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### Ontology for Learning object Metadata to make contextual search in E-library

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**Abstract:** In this paper, E-library is viewed as a recommender system for the e-content which is authored and published legally by an individual or many. As the size of the web is increasing tremendously, there is a big challenge in front of the service providers to attract and satisfy the learner, by providing him with search results which is based on his current choice and competency. Using ontologies and semantic web in E-library, we are able to standardized the specification for a given domain knowledge, which in return gives a clear view of the content and others features of the learning material. This extracted information can be shared between learners to provide user oriented and personalized search to the Learner . Education domain can use semantic web for ontology representation and its search mechanism for learning object. There are various standards for learning object like IEEE LOM, Dublin Core etc which are useful for data representation. But standards only describes its representation and do not have well defined ontologies which hinders its adoption for Semantic web. Therefore it is required to develop ontologies for Learning Object. It is also necessary that they should be accepted by communities to provide the semantics for the semantic web. The paper proposes the concept of developing of ontology for the standards, so that it can be used by E-learning providers to adopt semantic web and in return it will help in context of Collaborative Learning.

**Keywords:** E-library, Semantic search, Learning Object, Ontology, Content filtration, Collaborative Filtration

#### 1. INTRODUCTION

The true power of E-library is its ability to bring the right information to the right people at the right time [1] [2]. As the technology is advancing and worldwide content is condensing into WEB, the expectation of the learner is increasing. With on-time delivery of the content, they demand for good content too. Now they require learner focused data too. The sole criterion in front of E-library is not just, to deliver the E-contents but also rich and user oriented content.

It has been defined that amount of stored information in the web doubles every 2.8 years [2]. So for learner, problem is no longer that needed information does not exist but it is that specific information is difficult or sometimes impossible to locate in the vast network of technology in which it is stored. It is therefore a major

challenge in front of successful E-library to convert wide distributed information into a well defined meaning that is understandable for different learners depending upon their competency, interest etc.

All E-content publishers follow different standards for their content presentation, this hampers the integration of information across websites and therefore, learner has to himself integrate the results. Therefore, there is a sincere requirement of a E-library which will be able to provide a standard platform to all E-content providers to create a repository of their data and further it can be accessed according to individual needs of the learner.

## **2. BACKGROUND**

### **2.1. Ontology and E-library**

An Ontology is a formal, explicit specification of a shared conceptualization[3]. Ontologies are the formal structures that provide a shared understanding of a certain domain. They represent the semantics of a domain explicitly, enabling intelligent access to information[4]. This paper utilized the Ontology for content object description and user profiling and later it is used to provide hybrid(both content and collaborative) filtering to provide user with the targeted user oriented search results. The Ontology word is quite prevalent with E-library. It can be used in e-library in many ways[4]:

- a) Representing Domain knowledge.
- b) Providing metadata for key concepts and entities in the learning domain.
- c) Allows richer description and retrieval of learning content.
- d) facilitate exchange and sharing of learning content.
- e) Personalizing and recommending learning content.
- f) Designing curriculum and assessment of Learning

An Ontology describes the categories of objects described in a body of data and the relationship between those objects and the relationships between those categories". In doing so, an ontology describes those objects and the relationship between those categories. Following are the benefits of Ontology Development:

- a) Ontological analysis clarifies the structure of knowledge. Ontology is the heart of any system of knowledge representation for that domain.
- b) Ontology enables knowledge sharing.
- c) Ontology captures the intrinsic conceptual structure of the domain.
- d) Ontology facilitates sharing and reusability of knowledge. It promotes communication and collaboration and delivers a knowledge rich system.[3]

## **3. ARCHITECTURE OF THE FRAMEWORK**

The paper is utilizing all the benefits of ontology to improve the search in E-library. The E-library described acts as a common platform which takes the data from different e-content providers or it web crawler surfs the web at the background and find out the useful resources for making repository, data rich and updated. In case the content is submitted by the authorized person himself, the registration module registers the provider and gets all the information from him, about him and the e-content in accordance with the ontology explained later in this paper. If data is coming from the crawler, then it is mapped with the existing conceptualization and saved in the repository. In case, the provider or the crawler has some new parameter to conceptualization the learning object, the ontology is updated to make identification of the learning object in more detailed manner.

### 3.1. Ontology Mapper

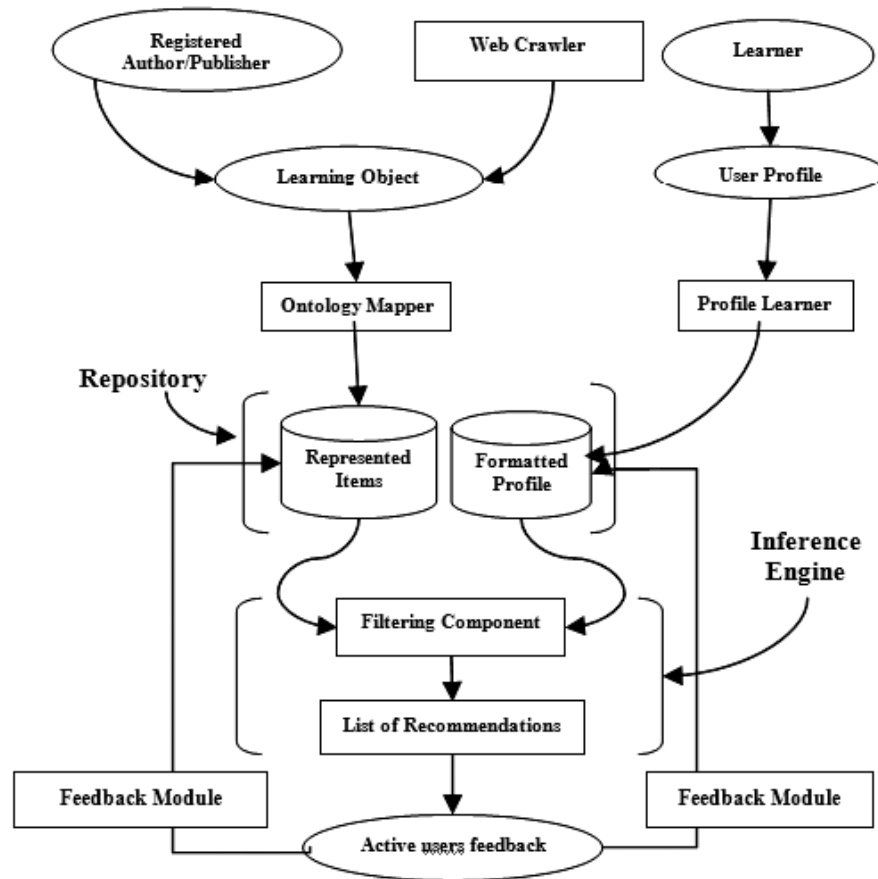


Figure 1: Components of the E-library with filtration module

The system is composed of following components shown in fig1:

- a) Front End
  - b) Query processor/Inference Engine
  - c) Ontology Mapper
  - d) Repository
  - e) Web Crawler.
- a) Front End: It is the interface provided to the learner for interacting with the system.(Request / Response)
  - b) Query processor: Once the request is thrown by the learner, the query processor process the request in order to infer the actual requirement of the learner. Better is the inference, better will be the results given by ontology mapper.
  - c) Ontology mapper: When the system has simplified and tokenize the request, the ontology mapper maps it with the repository. Similarity function is calculated with the each content and results are shown.
  - d) Repository: It is the database and main backbone of the application.
  - e) Web crawler: This module prevents the application from getting restricted to the only those items which are registered, as e-library should be updated and should contain all the latest material. In case, articles and manuscripts are not registered, the web crawler can search them and guide the learner for the same.

### 3.1.1. Filtration of the Results

Above are the different components of the proposed application. But still, the heart and the core of the working of the application lies in the way, we are able to describe or conceptualize the e-content. The ontology mapper will be able to find the perfect match for the learner, only if the content is well explained in the repository. Therefore, a detailed conceptualization is required.

A well defined Ontology will help to provide following filtration in the results:

- a. Content filtration
- b. Collaborative filtration.

*Content Filtration:* The Ontology will help to describe the learning Object and later by matching the specification mentioned in the query, the results will be filtered out. This type of refining the results is known as content filtration, as the content of the request and metadata is utilized to provide to filter out the results.

*Collaborative Filtration:* Many at times, situation may arise that the results after the content filtration will also be in huge number. In such cases, to order the results in the best possible manner, the ontology helps in providing parameters like “rating” parameter. This parameter in the conceptualization gets its initial value from the expert registering it on the website or the subject experts. But this value is dynamic and keeps on changing with the feedbacks of the learners. This parameter also helps in judging the learners of common choice and later can help in ranking the results according to the user similarity approach.

### 3.2. Conceptualization of the Learning Object

Each Learning Object in the repository is described using the following conceptualization fig3. It is composed of fields like ID, Title, ISBN, author, publishers etc Fields like review, rating , no of views helps in providing the

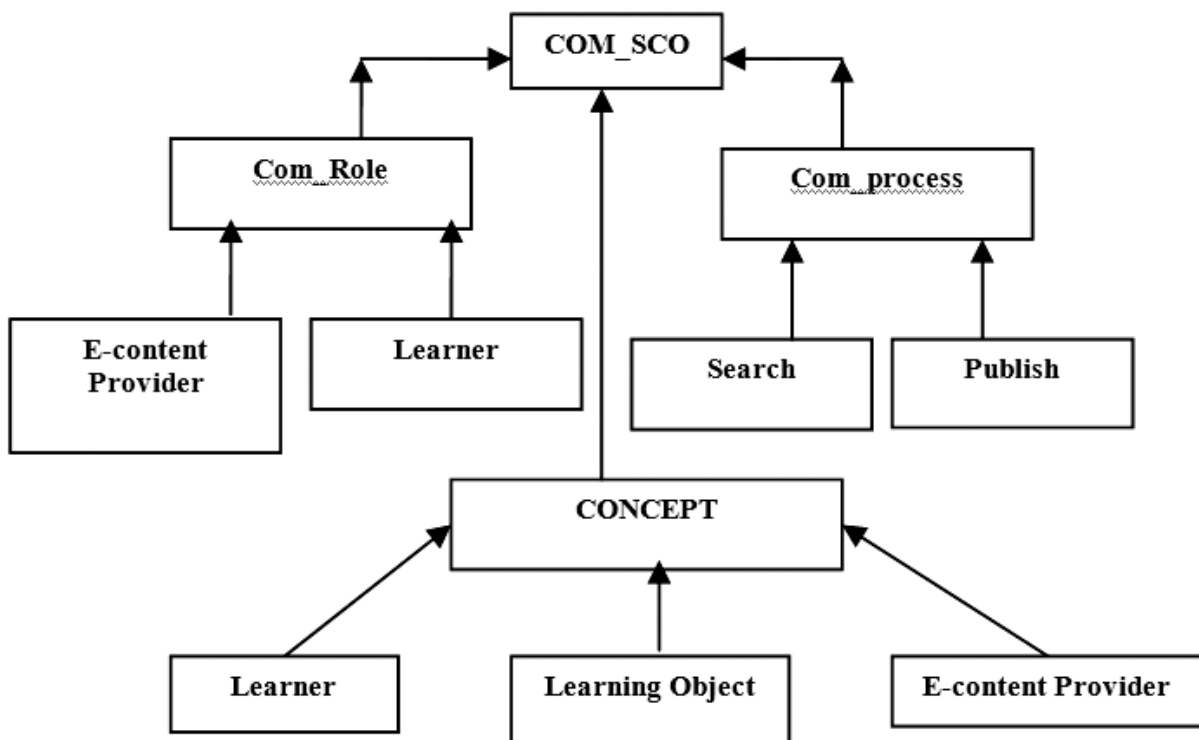
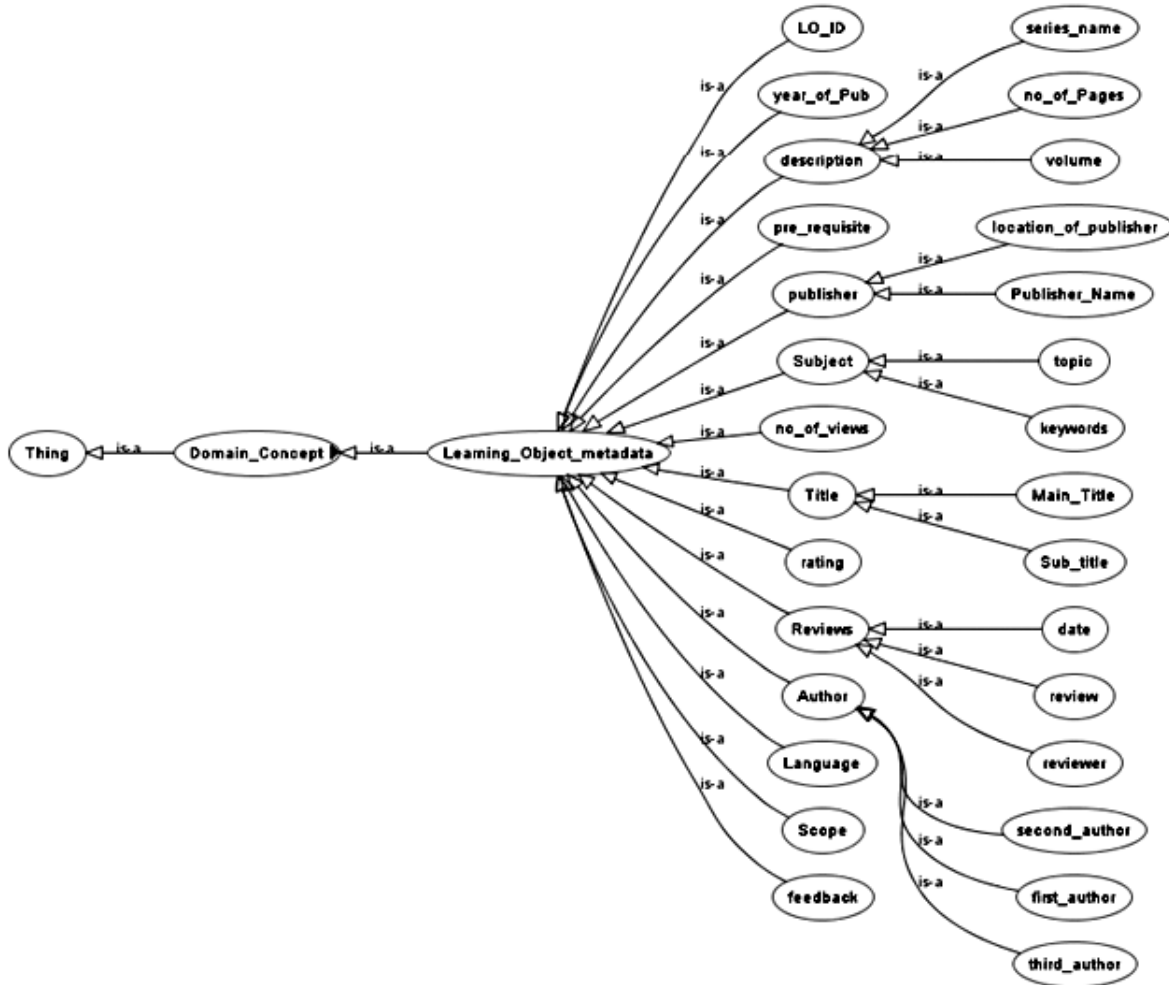


Figure 2 Proposed Ontology for the E-library

ranking of the similar references. Similar to learners, similarity between the learning objects can be also be calculated and used for recommendations.

The ontology described below for the learning object is developed using Protege4.5[5][6][7].



**Figure 3: Conceptualization of the Learning Object**

### **3.3. Working of the proposed system**

The working of the system is composed of shown in fig4:

- a) Interaction with the Learner
- b) Interaction with the Registered E-content provider
- c) Interaction with Crawler
- d) Working of Ontology Mapper/ Inference Engine

a) Interaction with the learner:

The system interacts with the learner in three ways:

- i) Registration of the Learner

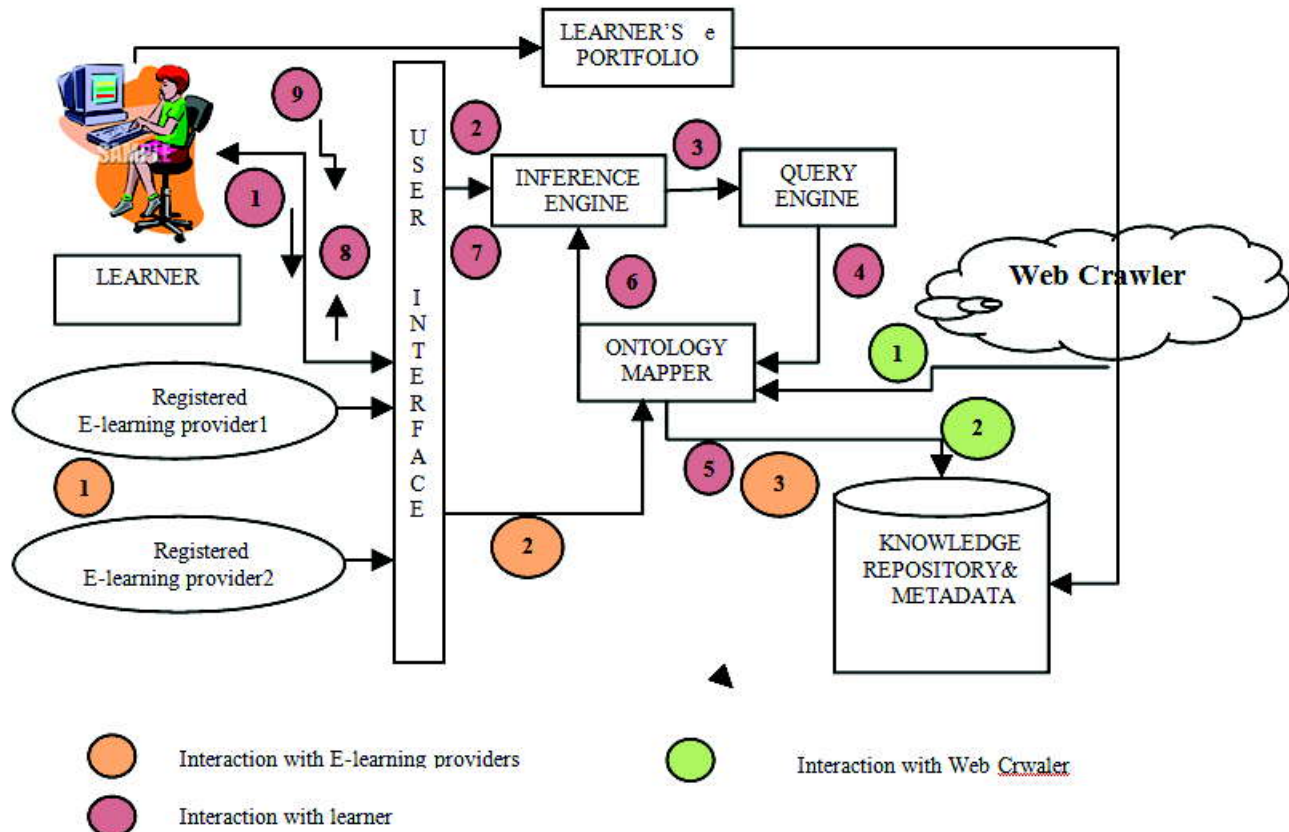


Figure 4: Working of the E-library

ii) Learner's Feedback

iii) Learner gives search request

i) Registration of the Learner: When the Learner uses the application for the first time, his profile is created. This profile helps in judging his competency, interests, proficiency in the mentioned fields etc shown in fig5. This profile can be utilized by the system in calculating the similarity between the learners and can help the system in providing collaborative filtering in case of the enormous match results, this profile can also be utilized when some learning object crawled by the web crawler is not having any readers yet and so no defined rating and feedback. In such cases, its initial rating and feedback can be taken from the learner depending upon his proficiency in the required subject.

ii) Learner's feedback: When learner has finished reading the learning object, a feedback is taken from him about the rating and review for the material. This feedback affects the overall rating and further help in ranking the results. The Learner's profile is also updated with his feedback.

iii) Learner' request and response: when learner request about material on mentioned topic, the system provides him with the relevant link which satisfies his current need of knowledge.

b) Interaction with the Registered E-content provider

When the provider registers, two types of profiles are generated. First is the provider's profile and other is the explanation of the content he wants to publish. The information of the content is the same required to conceptualize the learning Object which is mentioned above. If he wants to add some other field also, the ontology is free for adding a new field which can make the description more detailed.

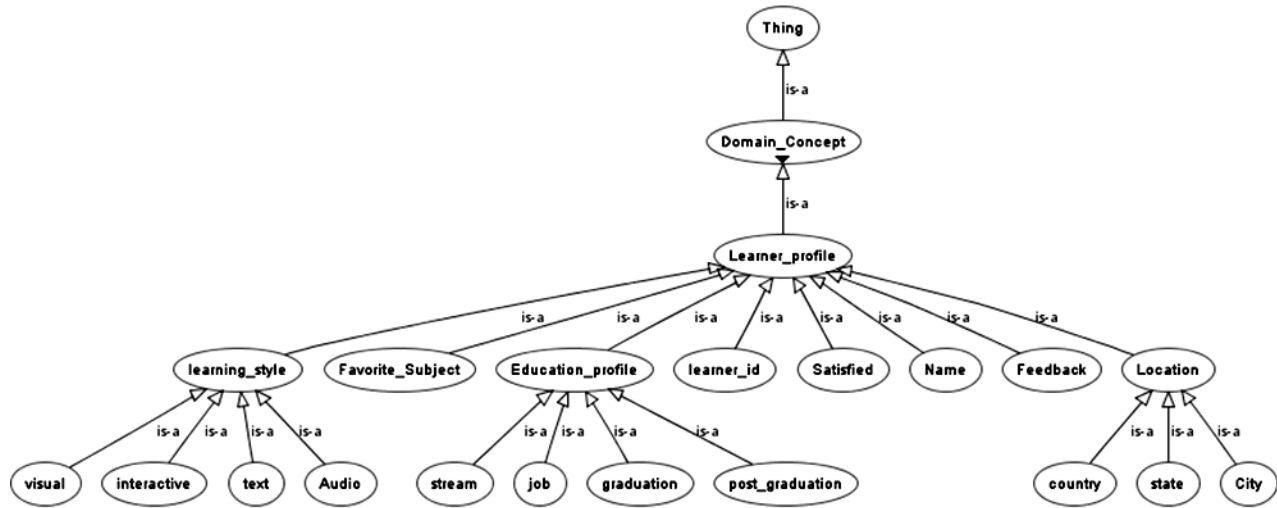


Figure 5: Conceptualization of the Learner's Profile

c) Interaction with the web crawler

The system has its web crawler, which adds on the latest available content. If the parameters of the crawled material does not match the system's ontology, the ontology mapper helps in removing the ambiguities.

d) Interaction of Ontology mapper and Inference Engine

The Ontology Mapper is the module which can map two concepts and find out similarities and infer the results. These results are rank and shown to the learner by Inference Engine.

#### 4. BENEFITS

As discussed previously, there will be lots of Benefits of using Ontology in E-learning such as: ‘

- 1) Search will be personalized and targeted, machine processable due to use of semantics and Ontology.
- 2) If the crawled page is following different ontology, there is mapper to map it according to the application. This helps in withstanding heterogeneity in Ontology.
- 3) The ontology is open for additions as user can add on the fields for making the description more detailed.
- 4) The E-library model follows 3P Learning Model, as it is providing Personalized search, involving learner's Participation in form of feedbacks and Pulling out the knowledge from learner and learning object. [9]
- 5) Whenever there is collaborative filtering, there are chances of Cold start, as there are no ratings for the content which are not yet referred and thus considered for the top rankers to the learner. In the proposed application, we are taking the initial ratings from the experts.

But still there are lots of challenges in front of the success of the application such as:

- 1) Problem of overspecialization: Many times due to many parameters for description, some important links are rejected.
- 2) Learner modeling is an extremely difficult task, due to the dynamics of the learner's knowledge and the diversity of the parameters.



- 3) It is also required that people involved in feedback should be intellectually competent to give a helpful and honest feedback. Therefore, application is creating user profile to judge her proficiency.
- 4) The crowd's collective intelligence will only provide better results if individuals are open, diverse and derived collective intelligence can be properly grilled and utilized in decision making process.

## **5. CONCLUSION**

Technology can play an important role in achieving a true model of e-learning which would need to demonstrate on what new learning principles the added value of the 'e' was operating. Propelling the need for technological innovation in education is technology itself. Ironically, many times availability of huge volume of information makes it even more difficult to find the information we need. The challenge of the new century is to take stores of information on web and build a useful and manageable base of knowledge that can be used by any student at any time to solve his problems. The proposed framework tries to work on the challenge so as to unify the data and learners together. Though it will requiring SLA, security, royalty issues and finally also requires a proper business model, it can be surely adapted as a base for Quality Enhancement of Web data used by online learners.

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