This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

Learning Management Systems and Learning 2.0

Alexandros Soumplis, Eleni Koulocheri, Nektarios Kostaras, Nikos Karousos, Michalis Xenos

School of Science and Technology

Hellenic Open University

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

Abstract

The unprecedented growth of Web 2.0 has affected learning and has made possible the growth of learning networks. Learning networks are shaped by communities in order to help their members acquire knowledge in specific areas and are the most notable feature of Learning 2.0, the new learning era which focuses on individual learning needs. The evolution of Learning to its 2.0 era, forces traditional Learning Management Systems (LMS) to incorporate more Web 2.0 features and slowly transform to Personal Learning Environments (PLE). A Personal Learning Environment being a loosely structured collection of tools with strong social networking characteristics gives users the ability to create, maintain and redistribute their own learning content. This paper is a field study of the most well-known and established LMSs along with their support for specific features within several categories of tools in the core of Web 2.0. The incorporation of Web 2.0 features within those LMSs differentiates them regarding their ability and their potential to be used as PLE environments and this study aims to be a qualitative classification of those.

Keywords: Education, Learning 2.0, Web 2.0, Personal Learning Environment, Learning Management System.

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

Introduction

One of the most popular web sites in the globe is Wikipedia, ranked in the top 10 globally according to Alexa (http://www.alexa.com/topsites), an online encyclopedia with more than 3,7 millions of articles contributed by its users. On the other hand one of the most famous and well known encyclopedias, The Encyclopedia Britannica, is ranked below 7000 globally (http://www.alexa.com/siteinfo/britannica.com). Also regarding credibility Wikipedia has been evaluated in several studies which suggested that "the actual differences in accuracy may not be particularly great" (Flanagin & Metzger Metzger, p 358). This is an indicative comparison and pinpoints the potential held by Web 2.0 in terms of giving user active roles regarding the use of Web 2.0. And in Web 2.0 the term "use" includes not only passive consumption of information but also active participation and content generation (Lindmark, 2009). The generation of content by the user himself is key factor for the value of Web 2.0 applications and also drives the exponential growth of online social networks; Only on Facebook (2011) there were more than 800 million users. The enhanced role of users, being the leading actors for the available content online, also altered their attitude by encouraging them to connect, collaborate and share information, experiences, values and interests (O'Reilly & Battele, 2009; Grosseck, 2009). Yet Berners-Lee argues that Web 2.0 is not something new but rather, it is a marketing buzzword used by Internet enterprises to mock the vast majority of users about something innovative while it is just the implementation of Web 1.0 in its full potential, thus instead of Web 2.0 suggested the term Read/Write Web (Laningham, 2006).

Moreover and along with the rapid growth of Web 2.0 researchers began to study its effect to traditional distant learning systems and to the learning process in general (Downes, 2005; Anderson, 2007; Brown & Adler, 2008). Distance learning is "education imparted at a distance

This is a pre-print version of the paper published in:
International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

through communication media such as radio, TV, telephone, correspondence, computer or video" (Tissot, 2004, pp. 60). In accordance to the Web 2.0 paradigm, the term e-Learning 2.0 was introduced (Downes 2005; Wallis, 2006) to describe a bottom-up approach to the learning process, decentralized and towards user generated learning content (Thalheimer, 2008). In the same context, the use of Web 2.0 features for participatory communities of learners and learning ecosystems has been described as Learning 2.0 (Brown & Adler, 2008).

While Learning 2.0 and the building of learning ecosystems are emerging, the traditional learning model regarding education is the typical classroom where the teacher provides learning material and guidance to the students. The increasing growth of ICT technologies and networks over the last 20 years has made distance learning more attractive and feasible and led to the buzzword e-Learning during the "New Economy" era (Ebner, 2007). The growth of e-Learning and its wide acceptance from educational organizations due to its positive effects (Weiss et al, 2002; Holzinger, 1997) encouraged the development of numerous Learning Management Systems (LMS) to support the e-Learning process.

This study describes the evolution of Web 2.0 and focus on its core features that relate strongly to Learning Management Systems and support the learning process. Moreover these features are checked against a selection of several LMS, methodologically chosen among others. This comparison chart then allows the loose classification of these LMSs regarding their ability to adapt to the Web 2.0 needs and the creation of Personal Learning Enviroments, which are the successors of LMSs in the Learning 2.0 context. The first section of this study is an introduction to Web 2.0 and how it influenced e-Learning and traditional Learning Management Systems. Next there is an extensive presentation of the most well-known and established Learning Management Systems and the rationale behind the choice of them among other according to the

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

described methodology. Also there is a brief description of some important core features and tools of Web 2.0 that can be existent and required within a distant learning environment. The following section presents a detailed chart where each LMS is checked against the chosen Web 2.0 tools in terms of existence and support for each tools in order to proceed to the discussion session where there are comments of the charts and propositions for the future roadmap of LMSs.

Towards e-Learning 2.0

The bloom of Web 2.0

In the beginning of the 1990's Tim Berners-Lee introduced the World Wide Web (WWW), an Internet service for people to collaborate and share their knowledge through the use of hypertext documents (Berners-Lee, 1991). Since then, the WWW has been a key element of the Internet and followed the same exponential growth as the Internet. According to ITU (2011) 70% of people in developed countries are Internet users and their number has doubled in five years, with more than 2 billion users in 2010. Moreover, Netcraft (2011) reports more the 500 million websites in October 2011 which is almost 5 times the number of websites before five years and 25 times the number of websites in the beginning of the new millennium. These numbers are a clear indication of the fact that the World Wide Web, usually referred to simply as the Web, is rapidly evolving and constantly more users use it for content sharing. While in its early beginnings and until mid 2010's the vast majority of users of the Web acted solely as content consumer and only very few of them where content creators as well (Cormode & Krishnamuthym, 2008). The situation changed drastically as the Web evolved in the second half of 2010's and the majority of users has turned to become content generators apart from being content consumers. This new era of the Web apart from making the user being in control of the

This is a pre-print version of the paper published in:
International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

content on the Web, has also been a key enabler for the bloom of online social networks (Bhatnagar et al, 2009). The new era of the Web has been characterized by the buzzword Web 2.0 and the first Web 2.0 sites emerged on early 2004. Tim O'Reilly was the first to name the "Web as a platform" as Web 2.0 (O'Reilly, 2006) and few years later, the same person ascertained that "It's time to leverage the true power of the platform… the Web is now the world" (O'Reilly & Battele, 2009, p. 10). The use of the term Web 2.0 was not accepted instantly and gained a lot of criticism, mainly as being a marketing buzzword rather than something new. Tim Berners-Lee argued that originally the Web has been created with the concept of connecting people and pointed that Web 2.0 utilizes Web 1.0 standards, so it should be thought more as an extension instead of something novel (Laningham, 2006).

A more accurate definition of Web 2.0 has been suggested by Downes (2004) who described it as a short term for the shift from what was called the "Read Web" to the "Read-Write Web". This shift makes any user the leading actor as he is not just a passive receiver of information, but becomes a self-publisher able to "self-express" himself. The capability of self-publishing gave users the ability to become part of a collective wisdom which was named after the term "wisdom of crowds". The term "wisdom of crowds" comes out of the idea highlighted in the title of Surowiecki's book (2004) "The Wisdom of Crowds: why the many are smarter than the few and how collective wisdom shapes business, economies, societies, and nations" where the author states "it's as if we've been programmed to be collectively smart" (Surowiecki, 2004, p. 11). The original concept of this idea was not meant to be applied on the Web but it has been very influential on the Web 2.0 style of thinking and it is the core of ideas like folksonomies, where users tag information and objects in a social environment (Vander Wal, 2005), or crowdsourcing which represent the act of a company or institution to take a function once

performed by employees and outsource it to an undefined network of people in the form of an open call (Howe, 2006). The idea of collective knowledge and harnessing the power of the crowds has its roots to a fundamental and crucial factor over which Web 2.0 operates. This factor is openness as Web 2.0 gains power from open spirit, open attitude, open standards, open data formats, open APIs (Application Programming Interfaces) as well as open source software. A special remark belongs to open APIs and open data format. Both enable the Web to operate as a platform and allow users to develop services on top of those platforms working together and exchange data to each other. Openness along with sharing, acting globally and peering are the key enablers that allow participants to exchange information freely, thus promoting collective intelligence (Kim et al, 2010).

The Web 2.0 has spread rapidly like wildfire (Lindmark, 2009) and there is already discussion about the future of the Web and even for Web 3.0. O'Reilly and Battelle (2009) argue that the Web is growing up, and we are all its collective parents. The Web is slowly moving towards intelligence and the Web learns. Data collected by and for the Web transform it from an unstructured collection of information and knowledge to a structured ecosystem where people, services, business, data, content and ultimately content co-exist, interact, form each other and create value. These special characteristics formed in a Web 2.0 environment create the conditions for the "emergence of new kinds of open participatory learning ecosystems that will support active, passion-based learning: Learning 2.0" (Brown & Adler, 2008, p. 32).

From LMS to PLE

The rapid growth of Web 2.0 among other influenced the way users acquire knowledge. Ian Davis (Davis, 2005) argued that Web 2.0 is an attitude not a technology as it led the Web back to its roots where participation was encouraged and it was a socially open network. This

This is a pre-print version of the paper published in:
International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

social openness inevitably influenced e-Learning and the learning process as a whole. The original learning process follows the traditional one-to-many model. An educator and all the attendants are present concurrently in the same physical location, usually the classroom, and the expert figure of the educator leads the learning process. Along with the growth of Internet and digital media the learning process also evolved to an asynchronous process where the educational content could be delivered to attendants not necessarily to the same physical location and not necessarily concurrently and gives learners the ability to follow the learning process on their own pace. However there still is the expert figure of the educator who drives the learning process and defines the learning content. Those two models of the learning process represent two different but coexisting eras in terms of the method and the means to achieve knowledge acquisition. Cobb argues that the first is Learning 1.0 while the latter is Learning 1.5, trying to pinpoint the fact that the learning process evolved to adapt to the advance of technology and exploit the opportunities teachers have by using new technologies, yet in its core the learning process remains unchanged (Cobb, 2008).

Along with the growth of Web 2.0, the learning process also moves towards a new dimension which has been named after the term Learning 2.0 to describe initially technology enhanced learning (Brown & Adler, 2007). Yet Cobb (2008) used the term Learning 2.0 to describe a new era of learning where the teacher-expert model breaks down and collaborations form between learners themselves rather than teacher and learners. Yet the roots of Learning 2.0 go back to 2005 when Downes presented the term “e-Learning 2.0” to describe the evolution of e-Learning along with the Web as a whole and pointed out that learning content is created and distributed in the Web 2.0 manner (Downes, 2005). In the Learning 2.0 era learning content does not follow the traditional route of composition, organization, repack and distribution but instead

This is a pre-print version of the paper published in:
International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

the content is syndicated. All participants contribute to the learning process, by contributing learning material and sharing learning experiences. Learners aggregate content, remix it according to their own needs and style, then enhance it with additional resources, their own knowledge and experiences and finally they redistribute this new "knowledge packet" to be the input for other learners interested in this topic. The learning process deconstructs to its elements and potentially every learner can become an educator. Thus the teacher is not the ultimate expert figure but rather a coordinator of the learning process able to give the primary guidelines in a learn-centric rather than course-centric approach. In the Learning 2.0 era, we do not talk about expert-driven courses but for social learning networks which are formed remarkably fast (Cobb, 2008).

The adaption of the learning process to technology enhancement as well as the wide deployment of e-Learning courses required the appropriate tools in order to serve as the environment over which the learning process occurs. The tools associated with e-Learning and particularly e-Learning 1.0, where there is a broadcast logic of transmissive teaching (Ehlers, 2009), are usually called Learning Management Systems (LMS). The term LMS is used to describe software to deliver and manage educational content and material with focus on delivering courses. As within a traditional classroom or educational institution, a course is divided into modules and lessons. Each course consists of the related education material as well as exercises, practice tests and self-evaluations. Moreover, in order to substitute face to face communication, LMSs may offer discussion fora or instant messaging capabilities. Typically these systems are integrated with an organization's informational system to provide extended functions such as the measurement of effectiveness and the impact of courses as well as the overall cost of training initiatives (Siemens, 2006). LMSs provide static educational material

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

with relatively poor opportunities for interaction, content-creation and collaboration among the participants.

Traditional LMSs project the impact of the “Read Web” to education. Yet according to Tim Berners-Lee’s original vision the Web itself has been transformed to the “Read-Write Web”, so it is expected that LMSs incorporating and supporting Learning 2.0 capabilities project the impact of the latter "Read-Write Web" to education (Downes, 2005). In the Learning 2.0 era, LMSs transform to Personal Learning Environments (PLEs). The name Personal Learning Environment is the evolution of what Downes (2005) named personal learning portfolios describing the personal online space where a learner create, maintains and presents his work. PLEs are systems that help learners to take control of and manage their own learning and consist of various tools and existing modules in LMSs, but in a less structured manner along with social characteristics as those are available on the Web 2.0 platform (Van Harmelen, 2006). In a PLE a learner can organize his material and search through it. Also the same material can easily be shared and the other users of the environment can post comments and thoughts on it, thus making it the seed for further discussion. Moreover within a PLE any user can create or join communities with common objectives and work collaboratively on achieving a learning goal. A PLE is loosely structured around various tools, with the most important of them being social networking and bookmarking, search, wiki, blogs, communities and file repository (Li & Huiping, 2010).

During the early stages of the emergence of PLEs, Scott et. al. (2006) identified six unique characteristics of PLEs that differentiate them from existing LMSs. The first characteristic is that PLEs focus on coordinating connections between the user and services in order to meet the demands of learners to integrate experiences and data from various

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

environments such as work, education, leisure and every day activities. Moreover a PLE should rely on symmetric relationship and give all users the opportunity both to share as well as consume resources and data. A direct consequence of the first two characteristics is the existence of individual content, thus the user of a PLE should not expect a homogeneous experience but in fact access, evaluate and use information from several and heterogeneous environments. Furthermore the Web 2.0 paradigm has served as a proof of concept for the potential of the use of open standards and lightweight open application programming interfaces (API) for data and service exchange between applications, systems and environments. Thus a PLE should exploit the use of open standards and take full advantage of existing APIs both to integrate and provide services. At this point it is vital to pinpoint the fact that a PLE can exploit the value of open standards and open APIs as long as the actual content within the PLE is also open, so PLEs should encourage users to accept and share their content under an open license such as the Creative Commons Licenses (http://www.creativecommons.org).

This fact offers increased adaptability to different learning approaches. In particular, in the Learning 2.0 era there is a shift from course and content oriented learning to a people centered learning, so instead of the traditional top down approach there is an adoption of a bottom up approach. Learners collaborate and interact with each other, with tutors and with instructors and all actively participate and shape the learning courses and learning material. The interaction and open interconnection between participants builds a learning network which allows the flow of information to all potential knowledge consumers and knowledge contributors. A learning network is like an ecosystem; it constantly changes, it is defined by interactions and knowledge is emergent and complex, therefore it has more in common with how human beings learn than traditional approaches to knowledge and learning (Downes, 2004).

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

A review of Learning Management Systems in the Web 2.0 context

LMS Collection

The previous section discussed about the evolution of learning in accordance with the evolution of the Web. The discussion presented the role of Learning Management Systems to support the e-Learning 1.0 course delivery. It also presented Personal Learning Environments which take a different approach from LMSs in order to support the e-Learning 2.0 concept. As Personal Learning Environments is a relatively new concept, the vast majority of existing tools and widely deployed installations to support e-Learning fall into the category of LMS. Thus under the e-Learning 2.0 perspective this study is about to methodologically investigate the most well-known LMSs available and their support for Web 2.0 features which will classify them closer to the e-Learning 2.0 area and prepare both institutions as well as participant to adopt to the e-Learning 2.0 attitude as described in previous sections. The collection of LMSs includes a wide variety of tools ranging from those that are traditional and well-established (from commercial and users' perspective) to more recent ones which are obviously closer to the Web 2.0 dimension. In the following section there is a detailed presentation of the rationale behind the selection of specific tools out of the myriads available.

Selection Methodology

The selection of LMSs was conducted following a structured and well-defined methodology. Initially, a wide research on the Web was conducted. This research involved selection and examination of lists of LMSs. The credibility of the lists' authors was also checked and the refinement of this generic list was the next step. This was conducted through five 'filters' that act in a complementary way. Tools that meet at least two filters were selected. These five filters were:

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

1. Award finalists: Tools that have been proposed as finalists to well-known software contests; these contests should have multiple categories and special e-Learning categories in order to maximize the impact of the award into this research.
2. Award winners: Tools that have been proposed as finalists to well-known software contests; these contests should have multiple categories and special e-Learning categories in order to maximize the impact of the award into this research.
3. Inclusion of ranking lists: Tools that have been included in ranking lists that have been set by e-Learning experts; this means that all these tools have already been well accepted by experts or community of users and this is significant for the inclusion of such tools in the final list of this research.
4. Positive comments by end-users: positive comments from end-users (included visually/hearing impaired ones) were taken into consideration. In order to make sure that these comments were spontaneous and objective, they were sought out of the official websites of the e-Learning environments.
5. Results from comparative studies: Comparative studies from e-Learning experts; these studies involve either features comparisons or technical reviews that reveal all weaknesses and strengths and contribute to a catholic overview.

One additional filter taken into consideration was the tools that have already set up and are in use by the Hellenic Open University for educational or research purposes. These tools have been added in the final list since the scope of this study has been to identify how the tools in use within to only official distant learning university in Greece face the Learning 2.0 challenges. The methodology schema (Figure 1) presents the interaction of these five filters.

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

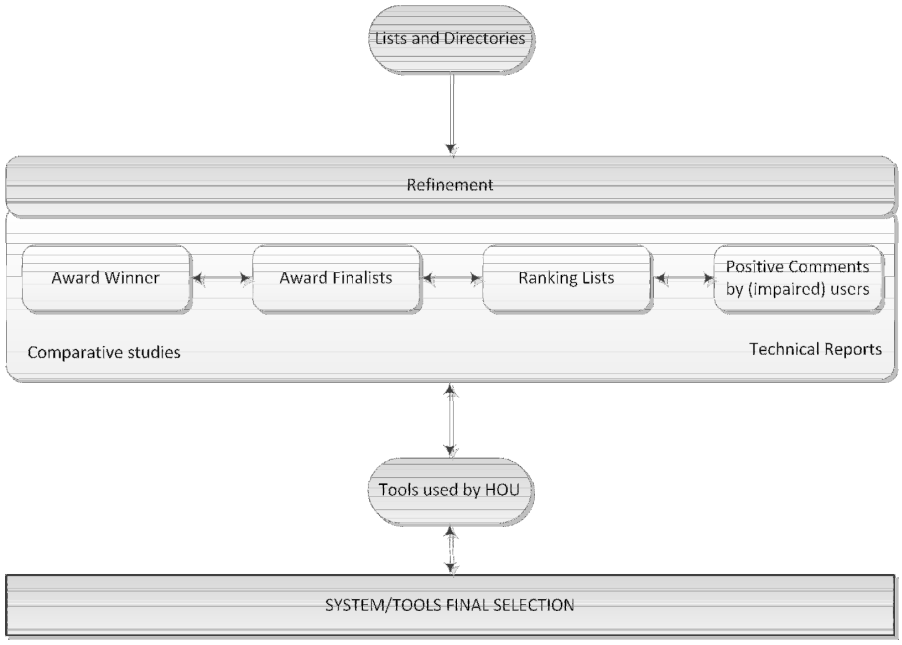

Figure 1 – LMS selection procedure schema

Choice of LMSs

The aforementioned method was applied in this research, in order to choose a set of LMSs for further study regarding their Web 2.0 features.

At first, a list of systems and tools has been gathered from several portals such:

- Centre for Learning and Performance Technologies UK (Hart, 2010).
- Elearninglearning (2010): Collection of reviews about e-Learning.
- ACM elearnmag (2010)

The next step was the refinement of this list. This refinement was achieved taking into consideration the five filters described above. Below, all five filters along with their corresponded sources are presented:

1. Award finalists:
    a. Software and Information Industry Association (SIIA) Codie Awards 2009/2010/2011(2011).

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

b. Brandon Hall Research Excellence Awards 2009/2010/2011(2011).

2. Award winners:
    a. Software and Information Industry Association (SIIA) Codie Awards 2009/2010/2011 (2011).
    b. Brandon Hall Research Excellence Awards 2009/2010/2011 (2011).
    c. Chief Learning Officer Awards 2010 (CLO, 2011).
3. Inclusion of ranking lists:
    a. Top 100 Tools for Learning of 2008/2009/2010/2011 (C4LPT, 2011), set by Centre for Learning and Performance Technologies UK.
4. Positive comments by end-users: Such comments were retrieved from end-users fora, communities' sites as well as from the video content provider YouTube.
    a. CANnect (2011): Comprehensive and accessible collection of online opportunities for people with visual impairments.
    b. Hearing Hub (2011): A community and virtual meeting place for educators and researchers in the field of deaf and hard of hearing education.
    c. ADCET (2011): Australian Disability Clearinghouse on Education and Training.
    d. Classroom 2.0 (2011): A social network for those interested in Web 2.0 and Social Media in education.
    e. Adult Learning Online (2011).
    f. Open ACS (2011): The toolkit for Online Communities.
    g. YouTube (2011).
5. Results from comparative studies:

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

a. Edutools (2011): Independent reviews, side-by-side comparisons, and consulting services to assist decision-making in the e-learning community by the Western Cooperative for Educational Telecommunications.
b. Elearninglearning (2010): Collection of reviews about e-Learning.
c. eLearn Magazine, (2011): Articles and reviews from comparative studies.

Finally, it is important to note the fact that the software license under which each product is released has not been a criterion for its selection.

The following table (Table 1) summarizes the relation between the aforementioned sources (alphabetically) and the systems and tools selected:

Source	**e-Learning System/Tool**
Brandon Hall Research Excellence Awards 2009	eFront
Brandon Hall Research Excellence Awards 2011	Desire2Learn
Chief Learning Officer Awards 2010	Meridian Global LMS: Winner of 2010 Learning in Practice Bronze Award
Edutools	.LRN, ATutor, Blackboard Learn, Claroline, Desire2Learn, eFront, JoomlaLMS, Moodle, Sakai, Edvance360 and OLAT
eLearn Magazine	LRN, ANGEL Learning, Blackboard Learn, Desire2Learn, Moodle, Sakai
eLearningLearning	Blackboard Learn, Docebo, Dokeos, EKP LMS, Informetica, Intralearn, itslearning, LAMS, Latitude LMS,

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

	Meridian Global LMS, Moodle, SharepointLMS
Positive comments from end-users	.LRN, Angel Learning, Blackboard Learn, Claroline and Moodle
SIIA Codie Awards 2010	Blackboard
SIIA Codie Awards 2009	ANGEL Learning and Edvance360 * Edvance360: Winner of CODiE Award for Best Postsecondary Course or Learning Management Solution 2011.
Top 100 Tools for Learning of 2008/2009/2010/2011	eFront, Elgg, and Moodle
In use by Hellenic Open University	Elgg, LAMS v2.3.3, Moodle v1.9

Table 1 – Learning Management Systems and the sources they derived from.

Web 2.0 Applications for Learning

In the Web 2.0 there are numerous applications and a vast amount of new tools is being actively developed. Regarding e-Learning and how these tools affect the learning process and particularly the tools used to deliver learning material there has been previous research which identifies some general Web 2.0 features as those are used in specific fields of education (Conole & Alevizou, 2010; Crook et al, 2008; Brown & Adler, 2008). Those Web 2.0 features include both synchronous and asynchronous communication tools but as this study relates to LMSs and platforms established for course delivery, there was a choice not to take into consideration tools for synchronous communication for evaluation purposes. As a result the final list of Web 2.0 features that are going to be used for evaluation and qualitative classification regarding e-Learning 2.0, are the following:

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

- Wikis and Glossaries, which may be included under the generic term co-authoring services.

Wikis are a collection of web pages designed to enable anyone with access to contribute or modify content. Wiki services are often provided by collaborative websites and aim to power community websites (Jokisalu & Riu, 2009). Tools with embedded wiki's creation capabilities, give the end-users the opportunity to exchange opinions on a topic and move towards a new situation where educational material is authored collaboratively, knowledge is dynamic and intelligence is collective. Similar to a wiki, glossaries are also created collaboratively by users. Many systems afford glossary modules that allow users to describe new terms regarding a topic encouraging both learners and teachers to participate to knowledge creation.

- Blogs which were initially named after the term weblogs. According to O'Reilly & Batelle (2009), "One of the most highly touted features of the Web 2.0 era is the rise of blogging". Blogs are a users' personal information database, but can also be used as a medium for community building, communication and reflection. Among the various possibilities for interaction, they usually offer a commentary function for feedback from readers and the opportunity for different authors to interconnect with one another's contribution. Learners on a course can use a personal blog to document their own work or texts chronologically and publish their methods or results for their classmates or ask them for feedback and thereby gain new input and perspectives for the continuing learning process (Jokisalu & Riu, 2009). According to Downes (2005), "blogging is very different from traditionally assigned learning content. It is much less formal. It is written from a personal point of view, in a personal voice".

- Fora, namely time-based asynchronous discussion. Similar with blogs, fora contribute to the facilitation of asynchronous communication among end-users, while they permit them to

exchange opinions, ideas and finally knowledge regarding a topic. They contribute also to the creation of a social network of members with common interests.

- RSS services that represent content syndication. One of the aspects that define Web 2.0 is content syndication through technologies such as RSS "Really Simple Syndication" which "is used to push out blogs updates. RSS allows someone not just to link to a page, but to subscribe to it, with notification every time that page changes" (O'Reilly, 2006, p. 24). RSS allows updated information from Web pages to be aggregated in one place using RSS aggregator software. As updates happen in online social network sites or new sites, RSS feeds enable learners to stay more attuned to friends or world events, respectively, though the range of multimedia information posted (O'Reilly, 2006).
- Multimedia sharing to represent content sharing. The new era does not require sophisticated technical expertise but allows users to publish, share, consume and remix content through features that are facilitated (O'Reilly, 2006). File-sharing, for example, evolves not as a sudden criminality among today's youth but rather in their pervasive belief that information is something meant to be shared. Sharing content is not considered unethical (as meant to be recently); indeed, the hoarding of content is viewed as antisocial. Open content is viewed not merely as nice to have but essential for the creation of the sort of learning network (Downes, 2005). Multimedia sharing has been divided into two sub-categories, file sharing (such as documents, presentations etc.) and application sharing.
- Audio and video conferencing in the context of communication and the creation of reusable context. As mentioned above, Web 2.0 supports knowledge creation collaboratively, using applications such as blogs and wikis. Audio and video conferencing objects can be recorded, reused (Rosenberg, 2000; O'Reilly, 2006), and delivered to the participants thus it can be

considered as content creation. Furthermore, audio and video conferencing contributes to the elimination of geographical barriers, since many of the related environments provide synchronous communication among the participants. This also enhances the delivery of knowledge collaboratively.

Web 2.0 Features in LMSs

Having constructed a list of LMSs for evaluation as well as a list of Web 2.0 applications for e-Learning tools it allows the next step of this research to be performed. The next step is to identify which of the identified Web 2.0 features is present in each LMS in the constructed list. In order to achieve that the most efficient, in terms of credibility and required effort, method has been selected for every tool or a combination of them. The available methods used either standalone or in any possible combinations where (a) published feature list, (b) public online available demo, (c) demo account on existing installations and ultimately (d) explicit installation using lab infrastructure and sample data when and if required. For every tool while the minimum requirement was at least one method to be applicable, it proved to be feasible to check and construct the Web 2.0 feature list with at least two or more methods. At this point it should be noted that the only requirement set for each Web 2.0 feature was to be available for an LMS without taking into consideration quality or usability factors which are beyond the scope of this study. The resulting matrix is in Table 2, where for every tool there is a mark in every column where a Web 2.0 feature is available in this tool.

	Product Name & URL	Wiki	Blogs	Forum	Glossary	RSS	Files sharing	Audio visual sharing
1	.LRN http://dotlrn.org	X	X	X		X	X	
2	ANGEL Learning v7.4 http://www.angellearning.com/	X	X	X		X	X	

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

3	Atutor v2.0.2 http://www.atutor.ca	X	X	X	X	X	X		
4	Blackboard v9.1 http://www.blackboard.com	X	X	X	X				
5	Claroline v1.10.4 http://www.claroline.net	X		X		X	X		
6	Desire2Learn http://www.desire2learn.com		X	X		X			
7	DoceboLMS v4.0.4 http://www.docebo.org	X		X	X		X		
8	Dokeos v2.0 http://www.dokeos.com	X	X	X	X			X	
9	Edvance360 http://www.edvance360.com	X	X	X		X			
10	eFront v3.6.9 http://www.efrontlearning.net	X	X	X	X	X			
11	EKP LMS http://www.netdimensions.com/products/lms.php	X	X	X			X		
12	Elgg http://elgg.org	X	X	X		X	X		
13	Ganesha v4.5 http://www.anemalab.org	X		X		X			
14	Informetica http://www.informetica.com	X					X	X	
15	Intralearn http://www.intralearn.com			X	X		X		
16	itslearning http://www.itslearning.eu		X	X			X	X	
17	JoomlaLMS http://www.joomlalms.com			X		X	X	X	
18	LAMS v2.3.5 http://www.lamsinternational.com	X		X		X			
19	LatitudeLMS http://www.latitudelearning.com/	X	X	X		X			
20	Mahara v1.3 http://www.mahara.org		X			X	X		
21	Meridian Global LMS http://www.meridianksi.com/products/meridian_global_lms/	X	X	X			X		
22	Moodle v2.0.3 http://www.moodle.org	X	X	X	X	X	X		
23	OLAT v7.2 http://www.olat.org	X	X	X		X	X		
24	Sakai v2.7 http://sakaiproject.org/	X	X	X	X	X	X		
25	SharepointLMS v2.1 http://www.sharepointlms.com/	X		X		X			

Table 2 – Learning Management Systems Features and Web 2.0 Features

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

The results on Table 2 indicate the fact that most of the existing LMSs have already incorporated some Web 2.0 features. Almost 75% of the LMSs have more than half of the Web 2.0 features under evaluation present which is clear indication about the effect of Web 2.0 on the LMSs as well as the adaptivity of the software market to the users' needs, as users of those systems, having any role, are accustomed to expecting and using feature rich applications exploiting the full potential of native Web 2.0 applications. On the contrary, none of the those systems included all of the checked Web 2.0 features and only a slight 10% of them included 6 out the 7. This notice along with the previous one leads to the conclusion that while LMSs tend to move towards the Web 2.0 and take advantage of its features, there is still much room for improvement and much effort to be done, in order to get close to the e-Learning 2.0 and their transformation to PLEs.

Another interesting remark that is derived from the Table 2 is the fact that the most common features available are Wikis and Fora. Both these features have been existent from the early beginnings of Web 2.0 and are very common and familiar to users. On the complete opposite side are the Audio and Video sharing capabilities which are existent in less than 20% of the LMSs, as a result of special requirements to support them. Those requirements impose limits both in the infrastructure supporting the LMS, in terms of bandwidth, computing and storage resources, as well as in the end users of the LMS in terms of bandwidth, equipment and expertise to use the special equipment.

Furthermore, the examined Web 2.0 features can be separated to two categories. The first category comprises of features that support asynchronous communication and include Wiki, Blog, Forum and Glossaries. Into this category can also be included RSS as long as it is used for dynamic content pulling from external resources and not for synchronous and dynamic message

This is a pre-print version of the paper published in:
International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

exchange between applications. The second category comprises of features related to synchronous communication and it includes Audio and visual sharing. Into this category can also be included the file sharing in the context of application sharing which allows concurrent access and use to the same application. Having separated the Web 2.0 features into these two categories it can be noticed that 70% of the LMSs support only asynchronous tools a fact that indicates the importance of asynchronous communication. Asynchronous communication is also important for LMSs as it allows users to collaborate, each on its own pace and having adequate time to use learning material, research more on specific subject and present complete items for sharing with others.

However the existing gap between synchronous and asynchronous features in LMSs imposes obstacles towards moving to e-Learning 2.0 and the massive use of PLEs. Moreover as it is argued that the use of technology will give the opportunity to learners to increase their autonomy and consequently increase their self-efficiency (Johnson & Liber, 2008), learners and other educational stakeholders are expected to push the software industry for better and faster integration of both features and even more within newer versions of the existing LMSs. Moreover few of these systems can exploit the full potential of Web 2.0 and encourage users to enrich the content of an LMS by adding new content or improving the already existing one. Also there are limited capabilities for users to expand, extend the functionality and build on top of the provided features of an LMS in order to adapt it to their own personal needs.

Yet, another fact to be noted is that the nonexistence of a complete system that combines both synchronous and asynchronous features, advocates the flexibility and diversity in the technologies and tools that the multidimensional process in a Learning 2.0 environment demands. The openness, which is a fundamental principle in Web 2.0 and exists in most open

source tools, gives the community the ability to adapt an environment to its specific needs and orientation. Data are to be used, transformed and enriched in any way as long as new tools or applications fit to the environment's framework. Flexibility is in the core of Web 2.0 application and it is a valuable asset of any e-Learning 2.0 environment.

Why Learning 2.0 is not the "Holy Grail" of education

Davis (2005) argues that the Web 2.0 is more an attitude rather than a technology. And while Learning 2.0 is still in its early stages, this fact also applies. The interdependency between a user's attitude towards technology and the usage of tools adds value to novel services as it feeds the loop:

- "Need of functionality" which leads to
- "Development of tools" which are
- "Used by users" who
- "Require new features", thus they create new
- "Need of functionality"

This never ending loop affects tools used for Learning and consequently modern LMSs are expected to incorporate more features and application closer to the Web 2.0 attitude. Also the fact that Learning 2.0 natively encourages openness, social interaction and collaboration among users, poses a demand for LMSs to become more adaptive to each learner's individual needs.

Yet, the adaption of the Learning 2.0 attitude should not be thought as the ultimate solution for knowledge acquisition and especially in lifelong learning activities as it poses the risk of digital division. Any potential learner is expected to have equal opportunities in accessing learning tools and should not be limited by his skills in using new technologies, tools or learning environments. Any learner must be able to form his social learning network, participate and

collaborate equally with focus on knowledge transfer and not use of the tools. In any other case where a learning network is not a win-win and beneficial case for all participants, it is highly possible for a learner not to have the expected learning outcomes, thus he is likely to drop off and turn to traditional learning methods. This will turn him again to a knowledge consumer instead of a knowledge consumer and contributor. Moreover according to Xenos (2008) a negative first impression is hard to change and a user expects to be able to locate and exploit all available functions easily even though eventually he will use only on a small fraction of the provided functionality. This fact makes highly likable for a learner who drops off a learning network to be reluctant joining in another in the future.

Future Research

This study focused on LMSs and some of them have been selected due to the fact that are being used within the Hellenic Open University. The analysis of the results indicated that Elgg is the only environment with the potential to server as an e-Learning 2.0 environment to support learning activities. These learning activities can be distinguished in formal and informal although the limits between them are fundamentally indistinct. Taken also into consideration dynamic nature of the formation of learning networks informal learning activities become an important part of the learning process within an institution. The question that rises as a result is whether informal learning outcomes can be evaluated and measured and even further how a participant can achieve official accreditation for specific learning goals. Hellenic Open University (HOU) has put effort on this direction by establishing, operating and supporting experimentally in its official learning activities an e-Learning 2.0 environment, named after the title HOU2LEARN (http://hou2learn.eap.gr) which aims to encourage students in computer science to share

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

knowledge especially on issues related to software engineering and software usability (Soumplis et al, 2011).

The dimension of formal and informal learning is especially important for e-Learning 2.0 environments thus the qualitative classification of this study might not be adequate as it takes into account solely the Web 2.0 dimension of a learning environment. Further research on the subject is going evaluate and classify learning environments according to both their Web 2.0 features as well as its formality features using the Twobility factor as the ranking criteria (Soumplis et al, 2011).

Conclusions

This study is an extensive analysis of existing Learning Management Systems in terms of the Web 2.0 features and applications they incorporate. The analysis resulted in a detailed matrix which records the available Web 2.0 features chosen for the analysis within 25 LMSs, methodologically chosen with specific criteria upon several dozens of others. This research aims to be a qualitative classification tool for those LMSs and a paradigm for the qualitative evaluation of any other regarding its potential to serve its educational purpose as a Personal Learning Environment.

Further analysis of the results indicates the incomplete support of some core Web 2.0 features, as those has been chosen as evaluation factors, from the majority of the LMSs under examination. This limited support indicates the fact that for LMSs further steps have to be taken in order to be considered PLEs, yet the fact that all LMSs incorporate at least 3 Web 2.0 features or applications designates the movement of LMS to adapt to the Web 2.0 attitude and each user's individual needs. This tension of LMSs to mirror a PLE's role is the first step towards the consolidation of the PLE era. It must also be noted that this analysis should not lead to the

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

misconception that there are no existent PLEs. On the contrary there are PLEs available and even some of the tools examined in this study such as Moodle, Elgg, Sakai and others, that apart from LMSs can also be considered PLEs.

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

References

ACM elearning mag, (2010). Retrieved February 15, 2011, from http://www.elearnmag.org/

ADCET - Australian Disability Clearinghouse on Education and Training, (2011). Retrieved February 15, 2011 from http://www.adcet.edu.au

Adult Learning Online, (2011). Retrieved February 15, 2011, from http://adultlearningonline.pbworks.com

Alexa Internet Inc, (2011). Retrieved October 30, 2011 from http://www.alexa.com/topsites

Alexa Internet Inc, (2011). Retrieved October 30, 2011 from http://www.alexa.com/siteinfo/britannica.com

Anderson, P. (2007). What is Web 2.0? Ideas, technologies and implications for education. *JISC,* Technical Report. Retrieved July 15, 2011, from http://www.jisc.ac.uk/media/documents/techwatch/tsw0701b.pdf

Bhatnagar, S., Herath, T., Sharman, R., Rao, H. R. & Upadhyaya, S. J. (2009). Web 2.0: Issues for the Design of Social Net. In Lytras, M., Damiani, E. & Ordonez de Pablos, P. (Eds.) *Web 2.0 The Business Model* (pp. 1–14). Springer Publishing, Doi: 10.1007/978-0-387-85895-1_8

Brandon Hall (2011). Brandon Hall Research Excellence Awards 2009/2010/2011. Retrieved February 15, 2011, from http://www.brandon-hall.com/awards/awards.shtml

Brown, J. S., & Adler, R. P. (2008). Minds on fire: Open education, the long tail, and learning 2.0. *Educause Review*, 43, 16.

C4LPT, (2011).Top 100 Tools for Learning of 2008/2009/2010/2011, *Centre for Learning and Performance Technologies UK.* Retrieved July 15, 2011, from http://c4lpt.co.uk/top-tools/top-100-tools-for-learning-2010/

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

CANnect, (2011). Comprehensive and accessible collection of online opportunities for people with visual impairements. Retrieved February 15, 2011, from http://www.cannect.org/

Classroom 2.0 (2011). A social network for those interested in Web 2.0 and Social Media in education. Retrieved February 15, 2011, from http://www.classroom20.com/forum

CLO (2011). Chief Learning Officer Awards. *CLO*. Retrieved February 15, 2011, from http://clomedia.com/articles/view/excellence-in-lms/2

Cobb, J. (2008). Learning 2.0 for Associations. Learning. Mission to Learn. Retrieved February 15, 2011, from http://www.tagoras.com

Cormode, G. & Krishnamurthy, B. (2009). Key differences between Web 1.0 and Web 2.0, First Monday [Online], Vol. 13 (6), (2 June 2008). Retrieved February 15, 2011, from http://pear.accc.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2125/1972

Davis, I. (2005). Talis, Web 2.0 and All That. Internet Alchemy. Broadway Business. Retrieved February 15, 2011, from http://iandavis.com/blog/2005/07/talis-web-20-and-all-that

Downes S. (2004). The Buntine Oration: Learning Networks. Retrieved February 15, 2011, from http://www.downes.ca/cgi-bin/page.cgi?post=20.

Downes S. (2005). E-Learning 2.0. *eLearn magazine*. Retrieved February 15, 2011, from http://www.elearnmag.org/subpage.cfm?section=articles&article=29-1

Ebner M (2007). E-Learning 2.0 = e-Learning 1.0 + Web 2.0?. *In The Second International Conference on Availability, Reliability and Security* (pp. 1235-1239) IEEE.

Edutools, (2011). Western Cooperative for Educational Telecommunications. Retrieved February 15, 2011, from http://www.edutools.info/

eLearn Magazine, (2011). *eLearn Magazine Education and Technology in Perspective.* Retrieved February 15, 2011, from http://www.elearnmag.org/

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

Elearninglearnig, (2010). Collecting the best reviews about eLearning. Retrieved February 15, 2011, from http://www.elearnmag.org/.

Facebook Inc, (2011). Retrieved 30 October, 2011, from http://www.facebook.com/press/info.php?statistics.

Flanagin, A. J., & Metzger, J. M. (2011). From Encyclopedia Britannica to Wikipedia. *Information, Communication & Society*, 14 (355-374).

Grosseck, G. (2009). To use or not to use web 2.0 in higher education?. *Procedia - Social and Behavioral Sciences*, 1, 478-482.

Hart, J. (2010). Centre for Learning & Performance Technologies (C4LPT). *C4LPT*. Retrieved February 15, 2011, from http://www.c4lpt.co.uk/

Hearing Hub, (2011). A community and virtual meeting place for educators and researchers in the field of deaf and hard of hearing education. Retrieved February 15, 2011, from http://hearinghub.ca/j/

Holzinger, A. (1997). Computer Aided Mathematics Instruction with Mathematica 3.0. *Mathematica in Education and Research*, 6(4), 37-40.

Howe, J. (2006). Wired 14.06: The Rise of Crowdsourcing. *Wired*. Retrieved February 15, 2011, from http://www.wired.com/wired/archive/14.06/crowds.html.

ITU (2011). Measuring the Information Society 2011, *International Telecommunication Union*. Retrieved 30 October, 2011, from http://www.itu.int/ITU-D/ict/publications/idi/2011/.

Johnson, M., & Liber, O. (2008). The Personal Learning Environment and the human condition: from theory to teaching practice. *Interactive Learning Environments,* 16(1), 3-15. doi:10.1080/10494820701772652

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

Jokisalo, E., & Riu, A. (2009). Informal learning in the era of Web 2.0. *Education, Vol. 14,* 1-6. Retrieved February 15, 2011 from http://www.elearningeuropa.info/files/media/media 19656.pdf.

Kim, K., Altmann J., & Hwang, J. (2010). Measuring and Analyzing the Openness of the Web2.0 Service Network for Improving the Innovation Capacity of the Web2.0 System through Collective Intelligence. In Springer (Ed.), *Symposium on Collective Intelligence, Advances in Intelligent and Soft Computing*, *Vol. 76/2011* (pp.93-105) Hagen, Germany. doi: 10/1007/978-3-642-14481-3_8

Koper, R. (2009). *Learning Network Services for Professional Development*. Berlin, Heidelberg, Springer.

Koulocheri, E., Soumplis, A., Kostaras, N., & Xenos, M. (2011). Usability Inspection of Informal Learning Environments: The HOU2LEARN Case. In Tsihrintzis, G., Virvou, M., Jain, L. & Howlett, R., (Eds.), *Intelligent Interactive Multimedia Systems and Services*, *Vol. 11* (pp. 39-49). Springer, Smart Innovation, Systems and Technologies, doi: 10.1007/978-3-642-22158-3_5

Laningham, S. (2006). developerWorks Interviews: Tim Berners-Lee. *IBM*. Retrieved February 15, 2011, from http://www.ibm.com/developerworks/podcast/dwi/cm-int082206txt.html

Li, J. & Huiping, Y. (2010, March). *Design of E-Learning2.0 Platform Based on Web2.0.* Presented at the Education Technology and Computer Science (ETCS), 2010 Second International Workshop on. doi:10.1109/ETCS.2010.481

Lindmark, S. (2009). Web 2.0: Where does Europe stand?, *Technical Note JRC 53035*. Retrieved February 15, 2011, from http://ftp.jrc.es/EURdoc/JRC53035.pdf

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

Netcraft LTD, (2011). Web Server Survey. Retreived 30 October, 2011, from http://news.netcraft.com/archives/2011/10/06/october-2011-web-server-survey.html.

O'Reilly, T., & Battelle, J. (2009). Web squared: Web 2.0 five years on. In O'Reilly Media Inc and TechWeb, *Proceedings of the 6th Annual Web 2.0 Summit*, Vol. 2. Retrieved February 15, 2011, from http://www.web2summit.com/web2009/public/schedule/detail/10194

Open ACS, (2011). The toolkit for Online Communities. Retrieved February 15, 2011, from http://openacs.org/forums

O'Reilly, T. (2006). What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software. *O'Reilly*. Retrieved February 15, 2011, from http://oreilly.com/web2/archive/what-is-web-20.html

Papadopoulos, T., & Xenos, M. (2008). Quality Evaluation of Educational Websites Using Heuristic and Laboratory Methods. In *Proceedings 2nd Panhellenic Scientific Student Conference on Informatics, Related Technologies and Applications*, (pp. 43-54), Samos, Greece.

Rosenberg, M. J., (2000). *E-Learning: Strategies for Delivering Knowledge in the Digital Age*. 1st Edition, New York, McGrow-Hill.

Scott Wilson, P., Liber, O., Johnson, M., Beauvoir, P., Sharples, P., Milligan, C., & others. (2006). Personal Learning Environments: Challenging the dominant design of educational systems. on Professional Learning, Competence Development and Knowledge Management-LOKMOL and L3NCD, 67.

Siemens G. (2006). Learning or Management System? A Review of Learning Management System Reviews. *Learning Technologies Centre*, Retrieved February 15, 2011, from http://ltc.umanitoba.ca/wordpress/wp-content/uploads/2006/10/learning-or-management-system-with-reference-list.doc.

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

SIIA, (2011). Software and Information Industry Association (SIIA) Codie Awards 2009/2010/2011 (2011). Retrieved February 15, 2011, from http://www.siia.net

Soumplis A., Chatzidaki E., Koulocheri E.& Xenos M. (2011). Implementing an Open Personal Learning Environment. In *Proceedings of the 15th Panhellenic Conference on Informatics with international participation PCI 2011* (pp.345-349). IEEE Computer Society Press, ISBN: 978-0-7695-4389-5, 30 September – 2, 201, Kastoria, Greece.

Soumplis A., Koulocheri E. & Xenos M., (2011). The twobility factor, in *Proceedings of the 7th eLearning and Software for Education Conference eLSE 2011*, *Vol. 2* (pp.55-63). 28-29 April 2011, Bucharest, Romania,

Stavrinoudis D. & Xenos, M. (2008). On technological issues affecting online learners' behavior. *Journal of Computational Methods in Science and Engineering*, 8(1), 183-194.

Surowiecki, J. (2004). *The wisdom of crowds: why the many are smarter than the few and how collective wisdom shapes business, economies, societies, and nations*. United States, Doubleday. Retrieved February 15, 2011, from http://www.nd.edu/~busiforc/handouts/Other%20Articles/Wisdom%20of%20Crowds%20Review%202.PDF

Thalheimer, l. (2008). Evaluating E-Learning 2.0: Getting Our Heads Around the Complexity. *Learning Solutions Magazine*. Retrieved February 15, 2011, from http://www.learningsolutionsmag.com/articles/84/evaluating-e-Learning-20-getting-our-heads-around-the-complexity

Tissot, P. (2004). Terminology of vocational training policy: a multilingual glossary for an enlarged Europe. Luxembourg: Office for Official Publications of the European Communities,

This is a pre-print version of the paper published in:

International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), Volume 6, Issue 4, pp. 1-18, 2011

2004, p. 60. Retrieved February 15, 2011, from http://www.cedefop.europa.eu/EN/Files/4064_en.pdf

Van Harmelen, M. (2006). Personal Learning Environments. In M. Memmel & D. Burgos (Eds.), *Sixth IEEE International Conference on Advanced Learning Technologies ICALT06*, 16(1), 815-816.

Vander Wal, T. (2005). Folksonomy Definition and Wikipedia. *Thomas Vander Wal*. Retrieved February 15, 2011, from http://www.vanderwal.net/random/entrysel.php?blog=1750.

Wallis, C. (2006). How to Bring Our Schools Out of the 20th Century. *TIME Magazine,* Vol. 168 (25), 50-56.

Weiss, R. E, Knowlton, D.S. & Morrison, G. R. (2002). Principles for using animation in computer-based instruction: theoretical heuristics for effective design. *Computers in Human Behavior*, 18(4), 465-477;

Xenos, M. (2008). Users' impressionism and software quality. In *MCCSIS08 IADIS Multi Conference on Computer Science and Information Systems* Proceedings of Interfaces and Human Computer Interaction (pp. 11-17).

YouTube Inc, (2011). Retrieved February 15, 2011, from www.youtube.com.