IDENTIFICATION OF ONTOLOGY BASED LEARNING OBJECT USING INSTRUCTIONAL DESIGN

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ABSTRACT
The success of e-Learning course material [12,18] is based on the pedagogical principles. Few of the principles are curriculum design with specific objectives, consideration of different social groups, learner engagement, ease of use, and ensure the acquisition of learning objectives with formative and summative assessment. But due to over-focusing on technology and dissemination of content, the educational pedagogy is less considered which insists on learner-centric guidelines [1,13,14] for developing Learning Content Management System (LCMS). The characteristics of semantic web is based on ontologies; which enable the organization of learning materials around small pieces of semantically enriched learning objects (LO). The research aims on ontology based approach of identifying such learning objects; which combines educational pedagogy and information technology through Instructional Design (ID).

Keywords: LCMS, Semantic Web, Ontology, Protégé, OWL.

1 INTRODUCTION
The evolution in the field of Information Technology made a frequent revision on implementation of eLearning with the new innovations. The technology should be chosen which promises the promotion of personalization, distribution, creation and reusability of LO [10,15]. XML is the most promising technology [16] to employ the specific parts of learning objects for the adaptation of the user centric cognitive styles with XSLT style sheets following the rule-based design pattern approach. However there is a lack of formal semantics inherent in XML to achieve semantic interoperability [4,5]. OWL (web ontology language), the semantic web technologies are promising solution to give an explicit definition of conceptualization of a specified domain and assembling learning objects [2,17,20]. The ontology integrated with the learner profile generates better results in an e-Learning LCMS System [8] and could be used in combination with multi-agent technologies for deriving personalized learning paths. The identification of LO in eLearning systems is developed using Protégé; which is an open source software that provides an extensible infrastructure and allows the easy construction of domain ontology.

The paper is structured as follows: Section 2 describes the application of ID; Section 3 describes example and set of rules for dynamically generating personalized associations.

2 APPLICATION OF ID PRINCIPLES
Instructional Design (ID) is defined as a systematic development of instructional content using learning and instructional theories to ensure the quality of education [12, 19]. It motivates self-paced learning among students. The major classes to be integrated through ID in the fields of Education Pedagogy and Information Technology are presented in Fig. 1.

Figure 1: Conceptual Class representation

The simple structure of LCMS in Fig. 2 can be made interactive with the chosen learning activities. This insists the suitable mapping of Education
Pedagogy and Information Technology through one of the simplest ID model ADDIE (Analysis, Design, Develop, Implement and Evaluate) and generated in Fig. 3 using OntoViz tool. It is useful to enhance the lesson content with additional learning objects to promote positive learning experience by learners. The phases of ADDIE are processed iteratively to define the Instructional Design Template for the course content preparation.

The learning style is carefully mapped with other classes in Fig. 4. It is true from the observation that the revised conceptual model of LCMS (Fig. 5) expanded with the identified learning activities in the instructional process aimed on a Learner-centric approach. However, elearning is still facing a problem of one-size-fits-all philosophy, a resulting cognitive overload, and the lack of personalization.

The defined LCMS structure promotes only the static learning; does not change according to learners’ models. The whole lesson or course runs as single file in the form of flash tutorial; mpeg movie or in specified file format and considered as a single Learning Object (LO).

Figure 2: Structure of LCMS

Figure 3: ADDIE maps Education Pedagogy and Information Technology
The well-formed structure of Elearning with the multimedia design will be heightened when it is dynamically personalized to individual learners. The learners learning experience will be natural/on the fly based on their learning experience [11]. The dynamic learning insists the construction of dynamic LO from loosely-bound content objects and has the flexibility to allow for run-time content organizing. Then it is possible to include examples/illustrations based on learners' profile. Some of the issues [3] to be addressed on achieving such a personalized learning are: How to integrate specific parts of a learning object, rather than learning object as a whole?: How to personalize content of same learning object according to learners' models?: and so on.

The key characteristic of Semantic Web architecture promises a powerful approach to satisfy the Elearning requirements. Learning material is semantically annotated and combined according to learner preference [6]. The process is based on semantic querying and navigation through learning materials, enabled by the ontological background [7].

3 DYNAMIC LO

The personalization of learning system should be made to support individual learner. There will be an initial assessment made to identify the learner's category and stored in learner's profile as shown in Table 1. The profile formed on first time login, and based on the query answered by the learner can be dynamically changed over a period of time; because of continuous monitoring and updated. The first stage of learner profile concerns the learning domain, where all the learners are default identified as Behavior learner. The learning style of media presentation is considered in the next stage. The third stage highlights the learner skill set. It is identified and updated dynamically based on different assessment (prerequisite, self-check exercise, criterion-referenced exercises, Assignment) at various levels. The stages of semantic decisions are assessed with more emphasis on learning theory and skill matrix.

The dynamic content page is constructed with the set of minimum LO for different kind of learners as given in Fig. 6 with the code snippet displayed in Fig 7. More additional examples should be added dynamically for learners with low skill based on learner performance and feedback [9]. The sample reasoning rules in Table 2, to reason over the distributed information sources. The personalized navigation of dynamic page can be achieved with web services by invoking the web method. The
pedagogical semantic agents will be used to gather information of learner profile and group the related learning objects. The dynamic activation of web link is achieved in .Net platform using web services. The code snippet of ActivateURL method is shown in Fig. 8. The overall framework of sequencing learner adaptation is derived in Fig. 9.

**Table 1: The learning Characteristics of Learner**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Domain</td>
<td>Beh: Behavior [Learning Objective, Prerequisite, Content, Example, Hands On, Self Check Exercise, Summary]</td>
</tr>
<tr>
<td>Cog: Cognitive [View and Build, Apply and Learn, Case Study, Group Discussion, Criterion Ref. Exercise, Lab Exercises]</td>
<td></td>
</tr>
<tr>
<td>Con: Constructive: [Do it Yourself, Explore It, Role Play, Simulation, Research]</td>
<td></td>
</tr>
<tr>
<td>Learning style</td>
<td>Media Preference A:Audio, V:Video, T:Text, P:Picture</td>
</tr>
<tr>
<td>M:Animation</td>
<td></td>
</tr>
<tr>
<td>Skill Matrix</td>
<td>Low, Medium, High</td>
</tr>
</tbody>
</table>

**Table 2: Reasoning Rules**

<table>
<thead>
<tr>
<th>Learner Type</th>
<th>Bundled Learning Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior</td>
<td>has LO1 and LO2 and LO3 and LO4 and LO5 and LO6 and LO7</td>
</tr>
<tr>
<td>Cognitive</td>
<td>has Behavior and LO6a</td>
</tr>
<tr>
<td>Constructive</td>
<td>has Cognitive and LO6b</td>
</tr>
</tbody>
</table>

**Figure 6: Learning Objects Based on Learner**

**Figure 7: Code snippet of learning sequence**

```csharp
Public Function ActivateWebSiteUrl(siteString As String) As String
    Dim buf As String = siteString
    Dim patternSite As String = "w\[w+\\/w+\\/w+\\/w+\\/w+\\/w+\\/\\"]\"
    Dim re As Regex = New Regex(patternSite)
    If re.IsMatch(buf) Then
        buf = re.Replace(buf, AddressOf WebSite.MatchEvaluator)
    End If
    Return buf
End Function
```

**Figure 8: Code snippet of ActivateURL web method**

**Figure 9: Sequence of Personalization (UML Diagram)**
4 CONCLUSION

In this paper, a conceptual framework of integrating education pedagogy and information technology through ID model is adapted. The primary aim of this study is to minimize the drop-out rate of elearning and promote the personalization. Further investigations will concentrate on multidimensional learning profile, and reasoning rules for more complex situations.

5 REFERENCES

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