A system for adaptation of educational contents to learners and their mobile device

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Abstract— **In this paper we propose a system that allows to adapt educational contents to learners, based on the knowledge of a learner who is conducting the training through his mobile device, contents will also be tailored to the features of the device and to the context where the learner is at the present moment.**

Keywords-m-learning; adaptation; learning objects; mobile devices

I. INTRODUCTION

Independence of, both, location and time is often highlighted as the main advantage of e-learning systems. However, in traditional e-learning the minimum hardware requirement is still a personal computer (PC), therefore there is no an absolute independence of location. Such independence is still not satisfied with the use of a laptop because true independence in time and place means learning where and when a person wants and can access to learning materials [1]. Mobile learning (m-learning) is an evolution of e-learning and it is based on the use of mobile devices. An advantage of this system is the high availability of these devices, since the majority of the population has a mobile device (mobile phone, PDA, etc.) on the hand or in the pocket most of the time [2]. Therefore, m-learning can be an important instrument for lifelong learning.

This paper proposes a system to solve the problem of adapting educational contents to the knowledge that a learner who is conducting the training through his mobile phone, contents will also be tailored to the features of the device and to the context where the learner is at the present moment.

In section II, the proposed system is presented. Section III presents the process of construction of learning objects adapted to mobile devices. Finally, section IV presents the conclusions and the future work.

II. PROPOSED SYSTEM

The proposed system (Figure 1) consists of different processes, as well as external agents that provide or receive information from the system. A description each of the parts of this system is presented bellow.

A. Processes

The system of adaptation of contents to mobile devices has been divided into three sub-processes: Construction, Evaluation and Training. Below their characteristics are shown.

- Construction: this process creates the learning contents adapted to mobile devices' learners and their knowledge, in this way, educational contents adapted to the needs of each user and each mobile device will be reached.
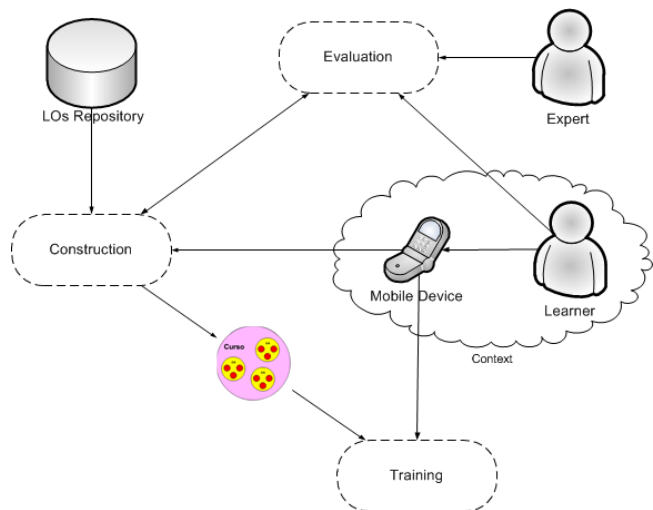

Figure 1. System of adaptation of learning objetcs

- Evaluation: this process considers the assistance of an expert in a particular subject or area. The expert may make further improvements or suggestions to re-adapt a learning object or course that has previously been adapted to a learner and his mobile device.
- Training: it is the process responsible for conducting the training of the learner through the learning objects that have been adapted to him and his mobile device.

B. External agents

- Learner: This profile is the person who will receive the training adapted to his mobile device and to the knowledge he already has (skills).
- Mobile Device: It is the hardware element that is used as means to receive personalized training. The

system adapts the contents and the training to the features that these mobile phones have.

- Expert: The figure of the expert is the person or agent capable of evaluating a customized course that has been built, he can suggest changes to it in order to improve training.
- Context: The context is the background information of everything which is related to the learner during training: noise, location, etc. Based on this information, the system can adapt its learning.

III. CONSTRUCTION PROCESS

This section details the Construction process (Figure 2) that, apart from being the main process of the system, lets create learning contents adapted to mobile devices and the needs (knowledge) of learners. The process takes as inputs: the features of the mobile device, learning objects (LOs) and the skills of the learner. As output, the process will generate a course adapted and customized to the learner.
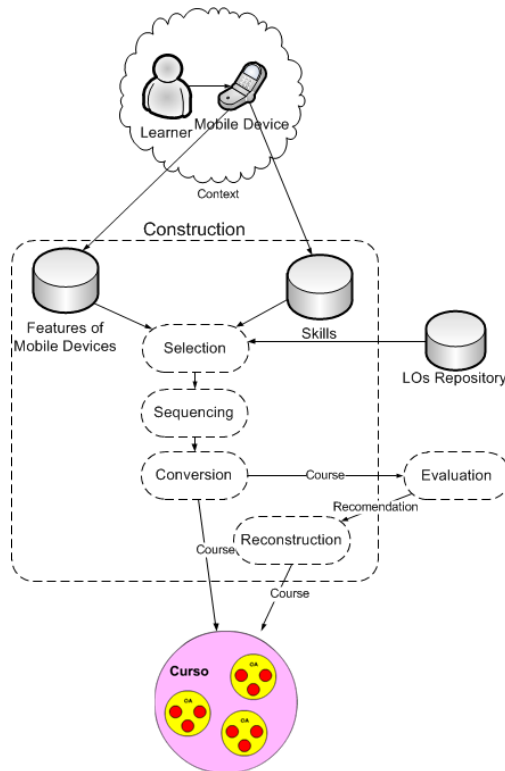

Figure 2. Construction process of adapted LOs

The Construction process is in turn divided into sub-processes that, taken together, can create adapted learning contents.

- Selection: It is the process responsible for selecting the components (learning objects, skills and features of mobile devices) in order to create learning contents. This process can be divided into two parts: on the one hand, the use of federated search systems to locate learning objects in different repositories [3], and on the other hand, the use of gap analysis

techniques [4] for the selection of appropriate components. The output of this sub-process is the set of components that have been selected that may be susceptible of being used for the adaptation process.

- Sequencing: The process to carry out an ordination of learning objects so that training is conducted according to the constraints involved in making learning [5]. This process can be stated as a constraint satisfaction problem and to use artificial intelligence techniques to solve them [6].
- Conversion: The process that performs the conversion and adaptation of learning contents, taking into account the limitations of mobile device used and adapting learning contents to their features (screen, operating system, etc.) if necessary [7].
- Reconstruction: If the expert has suggested or made changes on any content, this process will rebuild the course, finally obtaining as output the custom course which will be presented to the learner.

IV. CONCLUSIONS

This paper presents a system capable of adapting educational contents to learners that are doing training and to their mobile device used. The sequencing process and a part of selection process (federated search system) have already developed and tested, but the gap analysis and conversion process are still under development.

REFERENCES

[1] L. F. Motiwalla, "Mobile learning: A framework and evaluation," *Computers & Education,* vol. 49, pp. 581–596, 2007.

[2] A. Becker, "Electronic commerce: concepts, methodologies, tools and applications," *Premier Reference Source,* p. 2522, 2007.

[3] S. Otón*, et al.*, "Service Oriented Architecture for the Implementation of Distributed Repositories of Learning Objects," *International Jounal of Innovative Computing, Information and Control (IJICIC),* 2010.

[4] J. L. De Coi, Herder, E., Koesling, A., Lofi, C., Olmedilla, D., Papapetrou, O., & Siberski, W., "A Model for Competence Gap Analysis," presented at the 3rd International Conference on Web Information Systems and Technologies (WEBIST), Barcelona (Spain), 2007.

[5] L. de Marcos, Barchino, R., Martínez, J.J., & Gutiérrez, J.A., "A New Method for Domain Independent Curriculum Sequencing: A Case Study in a Web Engineering Master Program," *International Journal of Engineering Education,* vol. 25, pp. 632-645, 2009 2009.

[6] A. Garcia*, et al.*, "Courseware Sequencing Using Heuristic and Local Search," in *CSREA EEE*, ed: CSREA Press, 2010, pp. 70-75.

[7] T. Lemlouma, & Layaïda, N., "Adapted Content Delivery for Different Contexts," presented at the Applications and the Internet, 2003.