

# Enhanced Learning Management System with Semantic Technologies and Inferences

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## Abstract

The extensive implementation of Learning Management System (LMS) in the higher education institutions is widely accepted as a learning tool. Basically, LMS are easy to use and manage by that reason they are considered as best for the enhanced teaching and learning process. Traditional LMS are failed in providing the better services, does not support personalization and lack of interoperability between the users and machines. So, there is a huge demand for Enhanced Learning Management Systems (ELMS) to services provide the improvised with better interoperability. In terms of semantic web, inference engines are identified as the better mechanisms for interoperability. In this paper, we propose a framework for Enhanced Learning Management Systems (ELMS) with support of asemantic web technologies and inference engine.

## 1. Introduction

In recent years, e-learning tools have become very popular in all the fields of engineering, technology, life sciences and social sciences etc. Due to the tremendous growth in the information resources over the internet different web technologies offer abundant solutions for accessing, analyzing, sharing and displaying the learning content and make it available for gain some useful knowledge.

Learning Management Systems (LMS) have been developed to create such knowledgeable environment to provide the specific services like planning, managing and sharing all the learning processes within an organization which includes online, virtual classroom and distance learning. These services are best utilized for better understanding of the concepts and to enhance the learning capabilities [2]. Interoperability is required to construct the knowledge-intensive, open and accessible learning services [3,4].

Traditional LMS are unable to provide the better services and also not interoperable always they work in a closed system. Some LMS follows standard

LOM and most of them develop and operate on their own frameworks for content learning. The interoperability issues like student, course, teacher and grades will affect the flexibility of the teaching-learning process if they were not related internally in a proper manner. Most of the LMS will not allow adding certain new features to enhance the learning process by simply stick to their basic structure. So, by the above observations there is a huge demand for the novel LMS which could able to support add-on services with great interoperability.

Semantic Web technologies have been popularized by their enhanced services like Ontologies, Resource Description Frameworks(RDF) and interoperable inference engines. Semantic e-learning have been developed as a vertical of Semantic Web technologies to support existing content based learning services to semantic-aware and personalized learning services [5-7]. Ontology-based technologies and intelligent agents are intended to support semantic information processing on Semantic web.

Semantic web technologies and inference engines are capable to provide the required computational semantics and interoperability for automation of the tasks in LMS. The main objective of this research work is to propose a novel framework for enhancing the semantic web features for Learning Management Systems with the support of inference engines.

## 2. Related Works

Yen-Chun Jim Wu (2017) E-learning innovation instruments are by and large progressively used to encourage instructing in instructive organizations. This investigation inspected the mentalities of understudies and educators towards utilizing e-learning instruments in administration instruction. Instantly subsequent to leading workshops that presented 11 e-learning devices utilized as a part of classroom settings, surveys were managed to understudies and teachers from three state funded colleges in Taiwan. Reactions of 242 understudies and 46 educators with respect to 5 spaces of e-

learning apparatuses - input, classroom versatility, distributing, cooperation, and online networking - were dissected to explore their disposition towards the utilization of e-learning. The outcomes uncovered that understudies apparent the e-learning instruments of joint effort and online networking to be useful in learning and in expanding their future work; also, the instructors observed these e-learning devices to be helpful.

Cally Guerin (2017) An 'information society' depends on a workforce with abnormal state abilities in E-learning innovation. Proceeding with advancement of e-gaining will emerge incompletely from examine attempted by doctoral graduates. Be that as it may, contrasted with other related orders, e-learning has moderately couple of understudies taking up doctoral examinations. This investigation investigates a portion of the apparent hindrances to undertaking doctoral examinations in e-learning in three Australian colleges.

Jeretta Horn Nord (2017) Information and communications technologies (e-learning) provide global connections, communication, and empowerment. Empowerment drives social and economic development. This study, part of an ongoing global study, investigated the use of social technologies including the purposes used and benefits realized in Italy as a means of empowerment for women.

MajaSeric (2016) The objective of this examination is to inspect customers' view of the most recent innovation arrangements and promoting interchanges inside the lodging setting in two Mediterranean nations - Croatia and Italy. Specifically, inn visitors of four-and five-star lodgings situated in these nations took an interest in the exploration. Right off the bat, visitor impression of cutting edge E-learning innovation and correspondence consistency are dissected and thought about in Croatian and Italian inns

Edward M. Roche (2016) From the start of the PC age in 1936, e-learning innovation has been a power for good. Business limits were expanded. Systems enabled the multinational venture to work all inclusive. The Internet enhanced logical cooperation, filled web based business, and associated seven billion people the world over with Massive Online Open Courses (MOOC) and gaming. However, there is a dull side to e-learning. Work is obliterated. Computerized reasoning (AI) is supplanting people in clerical employments and being sent in fighting.

Hong Y. Stop (2015) User information has been a vital wellspring of novel item improvement and advancement, yet assembling exact client learning has been tedious and troublesome in light of the fact that client learning is implicit and internationally scattered. Be that as it may, e-learning innovation can extend the limits by making client information less demanding and more affordable to get to. Structures

and associations are developing to play out the undertaking of client data gathering.

Allison M. Meder (2015) Families of youngsters with correspondence handicaps were overviewed to investigate needs and inclinations in respect to portable media innovation, including iPads, as a type of augmentative and elective correspondence (AAC). The families reviewed announced needing data and support from experts, including discourse dialect pathologists (SLPs), who are proficient about AAC.

Jimmy K.N. Macharia (2014) Previous investigations have demonstrated that in the advanced education area, e-learning innovation gives the driving force to transform from the conventional ideas of instructing and learning, and prime inspiration driving the change in academic and expert exercises. This underscores the significance of e-learning in advanced education in accomplishing the objective of giving adaptable instructing and learning conditions.

Molly Van Niekerk (2014) The requests of the twenty-first century require powerful and maintainable utilization of E-learning Technologies in training. Different e-learning techniques and activities crosswise over South Africa have not brought about framework wide, reasonable e-learning joining in schools. In spite of the fact that the parts of principals are recognized in instructive administration, the inquiry remains how principals impact instructors' successful and feasible mix of e-learning through educator proficient advancement (TPD).

Daniel Silander (2013) The beginning of the 21st century carried with it acknowledgment of the test introduced by fear based oppression. To address this test, there has been a fortification of national and multinational security endeavors. The scholarly groups over the Atlantic have considered the requirement for research and guideline in a Homeland Security (HS) based educational programs

Rebeca Jimenez-Rodriguez (2012) Most of the examinations on the outcomes of e-learning innovation have been centered on US total information. Rather than these examinations, this investigation observationally surveys the mechanical impact of e-learning venture on three key factors - genuine yield, work, and work efficiency - in some European Union-15 (EU-15) nations and the USA utilizing board vector auto regression models.

In general, most of the existing LMS adaptation process are made from three generic models (EvgenyKnutov, 2012). First is the domain model which specifies what to be adapted. Second is the media space model where indicates what parameters can be adapted. Lastly, is the adaptation model itself where it specifies how one can perform the adaptation process.

### 3. Proposed Mechanisms

This research proposes a systematic and empirical analysis to consider the impact of e-Learning techniques on the education domain. A research framework is the process flow of mechanisms & procedure for extracting the needed information.

### 3.1. Standard LMS

The architecture shown in figure.1 represents the standard framework of Learning Management Systems.

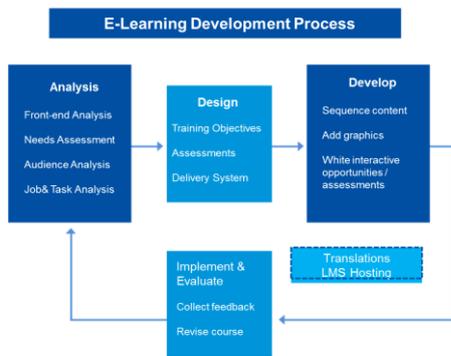


Fig.1. Standard Architecture of Learning Management Systems

The standard LMS architecture explains only about the 4 Phases of e-Learning development process.

- Analysis
- Design
- Develop
- Implement & Evaluate

#### Analysis

This is the first step of the eLearning development process. At this stage, we need to analyze the learning content, learning objectives and the profile of the target audience. The type of job or tasks that the participants are expected to accomplish after taking the course is also need to be considered.

#### Design

Design of a document incorporates the recommendations of the learning management team. Requirements of the stakeholders, training objectives and assessments required and design challenges are taken into account at this stage. This document also specifies the instructional, visual and audio elements to be included in the course curriculum.

#### Develop

The specifications in the design document are executed by incorporating the content, visuals and assessments into a storyboard. The page layout, graphic user interface and multimedia elements are all finalized at this stage and incorporated into the course.

#### Implement & Evaluate

The model built in this phase will be evaluated by releasing this model in to the market for beta testing and collecting customer feedback. After that the required revisions will be done on the actual development.

### 3.2. Proposed Framework

This phase builds a framework as shown in fig.2, enhances the functionalities of standard LMS with the support of semantic web technologies and inference engine.

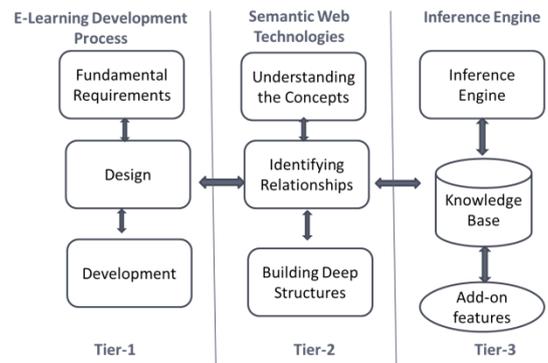


Fig.2. Proposed framework of Enhanced Learning Management System

The proposed framework of Enhanced Learning Management System (ELMS) is a 3-Tiered architecture. Each tier describes its own functionality.

#### Tier-1: E-Learning Development Process

#### Tier-2: Semantic Web Technologies

#### Tier-3: Inference Engine

#### E-Learning Development:

This phase describes about the initial steps required to build any standard LMS which include collection of fundamental requirements like concepts, constraints, standards and policies etc. Later, we need a basic design for the categorization of the collected requirements. Finally, this phase develops an enhanced learning process which could able to add new features periodically and always interoperable.

#### Semantic Web Technologies:

The main theme of this module is to construct the underlying deep structures of the given concepts by understanding their semantic properties and by identifying their internal relationships.

**Inference Engine:**

Inference Engine is a “computer program that tries to derive answers from a knowledge base and automates the pre-defined functionalities in a structured manner”.

It works in three steps.

1. Interpreter: It applies fundamental rules to execute the given list of activities.
2. Scheduler: It maintains control over the framework by estimating the effects of applying inference rules in terms of concept priorities.
3. Consistency Enforcer: It always maintains a consistent representation to generate the desired solution.

**Knowledgebase:**

Knowledgebase works like background knowledge to be used to optimize the content search process. It stores the most relevant information gathered from different sources. Based on the customer requirements we can have a chance to add new features and update the knowledgebase.

**4. Experimental Results:**

The proposed framework used the standard string matching algorithms like Brute-Force, Knuth-Morris-Pratt and Boyer-Moore algorithms and analyses their performance for searching a sting(s) of different lengths as shown in Table-1.

These algorithms help the knowledge base to update the information periodically and also having a chance to add new learning features. Hence, with the support of this knowledgebase; inference engine will automate the entire process.

Table-1: Search time for different algorithms

Searching String Length (L)	Time (seconds)		
	BF	KMP	BM
L=3	0.0122	0.0106	0.042
L=6	0.0121	0.0104	0.0248
L=9	0.0084	0.0132	0.0182
L=12	0.0083	0.0148	0.0163
L=15	0.0072	0.0132	0.0142

The performance calculations of each string matching algorithm are shown in fig.3.

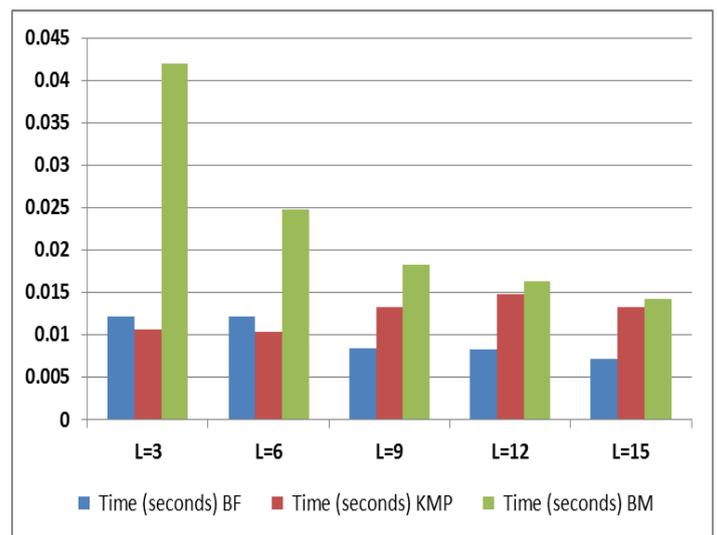


Fig.3. Performance Evaluations of different algorithms

If we observe clearly, the above results stating that brute-force approach is showing average performance and it can be used efficiently for string searching.

**5. Conclusion:**

This paper aims to build an Enhanced Learning Management System (ELMS) to overcome the limitations of traditional leaning systems. LMS are easy to use and manage by that reason they are considered as best for the enhanced teaching and learning process. Traditional LMS are failed in providing the better services, does not support personalization and lack of interoperability between the users and machines. So, there is a huge demand for Enhanced Learning Management Systems (ELMS) to provide the improvised services with better interoperability. In terms of semantic web, inference engines are identified as the better mechanisms for interoperability. Finally, we propose a framework for Enhanced Learning Management Systems (ELMS) with support of a sematic web technologies and inference engine.

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