ABSTRACT

Virtual Learning Environments have been the center of attention in the last few decades and help educators tremendously with providing students with educational resources. Since artificial intelligence was used for educational proposes, learning management system developers showed much interest in making their products smarter and more intelligent. Nevertheless, the questions of what an intelligent learning management system (ILSM) is and which tools and features are needed to make such system intelligent, are not clearly answered, therefore educational institutes do not have a proper tool to decide upon the degree of intelligence they need for their LMSs. This paper proposes a prevalent, thorough definition of “Intelligent Learning Management Systems”, and the design of a fuzzy model to measure the intelligence of these systems. In order to devise a comprehensive definition of an Intelligent Learning Management System, experts from around the world were consulted. Following that, different proposed Intelligent Learning Management Systems were studied, and forty-one features and tools were found and analyzed. After the analysis, experts’ opinions were taken into account to rank these features. The paper proposes thirteen most significant features and tools as criteria to be used in fuzzy analytic hierarchy process (AHP) as a fuzzy model to measure the intelligence of Learning Management System.

Keywords: Adaptation, Intelligent Learning Management System (ILSM), Multi Criteria Decision Making, Personalization, Recommendation Systems

1. INTRODUCTION

When analyzing an Intelligent Learning Management System (ILMS), the most crucial issue is to be sure that there is a common understanding and definition of such a system. Since the first proposed Intelligent Learning Management System, there is not a clear definition of what an Intelligent Learning Management System would be, and what the main difference between
and iLMS and Learning Management System is. Many researchers or education technology companies have named their Learning Management Systems “Intelligent” but determining how smart these systems are, and which features make them smart is the main aim of this contribution.

This paper aims to propose a prevalent and thorough definition of an Intelligent Learning Management System based on the definition and understanding of experts in e-learning, learning technologies and Internet technologies. Furthermore, other than a commonly accepted notion knowing its main features and tools is also crucial. All different Intelligent Learning Management Systems currently available were studied, and forty-one tools and features were distinguished within the research survey while some of them were just the same in function but have different names. Among them, experts identified thirteen most important features and tools as the key criteria, which every Intelligent Learning Management System should be equipped with. Once those criteria were defined, we asked the experts of Intelligent Learning Management System, Education Technology and Internet Technology to compare those measurements by a nine-point ratio measurement scale developed by Saaty (2008). Finally, a fuzzy model was proposed to measure the degree of intelligence of any Intelligent Learning Management System based on multi criteria decision making (MCDM). The paper proposed that by following this model, which is a fuzzy analytic hierarchy process (AHP), prospective clients would be able to rank their choices and measure their intelligence. Saaty (2008) defines the Analytic Hierarchy Process (AHP) as “a theory of measurement through pairwise comparisons and relies on the judgments of experts to derive priority scales. It is these scales that measure intangibles in relative terms.”

In the following sections, we will review the current proposed Intelligent Learning Management Systems and based on experts’ opinions a new definition will be proposed. Finally, the steps of designing a fuzzy model to measure the intelligence of Learning Management System will be explained.

2. BACKGROUND

2.1. Towards a Literature Framework on ILMS

In 1996, Joseph Beck and colleagues (Beck et al., 1996) published a paper on the Applications of Artificial Intelligence (AI) in Education. In this research, they introduced the construction of Intelligent Tutoring Systems, their parts and applications. Since then many researchers published papers about web based information systems, applications of the internet in learning, and intelligent tutoring systems. Some of these papers introduced new frameworks, ontologies, learning systems, tools and characteristics.

Between 1996 and 2009, the term ‘Intelligent Learning Management Systems (ILMS)’ started to appear in research papers and different Intelligent Learning Systems, tools and features were introduced. Rafael Calvo (2003) discussed different user scenarios for ILMS, which focused on Machine Learning (ML) scenarios and proposed a software engineering framework for the design and implementation of an ILMS. The three scenarios he analyzed were Content Management and Tagging, Recommendation Systems, and Sequencing of learning objects. He also discussed challenges of ILMS and software engineering issues. Sanchez et al. (2003, p.2) projected the ‘EUME’ system that aimed to solve the resource management problem in the context of collaborative learning. For the development of task models, they used the CommonKADS methodology. They also introduced software architecture and a system implementation in their research paper. Peter Moodie and Patrick Kunz (2003) proposed a recipe for the construction of iLMS, defined, and combined the Educational Activity Toolset, the Learning Object Library, the Adaptive Intelligent Agent and the Learning Community Agents, together in their iLMS.

In a similar work, Kao et al. (2005) developed a system “based on a decomposition
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