Chapter 7
Towards a Flexible Cloud Education Environment:
A Framework for E-learning 3.0

Rocael Hernandez Rizzardini
GES, Galileo University, Guatemala

Christian Gütl
IICM, Graz University of Technology, Austria & CBS, Curtin University, Australia

ABSTRACT

Web 2.0 tools offer innovative technologies for learning and training, and it exists a strong pedagogical foundation to include such tools in education. As a consequence of its more widespread usage arise issues in the context of managing these cloud services, such as to create adapted instances tool resources, to assign such resources to teachers and learners, and others. Web and educational interoperability technologies have provided initial paths toward building this type of e-Learning 3.0 cloud education environments, however, fundamental challenges remain such as granular tool resources management, and the lack of use of Semantic Web technologies to leverage automatic machine-processable tool API. To overcome these issues, an holistic model for flexible interoperability is contributed in this chapter. Covered aspects includes a semantic definition of tools' API, an interoperability service framework capable to automatically process APIs, a semantic proxy that enables usage of current APIs, and a system for learning activities orchestration using these tools. Furthermore, advanced semantic technologies to support the model for flexible interoperability are analyzed.

INTRODUCTION

Technology-enhanced learning has been a research area for many years that continues to evolve as new technologies enable new educational scenarios. *Tools and services* available on the Web allow learners and teachers to collaborate, communicate and share in new or enhanced ways has become popular as *Web 2.0 tools*. The term "Web 2.0" has been coined by (O'reilly, 2005). It indicates a shift towards a Web of tools and practices towards a more participatory Web to involve users more interactively. The tools offer mechanisms for sharing, collaborating, networking, content

media production and others. Consequently, this has also initiated a new form of learning which might be called "e-Learning 3.0", and builds on the Web 2.0 concepts, tools, cultural and societal changes. This new learning approaches can make use of a holistic ecosystem that contains among others: new cloud infrastructures (for content, services and computing) (Chao, 2012), multiple devices (desktop, laptop, tablet, smart phone, gaming consoles, smart boards, smart TVs, others), augmented reality, geospatial information systems. Subsequently the educational process can be experienced by means of tools that can be accessed through a diversity of devices, places, contexts, thereby enabling those new interactions between participants (Cochrame, 2012).

The term *Cloud-Based Tools (CBTs)* is used interchangeably for Web 2.0 tools. CBTs that are designed:

For collaboration have the potential to engage students, by allowing them to interact and brainstorm solutions, elaborate reports, and create conceptual designs. This approach can inherently enable and facilitate both formal and informal learning. It also promotes the openness, sharing and reusability of learning resources on the web. (Mikroyannidis, 2012)

CBTs have the capability for interoperate with third party systems, therefore can leverage the services provided to orchestrate educational experiences, instead of the standard standalone view of a CBT, thus enabling the possibility to create a holistic e-Learning 3.0 ecosystem.

CBTs are constantly evolving. Many of the so-called CBTs have improved the cloud infrastructure landscape, with its Web interoperability capabilities. Through opening the CBT Web APIs (further referred as APIs) to permit Web clients to use their technology, thus fostering new, improved and creative usage of the CBT. API stands for *Application Program Interface*, which in simple

terms can be referred as programmatic interfaces to control a CBT from another system such as a *Virtual Learning Environment* (VLE). This opens the possibility to create orchestrated services that provide more complex learning experiences, which were not possible before. Authors in (Hernández et al, 2013b) argues that

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 environments supporting teaching and learning activities. This also maximizes innovation potential, allowing interoperability of the best and most appropriate CBTs in the basis of learning needs, freeing up from a vendor specific approaches and limits, transforming the cloud education environment (CEE) into a digital educational ecosystem of services and resources available for the practitioners, in contrast to a large amount of not interoperable software services that are difficult to manage and organize for an educational setting. (Declan Dagger, 2007)

The *Cloud Education Environment (CEE)* paves the way for e-Learning 3.0. It augments any educational setting or system by exploiting as an ecosystem of applications, services, content providers, and computing power that does not belong to a particular educational institution. Therefore, this extends the range of possibilities to include many types of CBTs that can be used for educational objectives, some of them designed with that purpose and many others that might not be originally conceived for that but that will fit well for certain educational scenarios. The CEE has the potential to enable new educational scenarios while simultaneously fostering educational actions that bring new pathways for learning (Malik, 2009; Mikroyannidis, 2012). On the other hand, CBTs offer a diversity of rich

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