

# The use of Web 2.0 Technologies and Services to support E-Learning Ecosystem to develop more effective Learning Environments

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## Abstract

*In today's knowledge-based society, great demands are placed on getting information and knowledge anywhere and anytime. This is now made even more possible with the advent of advanced and sophisticated technologies and services. Society must now keep pace with the ever-changing knowledge processes, learn and enhance existing skills as well as create new ones. Accordingly, in order to produce more effective learning environments, contemporary instructional design and processes must support the development of the skills mentioned above. We must also leverage from today's technologies and services in order to seize this opportunity.*

*In this paper, an e-learning ecosystem (ELES) which supports modern instructional design and processes is introduced and described. Web 2.0 technologies and services to support the development of e-learning ecosystems will also be discussed.*

**Keywords:** E-Learning 2.0; Personalized Learning; Learning Style; Adaptive Learning Environment; Adaptive Learning Process; ELES

## 1. Introduction

Our knowledge-based society of the 21<sup>st</sup> century makes great demands on its members in virtually every part of their lives. They must keep pace with ever-changing knowledge processes, and based on that enhance existing skills, create new skills and continue to build new ones. As a result, modern instructional design, learning goals and processes must support the development of the aforementioned skills.

Educational approaches have changed dramatically over time from less formal schooling in the agrarian society to “mechanized” knowledge transfer in the industrialization age. From this remedial repetitive learning it has further evolved to today's learning with an understanding to become more independent in the learning process, strengthen metacognitive and teamwork skills as well as link knowledge in cultural context. Based on that, different modern educational strategies have been developed which includes aspects such as self-directed learning, collaborative learning, experiential-based learning, actively participating and content creation [2] [6] [15].

Instructional design and learning strategies have also influenced by technology, such as the development of motion pictures, radio, computers and other emerging information and communication technologies (ICT). Moreover, children who grew up with entertainment technologies such as Playstations, Wii, iPods, iTunes, etc; and mobile technologies are more than likely to apply ICT in virtually any situation. This new generation, termed as digital natives or net generation, uses technology as a tool everywhere, and at anytime for any purpose. They are experienced multi-taskers using several media simultaneously for communication, learning and entertainment [14] [15] [17]. Based on the pre-existing Web technologies a “new” Web for easier participation and collaboration has emerged and become popular under the term Web 2.0, a term coined by Tim O'Reilly. Diverse services have been available and are used more intensively in recent times [1].

In order to prevent uninteresting and boring learning activities in an artificial or even traditional learning environment, we strongly advocate the integration of state-of-the-art technologies to support a variety of modern learning activities. This gives students and teachers freedom to choose the tools and services they are familiar with which are not necessarily restricted to the learning process. Unlike most pre-existing computer-based learning environments which are mostly predictable with well-defined organizational and system borders, the integration of diverse technologies and distributed services as proposed in this paper increases the complexity considerably. This has motivated us to develop the E-Learning Ecosystem (ELES) model, a holistic approach for the development of more effective learning environment for small-to-medium sized enterprises (SMEs) [3].

In this paper, a brief outline of the ELES model is provided. This is followed by examining how Web 2.0 technologies and services can support the development of more effective learning environments.

## 2. E-Learning Ecosystem

As the integration of the diverse technologies and distributed services combined with a group of learning communities with a variety of learning styles are

highly complex, a sustainable model underpinning the design of an e-learning system is highly recommended.

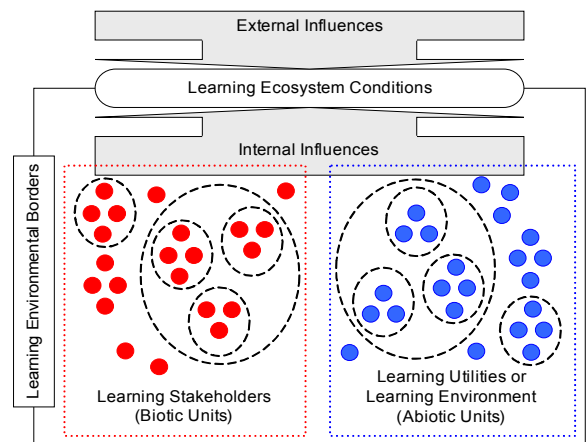
Today's educators have access to better and modern technologies such as Web 2.0 and they should capitalize on this advantage. Apart from ICT, research suggests that a broad range of factors including processes, strategies, motivations and culture could affect the application of knowledge [9]. It is because of this complexity facing today's educators that the design of any e-learning system must begin with the adoption of a sustainable model. The *e-learning ecosystem* (ELES) as a model was created for this purpose. This model is comprehensive and is capable of addressing the use of new technologies and tools, incorporating new learning approaches, adaptable to a variety of learning styles, and is responsive to the learning conditions.

The term 'ecosystem' within ELES is used to ensure that all factors encompassing learning are accounted for. Ecosystem is defined as a "complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space" [7]. A.G. Tansley, a British ecologist, defined ecosystem as "a biotic community or assemblage and its associated physical environment in a specific place" [13]. The definition implicitly highlights the existence of interactions among the biotic (living) and abiotic (non-living) components, as well as intrinsically within various highly-complex components.

The biotic units or the living parts of the learning ecosystem consist of the *learning communities and other stakeholders* such as teachers, tutors, content providers, instructional designers and pedagogical experts. The learning communities can either be individual or groups of individuals who can interact and collaborate synchronously and asynchronously with one another.

The *learning utilities* comparable to the abiotic units represent the non-living parts; include the learning media (content and pedagogical aspects), technology, and tools applied in teaching. The technology may include the architecture and infrastructure platform for the management, delivery and tracking of e-learning in the form of learning content management system (LCMS), learning management system (LMS) and content delivery system (CDS). Laptops, desktop computers, podcasting, PDA are also examples of some of the learning utilities. Information in the form of external sources such as lexica, digital libraries, and others are also part of the learning utilities. More modern and recent media includes the use of Web 2.0 technologies and service.

The *learning environmental boundaries*, an analogy to the specified physical boundaries of the ecosystem defines the physical and logical borders of the learning system. That is one of the system's characteristics, which are in common specified as the *learning ecosystem conditions*. The learning ecosystem conditions characterize important parts of an ecosystem learning system and they are affected by external and internal influences. In general these conditions are dynamic and ever-changing, but potential impacts on the system depend on the lifecycle of the examined system. These conditions are determined by external and internal influences, such as evolution of knowledge, educational goals, learning tasks, cultural and sociological aspects, and expectations by society, private industry and business organizations, the government, public service and not-for-profit organizations.



**Fig.1 Representation for the learning ecosystem (LES)**

The resulting learning ecosystem framework as shown in Fig. 1 stands out as a model that is useful in identifying the key contributors to organizational learning processes.

The main interests in the learning domain are relationships and interactions related to the information flow as well as knowledge transfer and transformation. Like a biological ecosystem, in an e-learning ecosystem, individuals can form groups spontaneously and can interact with each other or with learning utilities at the individual or group level. They also can perform, change or adapt specific behaviors in order to contribute to or perturb to the success of the learning ecosystem. Changes in the e-learning ecosystem conditions influence the "behavior" of the system and its components. To be successful and to be valuable for the system, each individual and group must adapt to the environmental conditions to find their niches. In

order to fit them all together, appropriate and suitable learning utilities must also be available.

By focusing on the learning utilities component of ELES or the architectural viewpoint, the biotic unit or the learning communities of ELES must be self-organizing. This self-organization is required to avoid a single point of failure. Furthermore, the behavior patterns for the interaction between clients or agents of different level of trust must be taken into account. To this end different architectures can be used to develop e-learning ecosystems. This architecture includes the service-oriented peer-to-peer architecture, the ecosystem oriented architecture, and Web 2.0 as platform [8] [10]. Web 2.0 technologies and services will be the focus of the remainder of this paper.

### 3. Web 2.0 Technologies and Services for building efficient E-Learning Ecosystems

Recent blogs claim that Web 2.0 is more an attitude rather than a new technology. Indeed, it has to been seen as a concept which addresses aspects of (1) Web technologies as a platform, (2) specific types of services and applications built on top of Web 2.0 technologies, and (3) specific kind of development approach. Web 2.0 covers also active participation, information exchange and access on micro content level, openness (API's and open content for reuse), social, group and 'wisdom of crowds' aspects [1] [4] [12].

As elaborated in Section 2, a modern learning environment involving various stakeholders needs to integrate a variety of services and content types, link users and user groups to one another as well as with services and content. Moreover, it must be flexible and adaptable towards users' needs and user preferred information and communication technologies.

This raises the question of whether Web 2.0 can meet the previously indicated requirements. To answer this question, a simple Web 2.0 layer model linked with the learning process is outlined in Fig. 2 and will be discussed in the remainder of this Section.

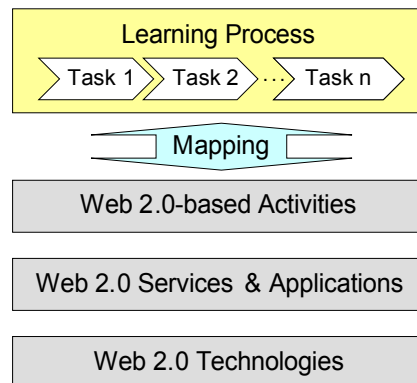


Fig. 2 Web 2.0 layers and the learning process

The bottom Web 2.0 layer in Fig. 2 addresses Web 2.0 technologies and provides the basis for the layers above. This includes technologies which make Web 2.0 services and applications more usable and convenient, such as AJAX, JavaScript, XSLT/XML, XHTML, Cascading Style Sheet and Document Object Model. XML-RPC, REST, RSS, Atom, mashups and the like. These technologies facilitate the subscription, access, propagation, reuse and compilation of small chunks of content (micro content) [8] [12] [16].

Services and applications addressed in the middle Web 2.0 layer are built on the abovementioned Web 2.0 technologies of the bottom layer. The following explanations based on [1], [4] and [26] give an overview of Web 2.0 services and applications. There exist a variety of service and application types and for each one different applications can be found. This great variety of existing types can be further classified into basic service and application types as well as into composite types. *Basic service and application types* includes weblogs, social writing tools, podcasts, media sharing tools, social networks, social tagging and social bookmarking and publication sharing systems and ePortfolio. *Composite service and application types* built on either the content or application of the basic types. They include search services which help to find content either by automatic methods or by applying social approaches such as user-based query building and adaptation. Other application at the content level deals with the compilation of micro content and the building of microcontent from microcontent. On the application level, mashups combine application and services. To be more precise, they combine the interaction with microcontent of individual services to gain added value. In the e-learning arena, research and implementation effort has emerged to reuse microcontent and combine pre-existing Web 2.0 services, such as the LearnLand Approach [6] and L2 platform [5].

The third layer addresses specific activities which are enabled by Web 2.0 services and applications. These Web 2.0-based activities include networking, sharing, communication, messaging, collaborative content writing and metadata management, information linking, information re-usage, information presentation and visualization [1] [8].

On top of Fig. 2, the learning process is outlined as a number of learning tasks. The learning process or the types and sequences of learning tasks are defined by the learning goals, teaching strategies and learning style. Each of the learning tasks can be mastered by one or even several learning activities. Such activities can be provided through the Web 2.0 services and applications by Web 2.0-based activities. Upon the selection of an activity, a specific implementation instances are given by concrete learning tasks as well as the teacher and student preferences. The selection process can either be performed by teachers and students or by computer-based applications; see examples as illustrated in Helic [11].

#### 4. Conclusions

In this paper we have argued that our knowledge-based society demands learning processes with improved learning procedures. The increasing widespread usage of modern ICT has become an important influence factor. As a consequence, enhanced learning environments are required to enable teachers and students to select tools and applications they are familiar with. To deal with such complex situations, the ELES model has been outlined. It is comprehensive and is capable of addressing the use of a great variety of technologies and tools, incorporating new learning approaches, adaptable to a variety of learning styles, and is responsive to the learning conditions. We have also shown that Web 2.0 technologies as well as services and applications can support the development of flexible e-learning environments on the basis of the ELES model. Web 2.0 technologies can be used as a platform for communication and information exchange as well as Web 2.0 services and applications. These services and applications provide the basis for a great variety of learning activities. Web 2.0 can therefore provide a foundation for a flexible and evolving learning environment.

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#### References

- [1] Alexander, B., Web 2.0: A New Wave of Innovation for Teaching and Learning? Educause, March/April 2006.
- [2] Bransford, J.D., Brown, A.L., and Cocking, R.R. (Eds.) How People Learn: Brain, Mind, Experience, and School. Expanded Edition. Washington DC: National Academies Press, 2000.
- [3] Chang, V. and Gütl, C. E-Learning Ecosystem (ELES) – A Holistic Approach for the Development of more Effective Learning Environment for Small-to-Medium Sized Enterprises (SMEs), Proceeding of the Inaugural IEEE International Digital Ecosystems Technologies Conference (IEEE-DEST 2007), Cairns, Australia.
- [4] Downes, S., E-learning 2.0, eLearn Magazine, last edited Oct.17th, 2005, Retrieved on 19 Jan 2008 from <http://www.eleammag.org/subpage.cfm?section=articles&article=29-1>.
- [5] Drážil, P., Pitner, T., E-Learning 2.0: Methodology, Technology and Solutions, Retrieved on 13 Jan 2007 from [http://www.fi.muni.cz/~tomp/12/e-learning2.0/ictc/12\\_platform.pdf](http://www.fi.muni.cz/~tomp/12/e-learning2.0/ictc/12_platform.pdf).
- [6] Ebner, M., Holzinger, A., and Maurer, H., Web 2.0 Technology: Future Interfaces for Technology Enhanced Learning? Universal Access in Human-Computer Interaction. Applications and Services, Lecture Notes in Computer Science, Volume 4556, 2007, 559-568.
- [7] Encyclopaedia Britannica, Retrieved on 13 Jan 2007 from <http://www.britannica.com/eb/article-9031944> & <http://www.answers.com/topic/ecosystem>.
- [8] Fumero, A., EDUWEB 2.0 - iCamp & N-Gen Educational Web, WEBIST (2) 2006: 299-304.
- [9] Grover, V. and Davenport, T. H. General Perspectives on Knowledge Management: Fostering a Research Agenda, Journal of Management Information Systems, 2001, 18(1), 5-21.
- [10] Hager, S., Digital Ecosystems – Comparing Architectures, seminar paper, Graz University of Technology, 2007.
- [11] Helic, D., Formal Representations of Learning Scenarios: A Methodology to Configure E-Learning Systems, In Journal of Universal Computer Science, 2007, Vol. 13, Issue 4, 504-531.
- [12] Lin, K-J, Building Web 2.0, Computer, May 2007, 101-102.
- [13] Pickett, S.T.A. and Cadenasso, M.L. “The Ecosystem as a Multidimensional Concept: Meaning, Model, and Metaphor Ecosystems”, Ecosystems Journal, Springer, New York, 2002, 5, 1–10.
- [14] Reiser, R. A., A History of Instructional Design and Technology: Part I: A History of Instructional Design. ETR&D, 2001, Vol. 49, No. 1, 53–64.

[15] Rogers, P.C., Liddle, S.W., Chan, P., Doxey, A., and Isom, A., A Web 2.0 Learning Platform: Harnessing Collective Intelligence, Turkish Online Journal of Distance Education (TOJDE), July 2007, Vol. 8, No. 3.

[16] Strouhal, L., The application of Web 2.0 Technology and Tools in E-Learning, Seminar Paper, Graz Universtiy of Technology, Austria, 2007.

[17] Thompson, J., Is Education 1.0 Ready for Web 2.0 Students? Innovate Journal of Online Education, 2007, Vol. 3, No. 4