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Standardized modeling learners to enhance the learning service in the ILE

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Abstract

With the development of the society of knowledge, learning managment system (LMS) as Claroline, Ganesha, Chamilo, Moodle ... are commonly used successfully in the online learning. In order to provide better service for the learners, most of these ILE (Interactive Learning Environment) focus on supporting teachers in the creation and organization of online courses. However, in general, they do not consider individual differences of each learner. In addition, they do not provide enough indicators to track the learners to determine their needs in a deadlock.
In this article, we examine the benefits of the integration of learning styles in the Web-based educational systems. Also we are interested in the use of traces of interaction in order to remedy the lack of feedback between teacher and learner. Thus, we propose a standardized learning model based on traces and learning style of the learners that can be distributed using semantic web technologies.

Keywords: ILE, interoperabilit, learner model, trace analysis, learning styles, ontology

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1. Introduction

In traditional teaching, teachers get information about the conduct training sessions and assessments of learners on the educational content by interviewing and observing their nonverbal expressions, which enable the evaluation of the teaching programs (Sheard, & al, 2003). In fact, The behavior of learners, their opinions, their learning styles and analysis of historical data (Gaf, 2009; De Ketele, & Roegiers, 2009), help to make decisions on the effectiveness of teaching strategies in order to improve the service learning and adapt the educational content according to the profile and learning style of each learner.

In these days, many Moroccan universities and institutions start offering courses and online training "Elearning". However, these electronic learning environments, lack of teacher-learner interaction (Zorrilla, & al, 2005), therefore, they lack information on the interaction of learners with the courses, their learning styles and on their profiles. Thus, they do not usually consider individual differences of learners and address an equipollent manner, also neglecting their personal needs and characteristics. This approach or analogy of learning often leads to frustration and boredom, which leads to dissatisfaction and consequently to a high rate of online courses leaving (Karampiperis, & al, 2005; Dagger, 2005; Bégin, 1978).

The customizing of ILE becomes a necessity that must be supported by electronic learning environments to improve the quality of education, many research are done in this area such as the electronic orientation that helps to build a well-defined academic and career project (Guerss, Aitdaoud, & al, 2015).

In our work, we propose an approach based on gross traces modeling of learners, using the model of the learner standard IMS LIP (Learner Information Package) (Smythe, & al, 2001) and PAPI (Public and Private Information) (Farance, 2000) in a quest for customization of educational support, we took into account the particularities of learners to design the proposed model of learning. In order to more effectively identify their characteristics.

In short, the proposed model:

- is very suited to the particular characteristics of the learner, such as traces of interaction and learning style,
- combines several standard modeling approaches to represent the information of the learner.

The article is structured as the following: Section 2 discusses the concept of online learning. Section 3 provides an overview of the main model of learning styles. In Section 4, we present the modeling approaches and the basic characteristics of the learner. Section 5 introduces the most important standards for learning and modeling, focusing on IMS LIP. In section 6, we briefly discuss the main differences of the proposed model with existing standards, and then we describe the model proposed in the learning context according to the learning style of each and possible extensions. Finally, in section 7, we conclude with directions for future work.

2. E-learning

E-learning offers many advantages over classical learning (Sun, & al, 2008) including the learning method which can be more adaptive than traditional learning. In view of the fact that traditional learning tends to support a single learning style, it means that the teacher often has to deal with a big number of learners in a typical classroom situation; As a result each learner receive the same course materials, regardless of the needs and personal characteristics of each of them. This situation can be improved in the e-learning system in which each learner can be arranged to receive the course material that is more refined for its learning characteristics. This e-Learning capability is referred to as personalization.

For this reason, we define the SWOT (STRENGTHS, WEAKNESSES, OPPORTUNITY AND THREATS) analysis indicators of e-learning as shown in Fig. 1:

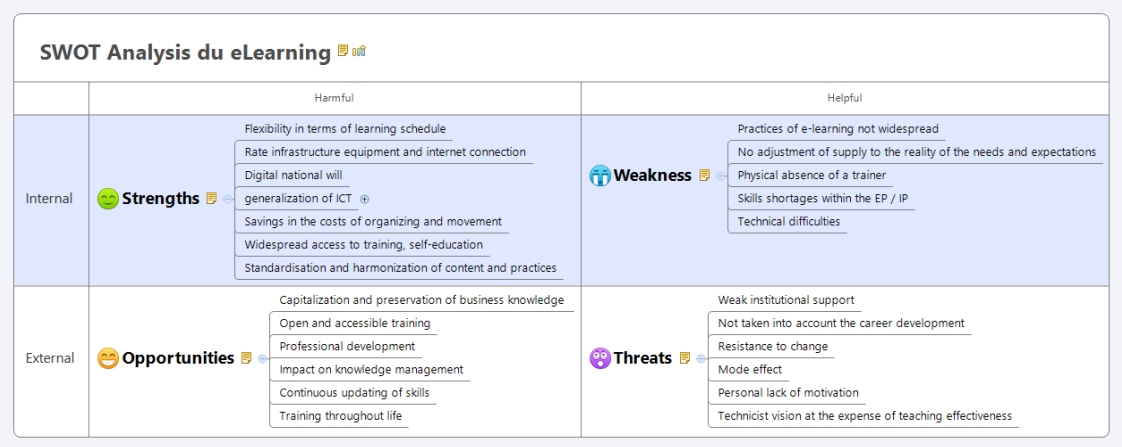

Figure 1. SWOT analysis of e-learning.

The learning process according to Huitt (Huitt, 2003) has various components that affect the characteristics of the learner and the behaviors of the activity/learner, learning styles, prior knowledge, and intelligence are some of the characteristics of learners, as well as the motivation that will affect the learners' activity in the learning process (Martens, & al, 2004).

2. Learning style

The learning style is defined as a characteristic that has strengths and preferences of how people take and process information (Honey, & Mumford, 1982)., and determines the unique learning for each learner.

Learning styles became more integrated into the learning technology and a lot of research is done in this area (Bousbia, 2008; Graf, & Kinshuk, 2007), such as the developed systems to provide adaptability according to the learning styles and learner skills. Although several models of learning styles exist in the literature, e.g. Kolb model (Kolb, 1984) and Honey and Mumford (Honey, & Mumford, 1982). The model of Felder and Silverman (FSLSM) (Felder, & all, 1988) is one of the mostly recently models used for adaptive educational systems, some researchers even claim that FSLSM is the most appropriate model to use in adaptive learning systems (Carver, & al, 1999; Kuljis, & al, 2005). Most models of learning styles classify learners in groups, while FSLSM describes the learning style of the learner in a more detailed way, and that, distinguishing between preferences on four dimensions: active/reflective, sensitive/intuitive, visual/verbal, sequential/global.

According to Felder-Silverman model, the different types of learning are classified into several dimensions based on how people process information, and each dimension contains two possible values:

- Processing: active/reflective,
- Perception: sensitive/intuitive,
- Input: visual/verbal,
- Understanding: sequential/global.

In Fig. 2, we can see the complete model with the descriptions for each dimension.

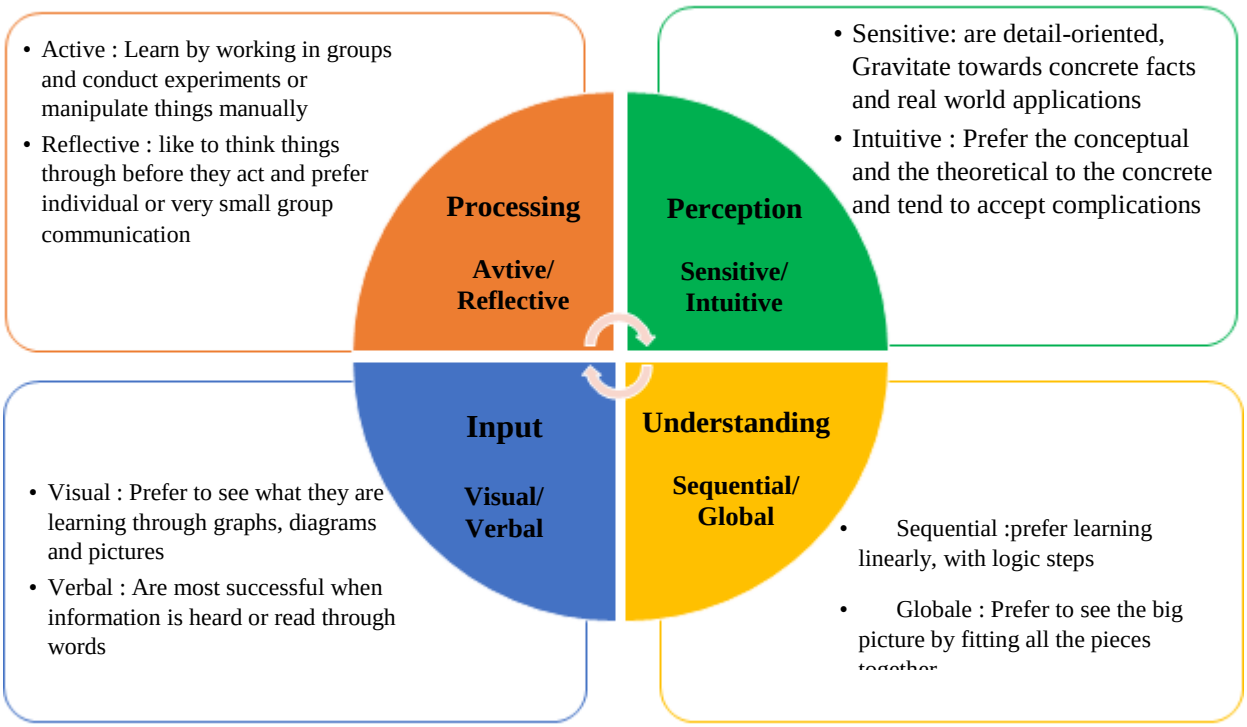

Figure 2. The Felder-Silverman model.

For each dimension, there is a value of -11 to 11 that indicates the preference on the respective dimension. These values represent trends, for example, a learner who has a highly active learning style can sometimes act reflective way.

3. Modeling approach

There are a variety of techniques and traditional approaches to represent the information acquired by the learner. The most used representation of learning model is the overlay model. The learner model consists of cognition, affection, motivation, and other psychological conditions that evolve during learning. In the overlay model which is often regarded as a superposition (subset) of the domain model (knowledge of the expert) (Conlan, O'Keeffe, & Tallon, 2006), which changes during learning. Therefore, the system provides the learner with educational materials until knowledge of it coincides with the knowledge of the expert. For example, "tracing of knowledge" follows the progress of the learning from one problem to another and builds a profile of strengths and weaknesses in relation to the domain model (Anderson, Corbett, Koedinger, & Pelletier, 1995).

Another approach that is widely adopted is the use of stereotypes (Kay, 2000; Rich, 1979). New learners are sorted into distinct categories, and the system adjusts its performance based on the category assigned to each learner. Fig. 3 is representing the overlay model:

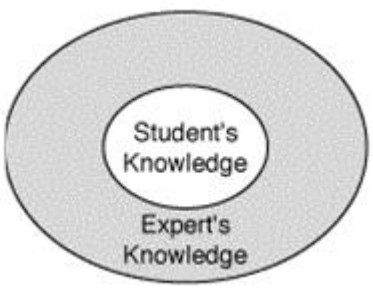

Figure 3. Overlay learner model (Beck, J. & all, 1996).

The realization of a learner model based completely on technical stereotype is strongly not recommended (McCauley, 1995). Because (1) system initialization derivative of descriptions or learner questionnaires may not be accurate for each domain skills.and (2) the system would be suited to the needs of very slowly learner. We have developed a model in which the permanent characteristics (Guerss, Aitdaoud, & al, 2015) of the learner profile (e.g. prior knowledge, experience in a specific field of knowledge) are initialized based on a stereotype. In addition, the evolving characteristics (Guerss, Aitdaoud, & al, 2015) are related to the learning process that is represented by an overlay model. After the initialization phase, the profile is changed dynamically and the overlay model that is updated with information collected by the interaction between the learner and the system.

4. Learner modeling

The adaptation of teaching courses, content and presentations to the needs of learners, and the monitoring of their progress in on-line training platforms, require that we collect data on these learners (Brusilovsky, 2003). The pertinent data recognized modes of production and operations have been the subject of many publications (Brusilovsky, 2001) that led to the establishment of the knowledge of the learner model.

4.1. Definition

The learner model is a data structure (as defined in the computer) that characterizes the knowledge acquired by the learner (Bruillard, 1997). The five main features shown in the user model are:

- The goal of the learner,
- His knowledge and training,
- His experiments,
- His preferences or interests,
- Motivation.

This model provides information on the environment to adapt to each user and update explicit (by asking the user using a feedback questionnaire or activity) or implicitly by the collection of his interactions resultant trace with the environment.

Among the many objectives of the learner modeling, according to Buche (Buche, & al, 2006), we include:

- Help a learner during his learning,
- Adapt the information, interface and support for the user,
- Facilitate the information search,
- Give the learner feedback reflecting their educational path.

4.2. The standards of the learner model

We will study in the following different existing standards for describing learner profile IMSLIP (learner information package specification) 'IMS' is a specification describing a classic approach to structured CV, it focuses on the history of learner and his learning experience. The aim of this standard is to facilitate the information exchange on learners between education systems, learning management systems, etc.

a. IMS LIP model

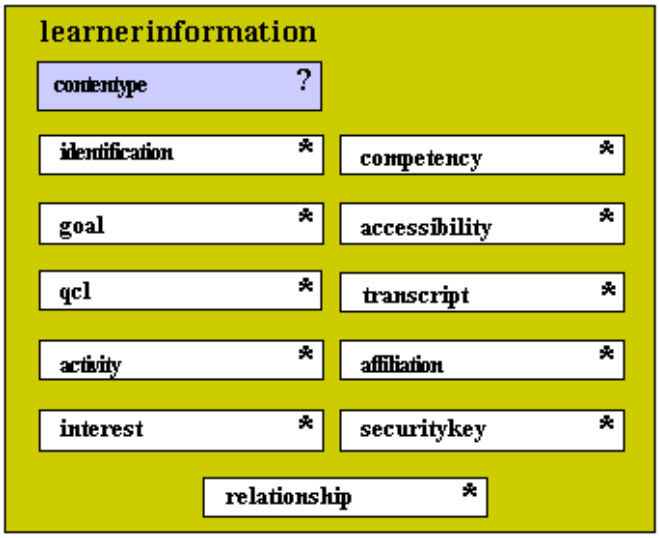

Figure 4. The IMS Learner Information Package (LIP) core data structures (IMS Global Learning Consortium, 2001)

As shown in Fig. 4, IMS LIP is structured in eleven basic categories:

- Identification: Biographic and demographic data relevant to learning;
- Goal: Learning, career and other objectives and aspirations;
- Qualifications, Certifications and Licenses (qcl): Qualifications, certifications and licenses granted by recognized authorities;
- Activity: Any learning-related activity in any state of completion. Could be self-reported. Includes formal and informal education, training, work experience, and military or civic service;
- Transcript: A record that is used to provide an institutionally based summary of academic achievement. The structure of this record can take many forms;
- Interest: Information describing hobbies and recreational activities;
- Competency: Skills, knowledge, and abilities acquired in the cognitive, affective, and/or psychomotor domains;
- Affiliation: Membership of professional organizations, etc. Membership of groups is covered by the IMS Enterprise specification;
- Accessibility: General accessibility to the learner information as defined through language capabilities, disabilities, eligibilities and learning preferences including cognitive preferences (e.g. issues of learning style), physical preferences (e.g. a preference for large print), and technological preferences (e.g. a preference for a particular computer platform);
- Securitykey: The set of passwords and security keys assigned to the learner for transactions with learner information systems and services;
- Relationship: The set of relationships between the core components. The core structures do not have within them identifiers that link to the core structures. Instead, all of these relationships are captured in a single core structure thereby making the links simpler to identify and manage.

b. PAPI model

PAPI (Public And Private Information for Learner) (CEN, 2009) is a standard developed within the group *Learner Model Working Group* which was not accepted as a standard by ISO. This group has

aimed to specify the semantics and syntax of learner information. This information can be of various types: acquisition of knowledge, preferences, performance, skills, and relations with other learners, etc.

Six types of information are defined by this standard, which also makes possible the extension of each of them. In the PAPI model, a learner profile is defined by: personal information about the learner, relational information, security information, information on learner performance, information "portfolio" (Mohammed, & al, 2015; Guerss, Aitdaoud, & al, 2015; Bentaib, AitDaouad, & al, 2014)and information related to the preferences of the learner (Paramythis, & al, 04). Fig. 5 depicts the conceptual view of the PAPI standard.

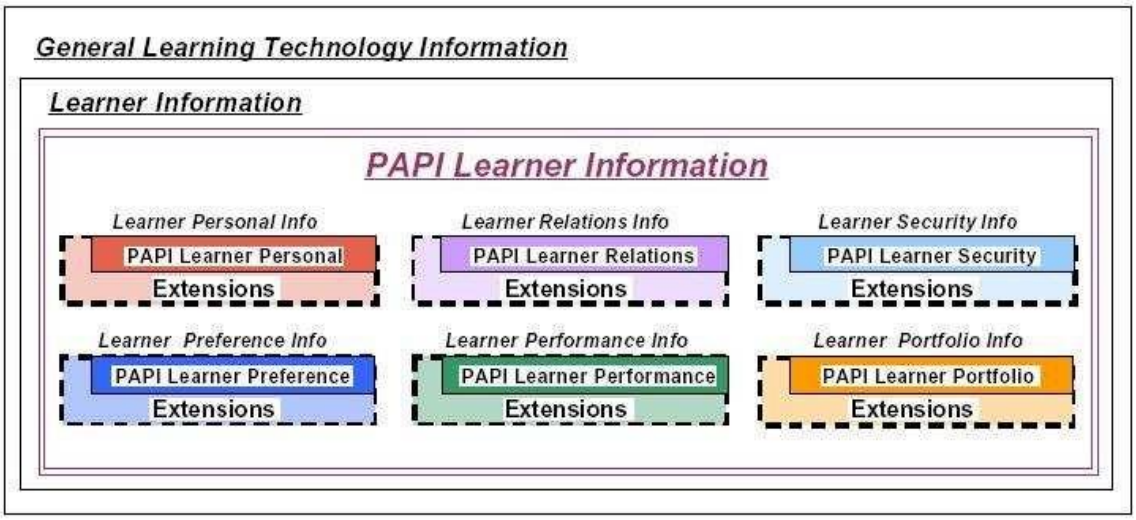

Figure 5. The main categories of the PAPI standard (Dolog, & Nejdl, 2003).

PAPI Learner specification describes a minimal subset of information on the learner. It represents one of the first proposals providing a framework that organizes learning data. However, learner data, including teaching, are not taken into account, and are exchangeable between different online learning systems. That is why this proposal has been an evolution of IMS in its new IMS LIP standard.

5. The model design

As part of our research, we develop a model that is partly based on the standards we mentioned in Section 5. It is known that PAPI and LIP are the most significant and important standards due to their commonly uses and the benefits, they provide when they are used together. In Ounnas (Ounnas, & al, 2007), the presentation of the main features of the aforementioned standards and the comparison between the two indicate the importance and completeness of PAPI and LIP standards. However, these standards reflect different perspectives on the attributes of a learner.

As shown in Fig. 6 the proposed learner model contain the personal information of the learner's, learning style, learning outcome, and achievement (records). These aspects are considered important to describe the learner profile. Motivation generally described the learning goal (aspirations and objectives) and the academic performance (competency, transcript and qualification) as personal aspects of the learner.

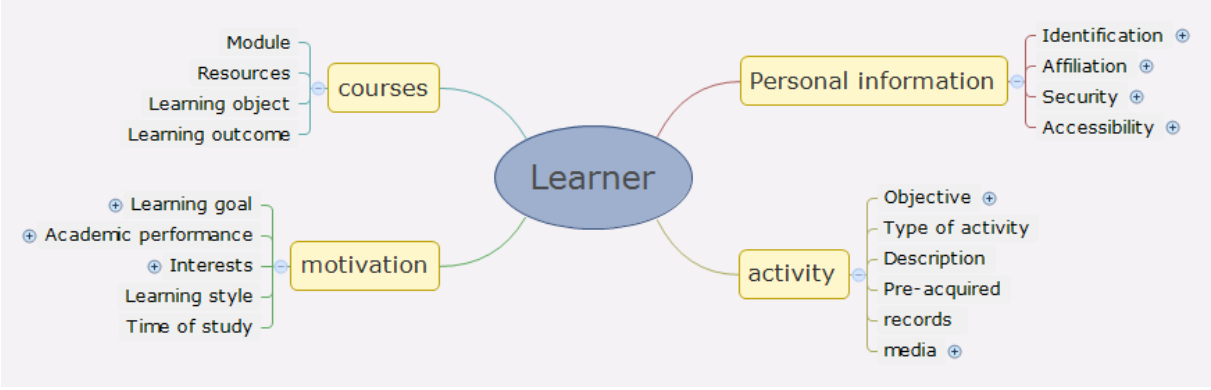

Figure 6. The Learner Model as displayed in XMind

In Table 1, we describe in depth the attributes of the learner model that was developed to capture the main concepts presented in Section 3. The objective of our research is not limited to static profile modeling of users, but encompasses both permanent and dynamic characteristics. In addition, the model is conform partly to the known standards for learner modeling, namely IEEE PAPI learning (Farance, 2000) and IMS Learner Information Package (LIP) (Smythe, & al, 2001).

Table 1. Description of classes and attributes.

ATTRIBUTE	DESCRIPTION
COURSES	comprises information relevant to the learner's performance during the overall educational process
Module	the course modules of the course program
Resources	course resources
Learning object	the learning objects that the learner has been taught
Learning outcome	the learning outcomes succeeded by the learner as indicated by the learning objects
ACTIVITY	in order to capture any detail in terms of a learner's activity for the current academic year
Description	the description of the activity

Pre-acquired	the experience on a specific course module that the learner has previously gained
Objective	the learner's objective on a specific course module
Records	the records of the corresponding assessment.
Media	the content placeholder for all text, image, video, etc. materials.
PERSONAL INFORMATION	is defined so as to represent mostly static and permanent learner information, describing not only simple data, like demographic data, but more complex characteristics that concern learner's interaction with the e-learning system.
Identification	contains all of the data for a specific individual or organization. This includes data such as: name, address, contact information, agent and demographics
Affiliation	used to store the descriptions of the organization affiliations associated with the learner. These affiliations may include education groups e.g. classes, cohorts, etc.
Security	used to store the passwords and security codes that are to be used when communicating with the learner.
Accessibility	the overall set of features that characterizes the learner's behavior during his interaction with the e-learning system, such as disability, eligibility and language capabilities.
MOTIVATION	Learner's motivation during the educational process
Learning style	Learner's learning style - This class will be further divided to the sub classes according to the Felder Silverman theory
Learning goal	overall goals set by the learner
Academic performance	used to store the summary records of the academic performance at an institution. This information may contain an arbitrary level of detail and so there is no proscribed structure for a transcript.
Interests	consists of descriptions of hobbies and other recreational activities.
Time of study	the average time per day that the learner can use for studying

6. Conclusion

The learner's monitoring activity is a rather complicated task and is facing several problems. The tutor must address the lack of feedback to ensure learners' motivation and prevent them given up the learning. The learner can feel himself isolated and meet so many difficulties in following his courses. As for the administrator of the platform, he seeks to ensure better quality of education.

To address these problems, we propose in this work to standardize the model of learning in order to ensure interoperability and sharing the learner profile, which is based on IMS LIP and PAPI standards. The approach adopted to represent the acquired learner information, is a combined approach between the overlay and stereotypes models. The proposed model collect the characteristics of each learner that are very important for the ILE in order to be adapted and personalized to the learner needs.

Finally, we plan to represent all the elements of the learner model using the concept of ontology, to identify their characteristics more effectively. The ontology will cover knowledge about learners learning styles, academic performance, personal information, and motivation.

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