

AHKME

Adaptive Hypermedia Knowledge Management E-Learning System

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Abstract

The aim of AHKME is to provide students and teachers an e-learning platform with adaptive features and knowledge management facilities, where students will have quality education contents that fit their characteristics, previous knowledge and learning styles and teachers will have authoring tools to define learning methods with adaptive features along with evaluation of learning objects. AHKME main goal is to be an open tool, with independence of the knowledge domain and type of users, which differentiates between educative contents and learning processes. To accomplish this objective, and guarantee reusability and interoperability of its educative elements, the System structures its semantic elements following the IMS specifications.

Keywords

E-learning, IMS, Adaptive, Knowledge Management, Student Modelling.

1. INTRODUCTION

The main difficulty of the e-learning systems and platforms developed was to structure the content and information based on the existing pedagogical models, so that they could reach a most widely educational environment and the best teaching quality.

To solve this problem there have been developed several technology specifications and standards to structure pedagogical contents to allow the modelling and characterization of a wide range of teaching environments [Wiley03]. Between many of the existing specifications there is the Sharable Content Object Reference Model (SCORM), a project of the Advanced Distributed Learning (ADL), and the Educational Modelling Language (EML) specification. However, these have some problems, SCORM is more of a standard integrator so it has a problem of being dependent of the standards it uses [SCORM03] and it doesn't consider the student's evaluation and characterization. EML is not a standard it's a specification that became obsolete with the IMS (Instructional Management Systems) Learning Design (LD) [IMS04], however it builds the learning experience based on learning activities, it's open to any learning theory and integrates aspects like the activity sequence, user roles, characteristics and student evaluation [Koper03]. An example of the EML application is the authoring tool called Hypertext Composer (HyCo) [García01]. Finally, we have the IMS specifications, that are standards for content structuring, developed by the IMS Consortium, that began to be a set of specifications of instructional

structuring, to become the standard it is today. It includes different structuring specifications, like learning objects and metadata structuring specifications, learning units and courses design specifications, specifications for user characterization and evaluation, among others. Its main goal is to be as general as possible.

Using this specifications we present AHKME, an e-learning platform where teachers have tools to create didactic materials plus evaluate learning objects to obtain quality educational resources, and students carry out their knowledge acquisition through quality learning objects as well as the most suitable adaptive learning technique giving their characteristics, the learning activities provided, the instructional design, the learning style theory, and the learning objects' features. Through the IMS specifications standard, we can guarantee reusability and interoperability of its educative elements. So, all the information is stored in packages of XML (eXtensible Markup Language) files and their schemas.

In this paper we will present a description of the platform with its different tools, and demonstrate the innovations and advantages that it brings. Finally, we are going to present some conclusions and future work that will be done.

2. AHKME DESCRIPTION

This platform is divided into several parts: Learning object management and Learning design sub-system, Knowledge management sub-system, Adaptive sub-System and Packaging and presentation sub-system.

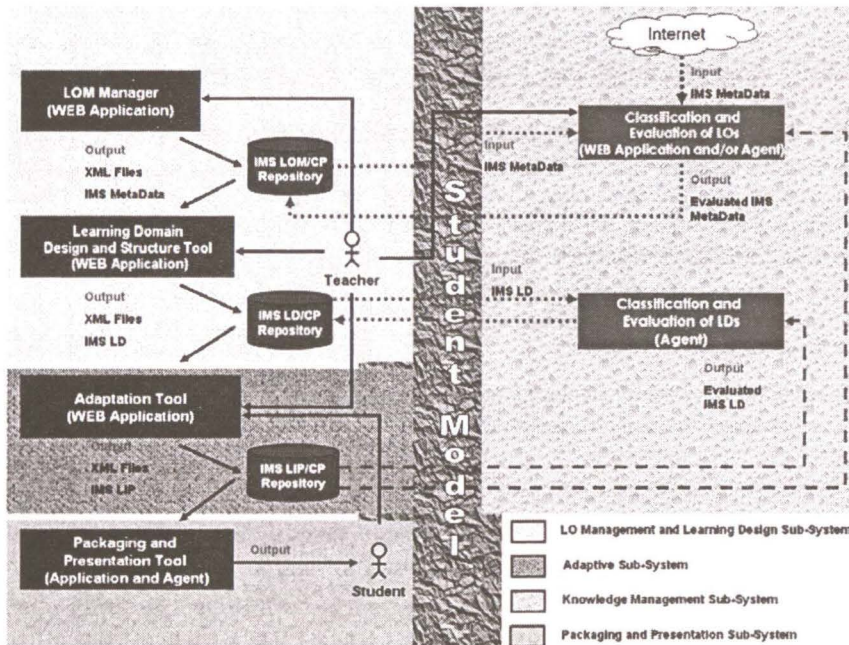


Figure 1: AHKME structure.

These sub-systems were thought this way following a certain sequence. First there's the creation of the Learning Objects (LOs), then there's the creation of the courses through Learning Design. In parallel with the LOs creation and the Learning Design there's a Knowledge management sub-system that evaluates the quality of the information provided. Then the information goes through an adaptation process based on the student's characteristics. Finally the information is presented to the student. This can be seen in Figure 1.

To implement the sub-systems mentioned before it has been developed Web applications using HTML (Hypertext Markup Language) and CSS (Cascade Style Sheets) for the design of the pages, PHP (PHP: Hypertext Pre-processor) to run in the server side for the manipulation of the XML files, JavaScript to run in the client side for the web-forms mechanisms and pop-up windows and several agents developed in .NET. These sub-systems use the XML as standard for file storage. This standard has been used because it allows the interchange of contents between different applications and platforms, facilitating the publication of contents.

2.1 Learning object management and learning design sub-system

The Learning object management allows teachers to define and create learning objects and associate its metadata. It follows the IMS LOM (Learning object management) specification that promotes the management of information as learning objects [IMS04].

The LO Management tool allows the user to edit LOs and to fill all the metadata associated to them, according to the IMS LOM specifications. Then, it passes all the information to an XML manifest, that gathers the XML files with the metadata and the resources files of the LO.

This tool facilitates the management of all the learning content, packs all these information in XML files that can

easily transport this structured information and gives the user a possibility to create some general metadata that can by default be associated to any LO.

The main advantage of using this standard is that through the association of descriptive labels to the learning resources we can index them and easily find, use and re-use them.

The Learning design has a tool where the teacher can define learning design components and their metadata, by creating, editing and structuring the courses, according to the level A of the IMS Learning design specifications, and the LO metadata that the course involves. In the process of the course creation an XML manifest is generated, that gathers the XML files with the course structure, its LOs and metadata, and all the resources files.

The Learning design in this platform provides the capability of designing units of learning that simultaneously include several roles, each of which can be played by several actors. Those roles can be learner and staff, what promotes both group and collaborative learning of many different kinds, the importance of which is increasingly recognized in both the commercial training and educational spheres [IMS04].

The advantage of using IMS LD is that the user can structure a course with metadata information in an XML file that can be reused to construct other courses and can easily transport the learning information to interact with other Learning Management Systems (LMS).

2.2 Knowledge management sub-system

The main objective of this sub-system is to guarantee quality to the information through classification and evaluation of LOs and LDs.

To classify and evaluate LOs there are being developed two different tools. One that allows teachers and experts to import, analyse, change, classify and evaluate LOs

through a Web application. This tool is being done using *JAVA* interacting with *XML* files. The other tool is an agent that will import LOs, evaluate and classify the LOs automatically based on previous classifications. To make this evaluation, the educational characteristics of the LOs are analysed and then it's calculated the final classification based on a metric created to compare the different values of the characteristics. This is being done using *NET* and *XML* files. All the LOs, in this sub-system, are standardized following a knowledge model that was developed for this purpose [Morales04].

To evaluate the LDs it's being developed an agent to analyse the structure and contents of the LDs in order to give quality to the courses.

This system takes into account the students' and teachers' interests by receiving the feedback from the Adaptive sub-system.

2.3 Adaptive sub-system

The Adaptive sub-system determines the most adequate learning method according to the students' characteristics, the learning design and the interaction with the student. It also establishes the best adaptive characteristics given certain student learning method, resources and assessments. For each student it stores its learning style, characteristics, current and previous knowledge.

This sub-system has a tool that proposes that the user should fill some inquiry forms, based on the data and metadata about the learner defined on the IMS Learning Information Package (LIP) specification that is based on a data model that describes the characteristics (like language, previous knowledge about subject, etc) of a learner needed for the general purposes of recording and managing learning-related history, goals, and accomplishments [IMS04]. Based on these inquiry results an agent parameterizes these in rules of adaptation and automatically generate adaptation models that reflect in the presentation tool. This information is stored on XML files.

The advantage of these features is that, the tool based the presentation of the learning content on the student characteristics. So, a student model is created to permit that the learning interface adapts to the student profile.

2.4 Packaging and presentation sub-system

It presents educational contents to each student according the adaptive meta-model. It is being developed a feature to record the student's interaction in order to give feedback to the other models.

It follows the IMS content packaging (CP) specification that allows authors to build online learning content, administrators to manage and distribute content and learners to interact with and learn from the content, creating a form to enable efficient aggregation, distribution, management, and deployment.

This sub-system has a tool where the user can create a content interchange package with all the course informa-

tion, based on the IMS CP specifications. Through this specification it can be distinguished three different types of user profiles: the teacher (author) who creates content interchange packages to distribute, the administrator who interacts with LMS, that stores and manages data content, and the learner (student) who interacts and learns with the system [IMS04].

The presentation tool is a web application that automatically publishes the content course pages according to some template pages and to the adaptation model.

3. CONCLUSION AND FUTURE WORK

The main advantages of the AHKME platform are its adaptive features based on student characteristics, its knowledge management capabilities that provide quality information for both, learners and teachers, as well as the interoperability and portability of their learning components by means of the different IMS specifications used.

Through the IMS specifications used, this platform has the capability of designing units of learning that simultaneously include several roles. It thus supports both group and collaborative learning of many different kinds.

Being a general purpose platform it can be applied to several kinds of subjects, students and learning strategies, in both the commercial training and educational spheres.

Our future work is to evolve the learning design tool to the level B of the IMS LD specifications that provides the inclusions of generic properties and conditions. In the adaptation engine, it will be added some features, according to the IMS Question and Test Interoperability and Enterprise specifications. Regarding the Knowledge management sub-system it will be added quality to the analysis of the LD, by developing a knowledge model and evaluation tool for this purpose.

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