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Innovative Learning: Technology-Enhanced Approaches built over Web Technologies

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***Abstract*— Recent years have witnessed the tremendous development and adoption of various forms of innovative learning in Higher Education. This paper builds on the current learning environments discussion and focuses on crossing the boundaries of current contexts. It features some emerging practices, including MOOCs, the mobile, game-based and social learning as part of an augmented learning experience; As well as using the Social Networking, the Semantic Web and Web services approaches to support learning through these emerging technologies.**

Keywords*— *Innovative learning; mobile learning; social learning; gamification; moocs; cloud computing; social networking; sematic web.

I. INTRODUCTION

Nowadays E-learning is enjoying wide popularity in Higher Education. It has reformed the educational field, and has altered the way we look at knowledge acquisition. Thanks to up to date technology, e-Learning environments are providing learners with a more impressive and useful educational experience. The technological innovations have made learning over the Internet possible. Compared with the traditional learning approaches, e-learning systems are superior in terms of convenience, independence, adaptation, and interaction [1, 2].

Today, the proliferation of learning innovations such as personal devices, distributed and heterogeneous applications and resources, requires the adoption of appropriate approaches to deal with the various information flows and tools to support learning. Such approaches are necessary not only in educational settings, but mainly in every life situation which can become a branch of lifelong learning. This paper reports on a renewed attempt to review and synthesize a substantial amount of current research on innovative learning approaches as well as the related Web technologies contributing to this promotion.

II. INNOVATIVE LEARNING APPROACHES

E-learning is one of the growing potential methods in the educational field. For institutions, to provide information technology that supports research and development Web technologies have to be combined to accommodate the required services. Over the last decade, it has been commonly argued that technology-enhanced learning might respond to the needs of the new knowledge society and renovate the way we learn.

A. Mobile learning

The use of mobile devices among people is highly rising and a novel tendency named mobile learning, is releasing new styles and challenges in learning. Owing to this advancement in mobile technologies, the learning process can take place anytime and anywhere, using mobile devices such as smart phones and tablets. Today, real life is mobile and mobile learning is definitely the direction we are moving. We consume more media on mobile devices than computers. It's argued that learning through mobile devices improves performance because of the learner engagement compared to traditional learning environments. Information on the learners' current learning context/situation should therefore be considered in order to provide the learner with appropriate learning objects/activities that fit best in his environment. [15] proposed the following architecture for higher education in a cloud computing environment.

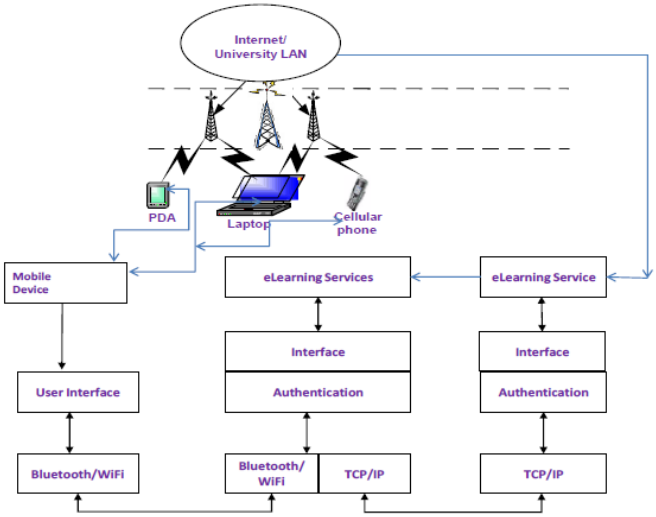

Fig. 1. Proposed Architecture for cloud based M-learning [15]

B. Social learning

Learning is social in nature, as has been emphasized by many researchers [4, 5, 6, and 7]. Social learning theory posits that learning is a cognitive process that takes place in a social

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context and can occur purely through observation or direct instruction, even in the absence of motor reproduction or direct reinforcement. [20]

Learning implies not only access to information but also access to other people [8]. In fact, the learning process is related to the activities, the environment, and the specific context in which it is developed and therefore social interaction is a critical factor. Today, this social and collaborative context can be created with the help of social media tools, which have started to prove their suitability for education [3]. Social media tools are increasingly being used in learning, allowing learners to actively engage with each other and with their teachers, co-create knowledge, share experiences, work and learn collaboratively. Recognizing the social aspect of learning, several TEL initiatives, such as Elgg, Moodle, CLIX, Plone, and Drupal are starting to integrate social modules into their solutions [9].

C. *Game-based learning*

Games and learning gamification are finally getting the recognition they deserve as powerful learning means. They are used to enhance learning for three main reasons: motivation, content mastery, as well as higher order skills. Games are tools that, when applied efficiently, result in the desired learning results. From this point of view, many researchers argue that computer games have the potential to change the mode in which people learn, and motivate and hold a new generation of learners in a way that traditional education does not.

In Figure 2 [16], the debriefing process between the game cycle and the achievement of the learning outcomes is shown. Debriefing illustrates the relationship between the game events and real-world events so to join the game experience and learning.

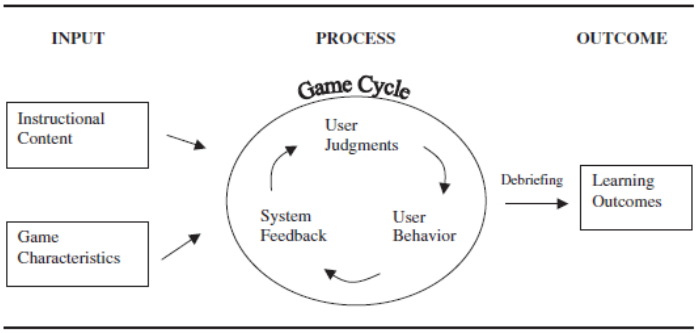

Fig. 2. Model of game-based learning [16]

D. *Moocs*

In the past year, Massive Open Online Courses (MOOCs) have attracted attention from the higher education community and the media. MOOCs are an evolving and expanding area with new developments likely to offer greater variety of courses and more innovative social learning pedagogies. They also offer the chance to run experiments that compare teaching methods. They can be considered as an extension of existing online learning approaches, in terms of open access to courses and scalability. At a time of globalization of education and constrained budgets, the current first-generation MOOCs stand for a starting point for experimentation in powering technology to increase access to education, to improve pedagogy, and to expand experience with innovative business models. As it seems to be confirmed in recent studies [10, 11], the MOOC concept already overpassed the peak and is actually dropping towards a more reasonable view.

Within the open education trend, new opportunities for sharing and collaborating are emerging. The following Figure 3 [17] depicts A number of related aspects of openness in different areas.

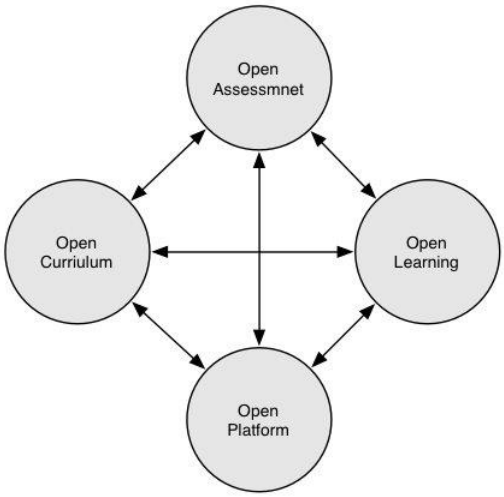

Fig. 3. Opening Up Higher Education [17]

E. *Challenges*

Disruptive changes in learning through emerging technologies are requiring new perspectives for the design and development of learning environments. These environments have to achieve specific requirements, such as adaptivity, flexibility, managing and analyzing massive amounts of data, immediate feedback for learners, as well as generating automated reports of the assessments' results. The aforementioned innovative approaches have to tackle the different dimensions of adaptation and personalization, including personal learning environments (PLE), efficient learner and group modeling, adaptive and collaborative learning methods and techniques, personalized mobile learning applications, well-organized educational games and evaluation techniques in such environments as well as the design and implementation challenges. By integrating information about the context and environment of the student into the learning process, new opportunities for providing adaptivity open up. Current research has to deal with using this information to provide learners with the appropriate material based on their contexts.

Furthermore, the current e-learning systems have to provide scalability, efficiency in resources utilization and costs associated with resource management. They also should be able to dynamically allocate the required computing and storage resources. A main issue could also be the impact of these approaches within informal and non formal learning

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contexts and the recognition of these opportunities to enhance and promote lifelong learning.

III. WEB TECHNOLOGIES

The recent emergence of Web technologies has a potential to alleviate the aforementioned challenges that should be tackled by innovative learning approaches so to make learning more efficient. Current investigations are nowadays focusing on the integration of Cloud Computing, Semantic Web and Social Semantic Web technologies in the e-learning space, and exploring the educational potential of their application in research areas, such as Learning Analytics and Big Data.

A. Cloud computing

Broadly defined, the cloud computing involves hosting ICT infrastructure, software applications, and other computing services into cloud servers and being accessed via the internet. Cloud computing provides delivery of services, software and processing capacity over the internet, reducing cost, increasing automating systems, decoupling of service delivery from underlying technology, and providing flexibility and mobility of information [12]. It relies on subsisting technologies like grid computing, virtualization, web services and of course the Internet, to provide on-demand services. These technologies must work harmoniously [13]. Basically there are three foundations upon which universities can implement cloud computing. These have been variously revealed as Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). Figure 4 [18] shows the layered organization of the cloud stack from physical infrastructure to applications.

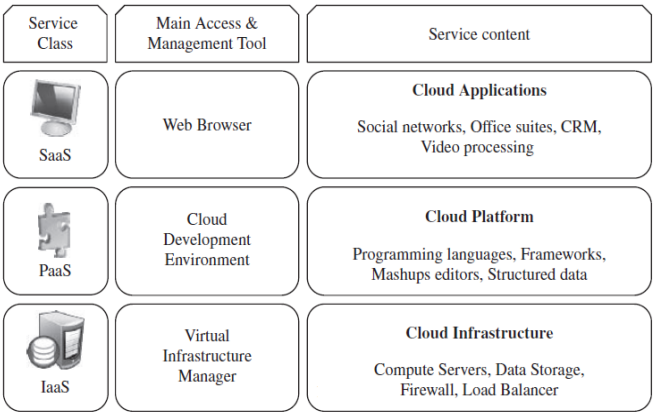

Fig. 4. Cloud service models [18]

Learners are already using various Web services for personal points. For instance, common social media outlets such as Facebook, Twitter, YouTube, and Flickr are based on cloud platforms provided by public cloud providers like Google and Amazon. As well, learners use Google cloud services like Gmail, GoogleDrive, and similar services from further providers. Hence, drifting existing learning services into the cloud is not something novel to the institutional society. In fact, academic staffs look forward to get same benefits in their activities through these cloud services as they do in their daily lives.

B. Semantic web

The Semantic Web constitutes an environment in which human and machine agents will communicate on a semantic basis [14]. It offers new technologies of web-based applications aiming at providing more intelligent access and management of the information and semantically richer modeling of the applications as well as their potential users. This permits automated agents to reason about the Web content, and react intelligently to unforeseen situations. Thus, semantic Web establishes a powerful approach to satisfy the eLearning requirements. It allows achieving reusability, shareability and interoperability among web applications. It provides advanced technologies to support more adequate and accurate representations of learners, their learning goals, learning material and contexts, as well as better access and personalized navigation through the available resources. The specification of components in a standard way could be realized through conceptualizations (formal taxonomies), ontologies, and the available web standards, such as XML, RDF(Resource Defintion Framework), OWL(**Web Ontology Language)**, DAML-S, and RuleML. Ontologies are particularly useful as they enable to share a common understanding of the information among people as well as among software applications. They make the domain assumptions explicit and allow reuse of domain knowledge so to avoid "re-inventing the wheel". Particularly, Web services offer a way to make such components mobile and accessible within the wide sea of web information and applications.
Figure 5 [19] depicts the components usually used as Semantic Web infrastructure when realizing functionality in applications.

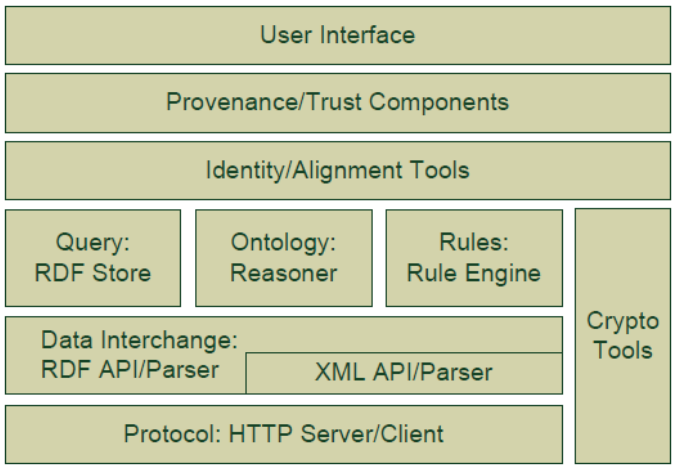

Fig. 5. Semantic Web Components Architecture [19]

C. Social networking

The social web is a set of social relations linking people through the Internet to build social networks among people who, for example, share interests, activities, backgrounds, or

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real-life connections. A social network service characterizes each user through a profile, his social links, and a selection of other services. These online social interactions shape the foundation of much online activities such as online shopping, learning, gaming and social networking websites. Most social network services are web-based and provide ways for users to interact together over the Internet, such as e-mail and instant messaging. Social networking services allow users to share ideas, pictures, posts, activities, events, and interests with people in their network. Through these sharings, collective intelligence is built.

Obviously, the trendy socialization of the Web has become powerful. The social Web has quickly become a way of life. Social network tools are reforming the way we communicate with each other inside and outside our learning environments. Hence, learning organizations seeking to evolve need to not only recognize the changes in technology and behavior but they also need to take a strategic approach to changing how learners are learning.

IV. CONCLUSION

Just like many ICT innovations, Web technologies can potentially improve the quality, and widen access of education. In this paper, we have illustrated how the current Web technologies are useful to provide support to the emerging practices in e-learning. We have sketched some key requirements for innovative learning environments. We argued that Cloud Computing, the Semantic Web, and the Social Web offer new perspectives on learning environments by providing intelligent management of Web information, and semantically richer modeling of tasks and their users. This permits more accurate modeling of learners, their goals, the learning objects and the different contexts of use, as well as more efficient access and navigation through learning resources. The aim is to advance intelligent learning systems to accomplish improved e-learning efficiency, flexibility, and adaptation for all of their users. The findings of the research showed that new Web technologies trends affect positively on innovative e-learning approaches.

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