# Interoperability between the new open e-learning platforms: an intelligent answering machine

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## Background

Nowadays, all of us know that interoperability is a very important issue in the e-learning research area, due to the importance of being able to share contents and knowledge from one e-learning platform to another. Mostly, the efforts are focussed on creating and using standards to allow the mentioned content sharing, as XML, SCORM, etc. In our organization we are also interested in another issue related with interoperability: sharing the knowledge of e-learning platforms in a transparent way, due to the fact that sometimes a student in a platform require information hosted in another platform or knowledge source. To get this goal we are involved in the creation of a new tool capable of accessing to the content of several e-learning platforms, allowing a student to use one platform to access transparently to the knowledge hosted in another platform.

The justification of this development is because in university environments, the communication between teachers and students causes, in many cases, an excessive demand on the teacher's response capacity. This demand is even stronger in Distance Education, as in the case of UNED (Spanish Distance University) where this communication is usually by email or by an e-learning platform. In this way, the usage of these technologies involves new problems that require new and innovative solutions from both pedagogical and technological points of view. Problems become more serious in the case of non-regulated education, due to the isolation level of all agents is much higher than the regulated education. In addition, the difficulty to maintain the personal communication flow between the group members makes impossible to achieve an appropriate level of monitoring of the students by the teacher.

As a consequence, UNED has developed many projects oriented to solve this problem, as PedCare in which a new methodology based on CRM (and named LRM) was created, optimizing the treatment of the information flow and communication processes between student and teachers, and monitoring and evaluating the student process itself. Thus methodology is completed with the implementation of intelligent tools based on an open and modular architecture that enables integration with most of the commercially available Learning Management Systems (LMS) offering new and complementary services that will satisfy significantly needs.

## Objectives

The main objective is to improve and optimise these relationships by means of a more efficient use of the knowledge stored in the new e-learning platforms, particularly, a student will be able to access to the knowledge of one e-learning platform from another. In order to obtain this goal, we have developed an intelligent manager capable to answer the questions of the students automatically, using the knowledge stored in e-learning platforms (course contents) as dotLRN, Moodle, WebCT; indexed in searchers as Google or Yahoo; data repositories as Wikipedia or institutional databases.

In this line of work, for instance, if a student has a question for a teacher or a tutor, he will be able to ask him via email or via an e-learning platform. The tool will receive the question, after reading the suitable inbox, it will find the most appropriate knowledge source to response, it may sometimes be an institutional database, a content searcher as Google, an e-learning platform or another kind of data repository as Wikipedia web site (figure 1). Finally the tool will obtain the most suitable response forwarding it to the student.

Figure 1: High level architecture.

In this way, the student will have freedom to decide which kind of method prefer to use to ask the

teacher, and our agent will decide the most suitable knowledge to answer him, making possible the interoperability between several e-platforms. Another possible scenario could be a student making a question to the teacher by a message in dotLRN platform, and the response will be obtained from a SCORM course hosted in Moodle. In another situation, this student would make the question via Moodle, the response would be obtained via dotLRN repository and the answer would be forwarding it by email. This number of possibilities is really very high, granting to this tool a great versatility.

## Description

In order to reach these goals, the architecture is very modular and open, allowing a high level of reusability. It has been designed using two middlewares, which provide compatibility, in one hand between the methods to send and to receive the messages: POP3 and SMTP communication standards for email, accessing to the Moodle databases, etc. And in the other hand, between the methods to access to the knowledge sources: HTTP1.1 to access to the data of the web sites as Google or Wikipedia, to access to the dotLRN databases, etc.

Consequently, to add a new input/output method or a new knowledge source for the tool, it must only be developed the middleware to interact with it, like a little "driver" who knows how to interact with both sides. In order to develop these middlewares the programmer will only create a class inheriting of an existing interface, implementing only a pair of methods, in which it is said how is the interaction.

In our architecture, this middlewares are internally designed using several interfaces (figure 2). In first place, the communication with the user is made up of two interfaces, which are called inboxInterface and outboxInterface, that have the responsibility of the communication with the user, using email, dotLRN, Moodle, WebCT, etc. To get this goal there are several classes that implement the methods of this interface, for example, dotLRNImplementation class, which connects with the dotLRN database and obtain the possible user messages to the teacher. This class will obtain the main question words thanks to a filter process to finally send them to an AnswerManager, who will be able to obtain the most suitable response. In the same way, there are implemented a moodleImplementation class, and a pop3Implementation class in order to allow the communication with Moodle and with the e-mail inbox.

In the knowledge repositories side, there can be seen another interface in charge of the communication with the knowledge sources, searcherInterface. For this interface there are a group of classes that implement it, which are called searbloxInterface and googleInterface, that know how to interact with the correspondent searchers, or dotLRN and moodleInterface that are able to obtain data from these mentioned platforms.

Figure 2: UML classes diagram.

In addition, the tool also provide a way to improve the monitoring process of the student activities, thanks to a feedback system, which allows knowing how good or bad are the answers given to the user. Every question asked a teacher is saved in a database, with a suitable valuation given by the student and by the teacher. Both valuations are very useful to improve or change the knowledge sources, simulating the real learning process.

Finally, from a business point of view, these kind of systems offer advanced added-value services to existing e-learning platforms, and due to the independence of the tools from specific technologies, it is ensured that they will cover a large potential market. All this methodology can be exploited with customers interested on improving or revitalising their actual learning processes. Possible applications are for organisations that want to improve relationship with their learners and for those that want to improve their evaluation methods of students progress or courses quality. Another potential clients are also education centres (private or public universities), public administration and organisations with authoring Virtual Campus as well as e-learning providers taking advantage of the added-value services for: improving management of communication channels with students, improving monitoring of students activities in the learning process and the evaluation process, or offering personalised learning contents and

searchers.

## Conclusions

This paper describes the main characteristics of this kind of systems, having in mind in the first place, the total integration with several knowledge sources, independently of the technology: e-learning platforms using SCORM, LOM or IMS-LD, content searchers, institutional databases, etc. In the second place, the independence of the communication methods used by the user: e-mail, e-learning platforms, etc. And in the third place, the improving of the monitoring process of the student activities, thanks to the feedback system, that allows knowing how good or bad are the answers given to the user.

The development of projects related to these technologies maintains the universities in the technological vanguard, giving rise to a new type of education based on the improvement of the attention provided by the educators, a personalization of the contents with the help of the new technologies and making possible to know the necessities of the students in every case, being able to solve the possible problems that appear in the learning process.

## Acknowledgement

The authors would like to acknowledge the Spanish Science and Education Ministry and the Spanish National Plan I+D+I 2004-2007 the support for this paper as the project TSI2005-08225-C07-03 "MOSAICLearning: Mobile and electronic learning, of open code, based on standards, secure, contextual, personalized and collaborative".

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