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Cloud Education Environment

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Cloud-based services are constantly evolving. Many of the so-called cloud services, traditionally known as Web 2.0 services because of their innovative features, have added an important element to the cloud landscape, which is interoperability features, opening their APIs to allow consumers to use their services in creative and innovative ways. This opens the possibility to create orchestrated services that provide learning experiences, which were not possible before. This also changes the paradigm from a monolithic architectural approach of education environments to a flexible, distributed and heterogeneous architectural setting for education environments, which is the aim of cloud education (learning and teaching) environments. This also maximizes innovation possibilities, allowing interoperability of the best and most appropriate cloud services based on learning needs, freeing up from a vendor specific approaches and limits, transforming the cloud education environment into a digital educational ecosystem of services and resources available for the practitioners, in contrast to a large amount of software services that are difficult to manage and organize for a learning setting.

In this special issue, we present contributions related to this field, especially relevant descriptions about the type cloud of services and how to address re-use of components. Three different and complementary architectures are described, first an initial approach for cloud interoperability service, which addresses general

interoperability of cloud-based services within a learning environment. Second, an affective-based recommendations architecture. Third, a generic framework for the coordination of pedagogical services. Additionally, the theoretical framework for a relevant topic, inquiry-based learning using cloud services. With regards to cloud computing approach, also a remote laboratory architecture is presented.

Finally, most of the publications of this special issue present several rich use cases for different contexts of the use of cloud-based services for educational scenarios, varying from a range of students, countries (including, Europe, Guatemala and some other Latin American countries), pedagogical approaches, type of tools, environments (cloud education environments, personal learning environments, traditional LMS), evaluation perspectives (usability, emotions, acceptance, etc.).

The first paper, from Marc Jansen et al "Using Cloud Services to Develop Learning Scenarios from a Software Engineering Perspective" presents the integration of cloud services within educational scenarios. It describes the cloud-based: communication services, repository services, production services, and processing services. It then presents a software engineering perspective on cloud services for learning applications with the re-use of software and infrastructure components. It also provides some examples like the integration of mobile contributions, and learning of signal propagations patterns. Finally, the paper addresses the interoperability and scalability scenarios.

The second paper from Rocael Hernandez Rizzardini et al. "Cloud Services, Interoperability and Analytics within a ROLE-enabled Personal Learning Environment", presents an initial architecture of cloud interoperability services that is compound of 3 layers: business logic, analytics, authentication; and the use of a set of cloud-based services for learning activities through widget technology. It then elaborates on the use cases of Galileo University in Guatemala, measuring factors such as ease of use, emotional aspects, and behavior analytics.

In their paper "A Generic Architecture for Emotion-based Recommender Systems in Cloud Learning Environments" Derick Leony et al., give a generic architecture for cloud learning environments that provides to the learner an affective-based recommendation of cloud services (learning resources or activities), which can be utilized for the learning process.

The contribution by Alexander Mikroyannidis et al. "weSPOT: A Personal and Social Approach to Inquiry-Based Learning" presents a practical and novel use of cloud-based tools to perform scientific investigations. It utilizes cloud Web 2.0 services and social networks to enhance the inquiry process. Future results will be of great interests and potentially useful for the scientific community.

Rafael Pastor et al. "Laboratories as a Service (LaaS): Using cloud Technologies in the Field of Education" presents the most cloud computing related paper in this issue. It presents a remote laboratories framework, providing remote laboratories as a service and explaining its resource provisioning.

Ricardo Queiro's et al. "Ensemble - an E-Learning Framework" presents a framework focused on the teaching-learning process through the coordination of pedagogical services. It also presents to domains of evaluation, together with an architectural model, data model, integration model and evaluation model.

The paper by Sylvana Kroop "Evaluation on Students' and Teachers' Acceptance

of Widget- and Cloud-based Personal Learning Environments" presents research in the area of Personal Learning Environments (PLEs). More specifically, results of attitudes and acceptance reasons of using widgets that contain cloud-based learning resources or activity services are presented, emphasizing that the essence is to be efficiently supported in the learning needs.

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Finally, we hope all our readers enjoy, learn and further research, share and collaborate their cloud-based education experiences!

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