is required, and there already exist specifications and standards to facilitate the definition of these models [5, 6] which have to be taken into account in the architecture described in [4].

#### 4. Conclusions and Future works

The expected result for FAA project is an Intelligent Learning Management System oriented to the personalised guidance of learners with special needs to allow their participation in the opportunities of web based education. It will offer contents, activities and service adaptation based on the users' learning needs and preferences taking into account the special needs derived from their functional diversity. The accessibility is not just a matter of contents, presentation and information access, but it is strongly related to the learning models. Therefore, accessibility has to be managed by personalizing and adapting learning materials, pedagogical models and interactions in the environment to satisfy the individual learning and special needs and preferences.

The next step is to evaluate the system with final users. Soluziona has developed a SCORM based course that will be used to validate the open, accessible and standard-based approximation to e-learning in an adaptive way of FAA by enrolling real users with functional diversity in FAA platform. Moreover, a market validation of this approach will be done in ALPE project, funded by the European Commission under the eTen program and to be started by December 2006. In this project, a set of twenty basic skills courses will be prepared to suit the pedagogical and technical needs for visually and hearing impaired and adult learners, and to deal with the localisation, linguistic and cultural requirements for the three

countries involved in the project (Spain, UK and Greece). The evaluations will take into account the different needs of blind, partially sighted, deaf and hard of hearing people who may not use written language as their first language or have problems understanding standard language. They will also consider the diversity in assistive technologies and converting tools, such as Braille display, speech output, subtitles, screen magnifications, aural presentations, symbols support integration and access to graphics. In Spain, the users for the trials will be selected among 1) the learners with disabilities enrolled at UNED who are experiencing some problems in writing reports or essays and who are likely to be in their first year of undergraduated programme, or 2) external learners with disabilities who need to improve their basic skills and enrol at UNED at different types of on-going education courses. The feedback obtained from these evaluation will be considered to improve the learning environment.

Furthermore, in October 2006 UNED and Soluziona together with other eleven partners have started the EU4ALL project [2], a European Integrated Project that aims to build an open and accessible service architecture for all to cope with the accessibility requirements in higher education institutions in Europe. The works done in FAA project as well as the experience achieved are being used as input for EU4ALL project.

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