Ontological Approach to Modeling a Learner in Adaptive learning Environment

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Abstract

Today, with the fast development of the "world wide web (www)" and E-learning technology, personalization and adaptation of content becomes more and more a necessity. This personalization improves not only access to information but also the quality of teaching. Moreover, support for learners in their learning path requires a suitable adaptation of content.

In this work, we aim to model the various elements and attributes related to an ALE (Adaptive Learning Environment) especially for learners. In this perspective, we build ontology to represent a learner profile and relationships between the different attributes that an ALE may contain.

Keywords—component; E-learning; Ontology; ALE; Adaptation; Personalization; learner profile

1 Introduction

The Online education is becoming nowadays a necessity as a modern educational system. However, this kind of teaching uses a wide dynamic system of information. In addition, whatever the level of students is, they will never be able to form a homogeneous group in terms of knowledge and skills. In this context, the E-learning system requires more development. In this sense, improving the E-Learning system requires the research for new ways that can effectively meet the needs for the student in accordance to what she or he wants and the available resources.

Many studies have been done in E-Learning area. Indeed, several authors have addressed this issue and have tried several approaches. To fill the gap between traditional learning system and the E-learning, the semantic web technology [1][2][3] is shown as a solution to make a personalized formation support in the learning area.

Furthermore, the evolution of the level of the student requires a following up in comparison with the environment of learning. In this case, it is very important to personalize the profile of the student which form a common basis for exchange between different resources [20][4].

Generally, the profiling by the user is specific category of applications [5], some authors use a method that integrates the concepts and properties necessary for the user profile [6][7] which is based on the ontology.

User modeling based on ontology can be presented in a generic framework [8]. It consists of identifying pertinent aspects of user profiles in a knowledge management system and integrates them into a generic framework based on ontologies.

Building a profile of a user based on the concepts of the predefined ontology. The profile is built by monitoring the navigation of the user over time and classify the content of visited web pages. Experimental results show that a profile can be constructed autonomously. Obviously profile users may contain irrelevant concepts. Treatment of a long monitoring can lead to eliminate undesirable contents [9].

2 State of art

Learner’s Profile consist a set of information that represents learner’s personal data such as his education, knowledge, goals and preferences... Those attributes can be initialized manually by the tutor or deducted from the learners activities (quizzes, forums,...) [9] .

2.1 Standards and data models

As standard, there are different profiles for learner’s data.

- IMS LIP

IMS LIP (learner information package specification)[10] is a specified description of a classic approach to structured CV. It focuses on the history of the learner and the learning experience. The goal of this standard is to facilitate the exchange of information on learners between education systems, learning management systems, etc. IMS LIP is structured in eleven basic categories: Identification, goal, Qualifications, Interest, Competency,
Transcript, Affiliation, Accessibility. Security key, Relationship.

- PAPI Learner

PAPI Learner (Public and private information)[11] is a standard proposed by the group Learner Model Working Group of the IEEE, which describes the learner information useful for communication between cooperative systems. PAPI is structured in six categories: Personal info, Relations, Security, Preferences, Performances, Portfolio.

### 2.2 Ontologies and learner’s Model

Since the last decade, learning is a very important element in the E-learning system. Ontology is considered as the perfect solution to represent it[5], many researchers and works discusses different ways to identify the learner, to create and update his profile.

Ontology for user modeling is presented in reference [6]. The authors of this work propose ontology to build a learner’s profile. The ontology proposed is based in her/his static characteristics only but dynamic information about the learner is not included.

Otherwise, Desislava Paneva[13] and Razmerita et al. [7] propose a Semantic web structure for representing a learner. The structure is based on the most important standards PAPI IMS Lip. The authors neglect the way how the profile is updated.

In the work referenced [16], the authors discuss in Ontology-based framework for Personalized adaptive learning project (OPAL), the way to represent a learners based on their learning preference and learning performance, Applied in java course. Winter et al. [17] offer some practices and advantages to modeling a learner based on the ontology.

Dolog et al.[12] offer a prototype In ELENA PROJECT, based on the web service. This prototype describes a search function that integrates the learner’s informations such his knowledge, learning style, interests, ..., and creates the specific links of each result generates such as the requirement of the device.

Marek[14] and Yasser et al[8] suggest an implicit way to build a learner’s profile, and updated automatically by analysing her/his behavior’s through the web-log.

By the same token, in [18], they propose a learner model ontology based on the knowledge of the Lerner and his learning style. Chen et al. [19] describe a learner model for a multi-agent architecture in the intelligent educational system.

The evaluation also plays a very important role in learner modeling. Bouarab Dahmani[15] presents a model of ODALA ontology (Ontology-Driven Self-Assessment for Learning Approach) which describes a self-assessment approach, it includes a diagnostic module to facilitate the detection of errors, for a better adaptation of the content and to the learners needs.

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Table 1: Comparison between different approach

### 3 Proposed Approach

The proposed approach combines the advantage of most existing model that’s lead to provide a global system representing a learner and the way to adapt the pedagogical content to his situation. Based on this needs, our new model present ontology divided on three sections:

- Onto-lp (Learner Profile Model)
- Onto-Adapt (Adaptation Model)
- Onto-Eval(Evaluation Model)

#### 3.1 Learner’s profile

The profile of the learner plays a very important role in the CBHLE (Computer Based human Learning Environment). Indeed, each learner must have a profile to provide his information, manually by himself or automatically by the system. In such a situation, we propose a profile composed with 5 components:

- Onto-LP = (Identification, QCL, knowledge, skills, placement Test)

  - Identification: describes the demographic and geographic data on the learner (name, age, address, email, etc.)
• QCL: describes all degree of Qualification and the diplomas.
• knowledge : background of learner
• skills : describe the skills and any experiences
• Placement Test: describe a test to categorize a learner according to his knowledge about the learning content. The test is generated and stored in a repository. The result of such a test is categorized in three levels (beginner, intermediate, advanced).

![Fig 1: Learner Profile Ontology](image)

3.2 Adaptation Model

After the check level, the system can categorized the learner with his resulting degree. Moreover, the content can be adapted to the specific learner and an assistant tutor or professor can be assigned. Certainly, many techniques and resources can be used in learning subject
• Statical content method : pdf, doc, URL
• Interactif Methode : video, audio, PowerPoint,…..

Onto-Adapt= (Postionnement Test, pedagogical subject, learning resources, learning activity)

![Fig 2: Adapation Ontology](image)

3.3 Evaluation Model

When the learner finished his learning unit, the last step is to have some activity about this pedagogical content. This step is called evaluation. The learner pass the evaluation unit, if he is able to validate it, this unit added automatically in his competence, otherwise what happen?

Onto-Eval= (Repository, Learning activity, Evaluation, Competence).

• Repository: bank of question generated automatically by a system according to specific subject,
• Evaluation: Is giving a judgment about the work provided, aim to make a decision about learners,
• Competence: all idea can learner have to exercised and validate a pedagogical unit.

![Fig 3: evaluation Ontology](image)
Fig 4 : Global Learner Ontology
4 Conclusion

The major objectives of the various Computer Environment for Human Learning (CEHL) is to provide the various courses for different learners according to their heterogeneity such their level of learning, degree of knowledge, interest ...

This article attempt the different aspect and relation to build ontology for better modeling a learner, not just his profile but the different sequence can meet in his learning path.

The aim of our work is to provide tools to follow the learner’s activities since his start the beginning (registration,..) until the end of his training (validate).

References


