Systemic Approach-Based, Intelligent and Adaptive User Model for U-Learning

Leonor Adriana Cárdenas-Robledo and Alejandro Peña-Ayala

Abstract— **In this paper we present a summary of a research proposal oriented to develop an intelligent, adaptive, and systemic user model. The purpose is to include this model as part of an ubiquitous learning system (ULS). The aim is to personalize the learning content delivered through ubiquitous devices in an intelligent way. The base line of the approach is ubiquitous computing, which allows users to have wireless access to contents through a variety of devices. It provides a kind of *everywhere* computing platform. In this way, an ULS promotes and facilitates people learning who use ubiquitous, pervasive, and mobile devices by means of presenting personalized educational contents in an interactive and attractive manner.**

Index Terms— **personalized and adapted contents, ubiquitous learning, user model, ubiquitous learning system**

I. INTRODUCTION

Ubiquitous devices have become widely used in daily life, opening a window of opportunity for education. These kinds of devices are suitable resources to provide educational content to individuals. Educational services are spreading anytime and anywhere by devices such as: laptops, smart phones, audio players, interactive TV, radio-frequency identification, GPS, smart watches, and interactive boards.

Currently, users in general spend a considerable amount of time in communication, entertainment and information search using devices such as a smart phone or tablet; during that time these devices could be exploited for educational purposes, using ubiquitous technology as a means to acquire knowledge about a particular topic or subject.

According to Ogata and Yano "…Ubiquitous learning integrates high mobility with pervasive learning environments, where the learner is moving with a mobile device and the system dynamically supports learning by communicating with embedded computers in the environment…" [1]. Whereas, Hwang, Tsai and Yang assert ubiquitous learning is: "…any

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learning environment that allows students to access learning content in any location at any time …" [2]. In resume, ubiquitous learning provides "anywhere and anytime learning".

Ubiquitous technology is an efficient way to supply educational content to individuals geographically disperse and those who are in constant movement. It also reaches a wide scope and provides accessibility to education, not only for users who live in the city, but also for those who reside in isolated regions, where ubiquitous devices make the difference to permit communication between people.

The research proposal considers the generation of a user model that integrates learner characteristics concerned with domain knowledge, learning styles, feedback, motivation, meta-cognitive skills, and user context. The idea is to intelligently adapt and update the educational content to the dynamic requirements of different users over time.

II. RELATED WORK

In this section an initial sample of related works is briefly presented. The first two works address a system/holistic approach and the subsequent ones correspond to learning and ubiquitous aspects.

The first work shows a holistic approach to personalize the human computer interaction to support and improve usability in e-learning systems. The authors analyze e-learning in relation to mobile devices capacities, student knowledge level, interaction styles, and skills [3].

In this context, a Systemic-Structural Theory of Activity (SSTA) with a holistic standpoint by means of teaching-learning technology is introduced in [4]. The SSTA offers ways to holistically integrate diverse viewpoints of teaching learning activity about conceptual, strategic, semantic, heuristic, algorithmic, logic, and computational issues.

Concerning ubiquitous topics, [5] presents a system that learns patterns based on the users locations and their properties. The system can infer properties and generate a user model to represent each new individual that is incorporated to the environment. The algorithm implemented is useful in ubiquitous computing environments in order to provide a user model for specialized information services.

As for [6], they offer an integrated approach based on an automatic, global, and dynamic student modeling. This approach uses the behavior and actions of students with the aim at identifying the students' progress, learning styles, interests, knowledge level, problem solving abilities, preferences, social connectivity, and location. They approach provides rich and accurate self-adaptation in each service and allow teachers to get a better understanding of the students' learning process in a ubiquitous learning environment.

In another vein, data mining techniques by are used [7] to support personalized learning content adaptation mechanism in mobile learning environments. The system applies data mining techniques such as clustering and decision trees, to manage historical learner's requests and deliver quickly a suitable content version adapted to the learner when there is a similar existing request stored.

What is more, [8] presents the creation of a dynamic user model based on learning styles to enrich and support the automatic generation of an adaptive IMS learning design. The goal is to reduce teachers' time and efforts by means of providing learners with personalized learning experiences [8].

III. RESEARCH PROPOSAL

We believe that it is necessary to explore more flexible and capable ways to provide a wide coverage of education at any level. Thus, it is important to use the variety of ubiquitous devices as a mean of learning transmission.

On the other hand, there are many educative institutions that offer educational programs using information technology and communication. However, most of the programs do not consider the individuality of the student, her/his learning style, or domain knowledge level. Thus, students deal with limited possibilities to develop a suitable school performance.

Chrysafiadi and Virvou [9] present a literature review where they found that the most common features described in student models are the student's cognitive features (e.g. knowledge, ability to learn and understand, memory, problem solving and making decisions abilities …). The authors state that students in addition of having cognitive abilities, they also need critically assess their knowledge in order to choose what to study. Therefore, adaptive and/or personalized systems must consider metacognitive skills.

Therefore, learner' traits about motivation, feedback, assessment, and meta-cognitive skills are worth to be considered in user modeling for an ULS. The aforementioned attributes will allow building more accurate and suitable user model in order to provide adapted and personalized contents to the learner.

This research proposal aims at developing a user model from a systemic point of view. Due to the complexity of the user modeling immerse in a ULS, it is important to consider a systemic/holistic approach to tackle the problem and achieve an effective engagement and performance for the learner.

With the intention to build a holistic user model for an ULS, this model must exhibit attributes that provide personalized content to learners in an intelligent manner. Furthermore, in order to accomplish a suitable level of personalization, the proposed user model represents the following domains: background domain knowledge, learning styles, motivation, feedback, metacognitive skills, and user context.

Motivation and metacognitive skills are essential issues to be addressed in this proposal. It is desirable to identify the effect of using ubiquitous devices in learning activities through a ULS. What is more, it is pertinent to determine how such devices motivate the students to learn. Moreover, it is important that the learner become aware of his/her own domain knowledge and her/his metacognitive strategies that he/she is able to use during the learning process in a ULS

The aim is: the ULS provides personalized learning content in an effective manner that engages the learner. Therefore, it is necessary to know how all these aspects are related each other and how they impact the school performance of the students.

IV. CONCLUSION

Ubiquitous technology has become more accessible due to the world wide spreading and cost reduction in devices production. It allows obtaining information and resources anyplace, anytime, and anywhere. In consequence, it is convenient to exploit this technology in educative sectors, and support individuals in motion or geographically disperse.

The user model proposed in this paper should exhibit features of intelligence and adaptation in order to fit the user characteristics, learning styles, domain knowledge, feedback, motivation, metacognitive skills, and user context, enabling to promote an attractive and pleasant manner to learn.

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