

E- LEARNING IN BUSINESS ORGANISATIONS – NEW CONCEPTS, TECHNOLOGIES AND MODELS

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Abstract: E-learning systems (EL) have established themselves as a key management instrument in business strategies for human resource management, for the improvement of the efficiency of processes for professional staff development and for the development of corporate knowledge.

The aim of this article is to present some of the new concepts for EL – an ecosystem for EL, collaborative learning, lifelong learning, ubiquitous learning, EL as a method for knowledge creation and the generation of collective intelligence. Furthermore, it aims to outline the potential of the key information technologies – mobile technologies, Web 2.0 and cloud services - for the development of efficient strategies and models for EL usage, its transition into an efficient and effective business practice and its establishment as a leading, electronically implemented activity (e-activity). To achieve the objective of the research article the following methods have been used – logical methods such as analysis, synthesis and comparison, and theoretical research methods such as abstracting and summarizing. The main empirical method applied is that of modelling.

Key words: electronic learning, ecosystem for e-learning, collaborative learning, cloud services, Web 2.0.

JEL: D80, D83.

In recent years e-learning (EL) or *‘the acquiring of knowledge, delivered and sustained via electronic means’*¹ has rapidly developed and is widely used both in the field of traditional education and in fields like staff

¹ Gunasekaran, A. Ronald D. McNeil and Dennis Shaul. “E-Learning: research and applications”. // Industrial and Commercial Training, 2002, 34(2), pp. 44-53.

training and the improvement of staff qualifications. In the world of business it has established itself not only as a *method of teaching*, but also as a *method for knowledge creation* and now establishes itself as a main electronically implemented activity (*e-activity*)².

The aim of this article is to present some new concepts for EL and information and communication technologies (ICT), which assist their implementation and determine effective strategies and models for the use of EL in business organisations. **The object** of study is EL in organisations that becomes a leading e-activity, while **the subject** of the study is the new concepts, ICT and models that contribute to its establishment as an efficient and effective e-activity.

1. Electronic learning in business organisations

The interest of business organisations in EL is a function of the dynamics of the business environment, and, in the last decade, of significant changes in the labour market, as seen in the considerable rise in the requirements of the work force, the intensive implementation of ICT in all areas of activity, the high mobility of staff, etc.; the dynamics of the business environment together with the need for the implementation of innovations, and a call for permanent learning and the development of staff. According to a forecast by the US Department of Labour from 2001, which was proved with time, towards the year 2015 80% of all jobs (compared to 30% in 2001) will be based on 'knowledge and skills, some of which so complex that they do not exist currently'³.

In business organisations, EL is directly related to two important supporting activities – *staff training* and *knowledge management (KM)*⁴, which are crucial to the improvement of individuals and their role in the

² See **Turban**, E., King, D., Lee, J.K., Liang, T.-P., Turban, D.C. *Electronic Commerce a Managerial and Social Networks Perspective*. Eighth Edition, Springer, 2015, ISBN 978-3-319-10091-3, p. 218

³ **Anderson**, C., Brennan, M. *E-Learning in Practice – Proprietary Knowledge and Instructional Design*. // IDC Analysis, September, 2001, <http://www.e-learning-site.com/download/white/isd-idc.pdf>.

⁴ Knowledge Management (KM).

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organisation, in the separate work teams, as well as in the activities and tasks. Knowledge is among the most important assets of each organisation and it is important that it is efficiently managed, i.e. compiled, stored, protected and repeatedly and appropriately used (which is directly linked to learning).

In practice, approaches, strategies and models are developed which adapt the traditional learning systems, including the conventional EL systems (together with their shortcomings), to the new conditions and needs. Organisations expect from the new systems a symbiosis between productivity of the workforce and concepts like lifelong learning, collaborative learning, etc., as well as to generate a synergistic effect in the form of *collective intelligence*, etc. ICT presents effective and efficient solutions in this respect and more specifically – Web 2.0 technologies, mobile technologies, cloud services, etc. They provide efficient alternative solutions in the modern form (technological and organisational) of EL and the systems for learning management.

EL systems prove and establish themselves as a key management tool in business strategies for the development of human resource and for the improvement of the efficiency of the processes for professional development of staff. They contribute to: informing the staff about the permanently changing functional requirements in their position and the job they do, thus contributing to the effective achievement of the strategic goals of the organisation; personal and professional development and improvement; allow the organisations to keep under control the budget allocated for learning, to develop and keep their employees, etc.

The effective use of new media and tools for learning require the development of a new type of literacy, which can be called *creative literacy* since it encompasses a number of new abilities that develop creativity. Besides the ability to adapt rapidly to the new ICT, *the 21-century learner* has to develop *a new type of social skills and cultural competences*. These skills are defined by Jenkins (see Table 1)⁵.

⁵ See **Jenkins**, H. *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century*. Chicago, IL: The MacArthur Foundation, 2009, p. xiv. ISBN 978-0-262-51362-3.

Table 1.
Characteristics of creative literacy

Characteristic	Ability to:
Game	- experiment with the environment as a form of problem-solving;
Presentation	- accept alternative identities for the purpose of improvisation and discovery;
Simulation	- interpret and construct dynamic models of processes from the real world;
Appropriation	- select and mix media content in a meaningful way;
Multitasking	- review quickly a given environment and attention to focus on the necessary characteristic details;
Distributed knowledge	- interacts fully with tools that expand the mental capacity;
Collective intelligence	- collect knowledge and compare materials with other people with the purpose to achieve a common goal;
Judgement	- assess the reliability and credibility of different information resources;
Transmedia navigation	- follow the flow of materials and information across multiple modalities;
Networking	- look for, synthesise and disseminate information;
Negotiation	- pass through diverse communities, differentiate between and accept multiple perspectives in order to understand and follow alternative norms.

2. Key concepts in the development of EL

Several terms are used in specialised literature related to EL. Broadly speaking EL is an online delivery of learning materials and realisation of learning methods through ICT, which is used for the purposes of education or for acquiring knowledge at any time and anywhere. The narrower term *online learning* is related to Web-based learning, whereas we can talk about *mobile learning* when the learning materials are accessible via wireless communications, smartphones, tablets and other mobile devices.

The drivers that stimulate the development of EL are classified into four main groups as is shown in Table 2.

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Table 2.
Engines for development of EL

- economic:	<ul style="list-style-type: none">• increase in the costs of conventional learning;• competition and need for decrease in the costs of staff training;• globalisation of business;
- technological	<ul style="list-style-type: none">• constantly growing online content and learning materials;• developed intranet and internet;• virtual realities and social networks, which rapidly gain popularity;• computer games which can also be used in education;• virtual universities and virtual classrooms;• technological changes and innovations, e-books, etc.
- organisational:	<ul style="list-style-type: none">• globalisation of business processes and activities;• the need for education of people positioned in different geographic locations and different time zones;
- social:	<ul style="list-style-type: none">• Learning – on – demand;• Lifelong learning;• Ubiquitous learning and social networks.

The development of EL is marked by several key points in terms of the adaptation of certain concepts, information, communication and organisational technologies. This paragraph focuses on some of the concepts, while the next one focuses on three key ICT's which we perceive as crucial for establishing EL as an efficient and effective business practice.

2.1. The concept of e-learning ecosystem

The concept of an 'e-learning ecosystem' is established in specialised literature, launched by Chang and Gütl⁶. In line with the trend

⁶ See **Chang, V** and **Guetl, C.** E-Learning Ecosystem (ELES) – A Holistic Approach for the Development of more Effective Learning Environment for Small-to-Medium Sized Enterprises (SMEs), <http://citeseer.ist.psu.edu/viewdoc/download;jsessionid=CF9588C49A39C453BA5BED7F3B0BC59A?doi=10.1.1.161.7975&rep=rep1&type=pdf>;

Gütl, C. E-Learning in modern Learning Settings: Recent Research Activities; <https://www.ejel.org/issue/download.html?idArticle=165>.

for development of EL systems, which are to be more efficient in terms of functionality and costs and to be more adaptable to the needs of the individual, scientists apply one 'ecological and holistic approach'. They develop the concept of *e-learning ecosystem* mainly with the aim to find out ways and means with which to improve the modern *learning environment*.

The authors base themselves on the popular definition, according to which an ecosystem is a flexible '*complex of living organisms, their physical environment and all their interrelationships in a particular unit of space*'⁷ and they use the applicability of this concept for various subject areas and systems, consisting of living (biotic) and non-living (abiotic) components and their relationship in certain physical limits. According to Chang and Gütl, the errors and failures in the past with regard to the e-learning ecosystems are a result of the lack of understanding, in the first place – learning as a human cognitive process (characteristics of the living component), and secondly – the lack of and the poor knowledge of the new technologies by the participants (direct and indirect) in the EL process (the interaction of the participants with the non-living component). In this respect the idea of applying the concept of the ecosystem in education in general and specifically in EL is justified and effective⁸.

Applying the ecosystem model in different subject areas suggests specifying, subsequently optimizing, and a maximum use of the following characteristics of the system: specification of the living and non-living components; time range, temporal and spatial scale of the system; physical boundaries of the system; description of the type and scope of the relations and the interaction between the separate components; limitations in the behaviour of the system. On the one hand, this process helps for the precise analysis of the complex and dynamic conditions and challenges of the modern learning process, and on the other - it helps identify the characteristics and current requirements regarding the learning environment.

⁷ Encyclopaedia Britannica, quote from **Mona, N.** and **Shimaa, O.** An Ecosystem in e-Learning Using Cloud Computing as platform and Web2.0. // The Research Bulletin of Jordan ACM, Vol. II (IV), p. 135.

⁸ This concept is successfully applied in various spheres such as economics (business ecosystem, digital ecosystem), knowledge management, grid systems, etc.

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According to the definition of Chang and Gütl *the learning ecosystem*⁹ consists of the *stakeholders* (living components), incorporating the whole chain of the processes of shared learning; *learning environment* based on services, supporting learning within specific boundaries, called *learning environmental borders*.

Stakeholders. The living components in the system are the direct and indirect participants in the process. They can be divided into two main groups: *learning communities* and *other stakeholders*. The first includes individuals and groups of individuals who can cooperate. The characteristics with which the e-learning ecosystem has to comply with and has to be able to serve with respect to these stakeholders are: individual learning styles; different learning strategies; personal preferences; pre-knowledge and competency level of the individual or the group; as well as other individual and group characteristics with regard to the process of learning. The second group – *other stakeholders* comprises of teachers, tutors, content providers, experts in various areas of knowledge; instructional designers;; pedagogical experts; IT support specialists; providers of infrastructure and platforms for EL. They also have multiple features.

Learning environment (utilities). The non-living components of the system comprise of services, supporting learning. They form the learning environment and are: static and dynamic learning media (providing the content and the pedagogical aspects); basic knowledge (in the form of external sources of knowledge like digital libraries, Wikipedia, etc.); technologies and tools applied in education (a wide variety of personal desktop and mobile computer devices, webinars, podcasting, etc.); learning management systems¹⁰ (LMS), learning content management systems (LCMS), content delivery systems (CDS) etc. The differentiation of the stakeholders and the environment puts emphasis on the fact that learning is a process integrating living and non-living components (together with their specific characteristics) which is also performed in a complex environment (the learning environment). Maximum flexibility is required

⁹ Learning Ecosystem – LES

¹⁰ Learning Management Systems (LMS), Learning Content Management Systems (LCMS), Content Delivery Systems (CDS).

from this environment in order for it to be able to take into consideration dynamic factors¹¹ like: the different learning styles of actual and potential users, the various strategies and types of communication, better learning on the basis of the new ICT for lifelong education, the development of an adaptive hypermedia and the increase in the open-source software, the need to improve the quality of EL, etc.

Constraints in the e-learning ecosystem. The terms of the ecosystem for learning, which are naturally very dynamic, are formed as a result of internal and external influences like – current and developing knowledge, learning objectives, learning tasks, cultural and sociological aspects, public mood and expectations, expectations on the part of business organisations, the government, non-profit organisations, etc. The interaction between the biotic and abiotic components of the ecosystem is controlled by the internal and external conditions of the ecosystem.¹² One of the main characteristics of the learning ecosystem is its *boundary*, which defines its physical and logical limits.

2.2. The concepts of ‘collaborative learning’, lifelong learning’ and ‘ubiquitous learning’

According to the definition of Roschelle and Teasley, *collaboration is ‘a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem’*¹³.

¹¹ **Wurzinger**, G., Chang, V., Guetl, C. Towards greater Flexibility in the Learning Ecosystem – Promises and Obstacles of Service Composition for Learning Environment,
<http://ftp.iicm.tu-graz.ac.at/home/cguetl/publications/2009/Wurzinger%20et%20al.%202009%20-%20IEEE%20DEST.pdf>

¹² See **Chang**, V and Guetl, C. E-Learning Ecosystem (ELES) – A Holistic Approach for the Development of more Effective Learning Environment for Small-to-Medium Sized Enterprises (SMEs),
<http://citeseer.ist.psu.edu/viewdoc/download;jsessionid=CF9588C49A39C453BA5BED7F3B0BC59A?doi=10.1.1.161.7975&rep=rep1&type=pdf>; p. 4.

¹³ **Roschelle**, J., Teasley, S. The construction of shared knowledge in collaborative problem solving. In C.E. O'Malley (Ed). // Computer-Supported Collaborative Learning, Berlin: Springer-Verlag, 1995, p. 70.

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Specialised literature is full of publications¹⁴ on the topic of the concept of collaborative learning. Generally it describes a strategy for teaching and learning which is characterised by the fact that the learners organise themselves in groups (following certain rules). The aim is to improve the achievements of personal and team learning through communication, cooperation and collaborative knowledge construction¹⁵. The members of the group perceive themselves as a team for team work. In order to achieve the learning objectives they share information with each other and with other groups, initiate and take part in dialogues, discussions, debates and other forms. It is beneficial to both the development of the individual cognitive abilities of the learners and the development of collective intelligence¹⁶.

The concept of *'lifelong learning'*¹⁷ includes all activities related to learning – *formal and informal, which are on-going with the purpose of development of knowledge, skills and competencies*. They take place in different environments, both within the framework of formal education and systems of education, and outside of them. Lifelong learning involves permanent investment in people and knowledge; stimulating the acquisition of basic and additional skills, including numeracy skills; expanding the possibilities for innovative and more flexible forms of education, etc.¹⁸.

We are currently witnessing the emergence of the concept of *'ubiquitous learning'* (u-learning), which is based on the ubiquitous access to computer technologies and sources of information. This concept, or rather a learning paradigm, is a natural next stage in the development of learning leading to a greater independence from factors like space, time, financial resources, etc. The development follows the model: *conventional learning – e-learning – mobile learning – ubiquitous learning*. An 'environment for ubiquitous learning' is constructed on this basis, which not only

¹⁴ See **Dillenbourg**, P. What do you mean by collaborative learning? In P. Dillenbourg (Ed). // Collaborative-learning: Cognitive and Computational Approaches. // Oxford: Elsevier, 1999, pp.1-19.

¹⁵ See **Peng Shadong**. "Collaborative Learning from Face-to-face to Computer-assisted to Mixed One," // E-education Research, August 2010, pp.42-49.

¹⁶ Collective intelligence – the ability to gather knowledge and compare materials with other people in order to achieve one common goal.

¹⁷ Lifelong Learning (LLL).

¹⁸ Eurostat, Statistics Explained. Lifelong learning statistics, 2016, <http://ec.europa.eu/Eurostat/statistics-explained> (16.05.2016).

allows everyone to learn anytime and anywhere, but also to learn exactly what they need at the time and place when they need the knowledge and in a way which best suits the individual and their specific goals¹⁹. The main characteristics of ubiquitous learning are: permanency, accessibility, immediacy, interactivity, context awareness, etc.

2.3. New role of e-learning as a method for knowledge creation and generation of collective intelligence

EL establishes itself in the world of business both as a method of education and as a method for knowledge creation. EL and KM have a common focus within the organisation and that is *knowledge*. The difference between them lies in the purpose for which this knowledge is used. EL uses knowledge to enhance individual learning, whereas KM uses it to improve the actions of the individuals in the organisation or in the working group.²⁰

Together with the accumulation and processing of large volumes of data, the extraction of knowledge from these data has a great importance along with their application in the business. Taking knowledge as one of their most important assets, business organisations allocate resources for its management, which involves activities for creation and extraction of knowledge, storage, protection, constant updating, dissemination and repetitive use of knowledge.

Although '*collective intelligence*'²¹ is a concept which has been used for decades to denote the phenomenon that when *a group of people work together or in partnership towards the solution of a problem qualitative breakthroughs take place (new knowledge and innovations are generated.)*, it gained particular popularity as a result of the new ICT. Crucial in this case

¹⁹ See **Saadiah**, Y., Ahmad E., Jalil, E. The definition and characteristics of ubiquitous learning: A discussion. // International Journal of Education and Development using Information and Communication Technology (IJEDICT), 2010, Vol. 6, Issue 1, pp. 117-127.

²⁰ See **Turban**, E., King, D., Lee, J.K., Liang, T.-P., Turban, D.C. Electronic Commerce a Managerial and Social Networks Perspective. Eighth Edition, Springer, 2015, ISBN 978-3-319-10091-3, p. 229.

²¹ See **Segran**, T. Programming Collective intelligence. O'Reilly Media Inc., 2007.

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proved to be the ability of Web 2.0 technologies to collect and combine information from thousands of individuals. Nowadays people are using the Internet to make purchases, seek out entertainment, do research, build their own web sites, social groups, etc. Through technologies, their behaviour can be monitored and used to derive personal information without having to interrupt the users with questionnaires. In the field of education, this means delivering information compiled on the basis of studying the behaviour of *all* participants in the group for collective learning.

According to Hussny, H.²², Mateen, A, Nayyer, M., Mustafa, when applied in the e-learning ecosystem, collective intelligence influences in the following ways: it provides higher speed of memorization; improves the possibility to complete a transaction and find out questions users are interested in, etc. Authors differentiate three levels of collective intelligence, connecting them with the IT tools used. They are:

- Direct intelligence, which is generated by collecting information from the users like: recommendations, evaluations, comments, bookmarks, content, voting, tags, etc.
- Indirect intelligence, which is generated by collecting it from the users or from applications of information, whose text is usually unstructured like blogs, wikis, participation in online communities, etc.
- High level of intelligence, which is collected through the methods for searching and deriving of data from (searching, clusters, Web mining, Text mining).

3. Information technologies and services for realisation and development of the new concepts for e-learning

The main *shortcomings* of the widely used today E-learning systems are a reflection of out-dated pedagogical, organisational and social views and the technologies used. Currently the most disturbing ones are²³:

²² See **Hussny**, H., Mateen, A, Nayyer, M., Mustafa, T. E-Learner's Collective Intelligent System Framework: Web Mining for Personalization in E-Learning 2.0 Ecosystem using Web 2.0 Technologies. // International Journal of Computer Applications, March 2013, Volume 66, No.4.

²³ See **Mona**, N. and Shimaa, O. An Ecosystem in e-Learning Using Cloud Computing as platform and Web2.0. // The Research Bulletin of Jordan ACM, Vol. II (IV), pp. 134-140.

- Isolation of the learner;
- Almost a complete absence of: educators' feedback, collaboration, social networking;
- The costs for each participant are relatively high;
- There are a lot of uncertainties regarding the quality of the learning and technological resources, technologies and support services;
- Technology and market forces dominate over educational aims and institutional development strategies in EL management.

These and many other shortcomings and weaknesses of the ELS are overcome with the help of new organisational concepts (like the ones discussed in the previous paragraph) and introduction of modern technologies such as mobile communications, cloud computing, Web 2.0 technologies, etc. We are witnessing the development of a *new generation of systems for e-learning*, whose characteristics are defined by the highly dynamic nature of the Internet as a medium in which users collaborate by sharing information, implement software applications and develop new online services. A new generation of ecosystem in e-learning is emerging as a prevailing method for organisation of the information infrastructure on the basis of *Web 2.0 technologies* as they are becoming more and more popular tools for support of the e-learning ecosystem and *cloud services*. This method is characterised with the following:

- a) it uses a wide range of hardware devices (mainly *mobile devices*);
- b) basic tools for support are *Web 2.0* technologies;
- c) the system is hosted and stores the information with which it works in *the cloud*.

Theoretical research and practical achievements in the field of education allow us to outline three main areas of learning, which have the potential for effective and efficient development of EL. These are: educational (academic) training courses; staff training in organisations; and lifelong learning. On their basis we can outline three main potential areas for using the new generation of EL and its transformation into an efficient and effective business practice, and these are namely²⁴:

²⁴ See Emilova, P., Popov, V., Tachev, T. Klauz bazirano elektronno obuchenie za nuzhdite na balgarskite biznes. // Almanah nauchni izsledvaniya, ISSN 1312-3815, volume 23, 2016, pp. 65 – 94.

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- EL as a core business process in educational institutions. Here possibilities for *delivery* of educational services can be realised (in the form of academic resources and content, research applications and educational tools).
- EL as an auxiliary business process in business organisations. There is an opportunity here for business *users* of educational services.
- EL from the point of view of the individual as a user of the educational services. There are opportunities here for construction of *personal environment for learning* for the end user, for collaborative learning, etc.

3.1. Mobile communications and devices in e-learning

The current stage of development of ICT represented by: *pocket mobile devices* (smartphones, tablets, personal digital assistants (PDA), electronic readers, etc.); *wireless communications* (Wi-Fi); *mobile operating systems* (Android, iOS, palmOS, WebOS, Windows Mobile); and *the new generations of mobile communications* (3G and 4G) are a powerful incentive for EL. These technologies gave rise to the concept of 'mobile learning'. As a variation of EL, it aims to create comfortable conditions for the parties in the bilateral process of education, allowing the stakeholders, above all, not to be bound to the physical location of the learning process, together with a number of other advantages.²⁵

Mobile technologies have educational potential in social, pedagogical, economic and personal aspect, the most important of which are:

- They promote and encourage 'learning anywhere anytime'.
- Wide accessibility of mobile devices (low price), which allows learning to reach more people.
- They have social potential connected with their abilities to promote collaboration and communication between people.
- They create conditions for personalised learning by supporting differentiated, autonomous and personalised learning via mobile devices.

²⁵ See **Emilova**, P, V. Kraeva. Mobilnoto obuchenie – sashnost i predizvikatelstva. // Vissheto obrazovanie i biznesat v konteksta na Statégiya Evropa 2020, V. Tarnovo, 2014.

- They provide conditions for effective realisation of concepts such as 'lifelong learning', 'ubiquitous learning', etc.

3.2. Web 2.0 technologies in e-learning

Web 2.0 applications 'are used repeatedly for generation of content by the users and initiate social collaboration'²⁶. Some increasingly popular forms of social interactions are discussions, commenting, collaborative writing, joint project work.²⁷ Today some of the applications of Web 2.0 – Wikipedia, YouTube, Facebook, LinkedIn, MySpace, Twitter, Google Maps, etc. are widely used to create and share information. Furthermore, Web 2.0 applications offer a wide variety of functionality and data through web interface for third parties. In addition, something very important, according to Cormode²⁸ and Krishnamurthy, the participants in all social media are as significant as is the content they publish and share with other people. Thus, the individual gets the opportunity for *social realisation*, which is a characteristic that we believe is particularly significant in terms of the e-learning ecosystem.

In specialised literature, the concept of the *e-learning 2.0 ecosystem*²⁹ is used for the integration of Web 2.0 technologies and the e-learning ecosystem. The review of numerous theoretical studies³⁰, as well

²⁶ **Gunasekaran, A.**, Ronald D. McNeil and Dennis Shaul. "E-Learning: research and applications", Industrial and Commercial Training, 2002, 34(2), pp. 44-53.

²⁷ See **Christian Safran**, Denis Helic, et al. "E-Learning practices and Web 2.0". // ICL Conference, September 26 -28, 2007.

²⁸ See **Cormode, G.** and. Krishnamurthy, B. "Key Differences between Web1.0 and Web2.0", February 13, 2008.

²⁹ E-Learning 2.0 Ecosystem.

³⁰ See **Sclater, N.** "Web 2.0, Personal Learning Environments, and the Future of Learning Management Systems", 2008, <http://www.igiglobal.com/Bookstore/Article.aspx?TitleId=42095>; **Fiaidhi, J. and Mohammed, S.** "Learning Agents Framework Utilizing Ambient Awareness and Enterprise Mashup". // The International Journal of Instructional Technology and Distance Learning, 2008, 6(3); **Hopkins, D.** Benefits of Collaborative Learning, <http://www.dontwasteyourtime.co.uk>; **Mona, N. and Shimaa, O.** An Ecosystem in e-Learning Using Cloud Computing as platform and Web2.0. // The Research Bulletin of Jordan ACM, Vol. II (IV), pp. 134-140. **Hussny, H., Mateen, A, Nayyer, M., Mustafa, T.** E-Learner's Collective Intelligent System Framework: Web Mining for

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as the good practical solutions presented in scientific periodicals, allow us to outline the characteristics of the new generation of e-learning 2.0 ecosystems as follows:

- new opportunities for creation and sharing of content, as well as collaboration with other individuals;
- easy to use learning environment, which considerably simplifies the learning process;
- placing the learners in the centre of activities;
- creating new forms of collaboration and cooperation;
- creating new forms of information and knowledge consumption;
- opportunities to develop creativity;
- ability for joint problem solving and development of collective intelligence;
- access to resources and tools with which the stakeholders can personalise the learning environment and express themselves in a number of different media;
- quick feedback in the learning process;
- improving the efficiency, effectiveness and flexibility of the E-learning ecosystem;
- attractive opportunities for the cooperation and exchange of learning content between the stakeholders.

3.3. Cloud services and ecosystem for e-learning in the cloud

The technology of so-called *cloud computing* combines the latest achievements in the field of virtualisation, storage technologies and broadband Internet access. From the viewpoint of infrastructure the model known as 'cloud computing' provides services by using the technology for resource virtualization³¹. Virtualization overcomes physical limitations,

Personalization in E-Learning 2.0 Ecosystem using Web 2.0 Technologies. // International Journal of Computer Applications (0975 – 8887), Volume 66– No.4, March 2013.

³¹ See **Laan, S.** IT Infrastructure Architecture: Infrastructure building blocks and concepts. Lulu Press Inc. Second edition, 2013.

characteristic for the isolated resources and automates their joint management. In this respect, the model of cloud computing is an innovation regarding the organisation of information storage and implementation of applications. Instead of the traditional approach for the data to be stored on a personal computer, they are transferred into the cloud³². Cloud architecture gives the users access to files and applications (personal and somebody else's) from different online resources and facilitates collaboration.

The nature of cloud services lies in *use over the Internet of distributed and dynamically scalable virtual resources in the form of services*. The architecture of cloud computing is realised in three layers – Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), which operate the various services, brought by the cloud providers. The user uses a *virtual computing environment*, which is: available through established user interface; implemented using distributed computer structures; and is provided dynamically according to the user's current needs.³³ In this respect, three main advantages of the virtual environment can be outlined³⁴. Firstly, cloud computing changes radically the IT infrastructure of organisations and its perception. The users get the feeling of access to infinite computing resources, available on demand, which eliminates the need to make preliminary plans and costs for the delivery of such resources. Secondly, cloud computing has a critical impact on investment. Capital expenditures for ICT are replaced by operating expenses for processing, in accordance with current needs. Organisations can begin with a request for some hardware and system

³² The cloud is a type of parallel distributed system, consisting of connected, globally distributed, virtualized computers, which are dynamically presented as one or more combined computer resources, based on a quality service agreement between the service provider and the client. The use of the word 'cloud' in the term is based on the image of a stylized cloud with which the Internet is indicated in architectural, technological, organizational and other diagrams.

³³ See **Boyanov**, K., Todorov, D., Turlakov, H. Osobenosti na izpolzvaneto na virtualizirani razpredeleni komputarni resursi. // Godishnik na sektsiya "Informatika" Sayuz na uchenite v Balgaria, Volume 3, 2010, pp. 3-11.

³⁴ See **Armbrust**, M. et al. Above the Clouds: A Berkeley View of Cloud Computing. // Technical Report No. UCB/EECS-2009-28, February 10, 2009. <http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.pdf>, p. 4.

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resources and increase them according to their needs. Thirdly, there is a possibility to pay only for the resources used for a random and short period of time during which they were actually used (for example, CPU time per hour or memory volume per day).

It should be noted that cloud computing technology is not revolutionary in the technology it uses, and neither is it a new IT architecture or methodology. It is a new model for resourcing organisations and in reality, it is an economic and organisational change, not a technological one.³⁵

In practice *three models of virtual computing environment* are used (cloud) – public, private and hybrid environment cloud. In the *private cloud* model the organisation-owner and the organisation-user of virtual environment is one and the same. The advantage of this model is the higher level of security that it provides, whereas the main disadvantage is the likelihood of overload and inefficient use. In the *public cloud* model, the owner and the user of virtual environment are different organisations, and the environment is made freely available over the Internet. The main advantage of this model is the possibility for optimal utilization of resources, whereas the main problem is security and the lack of (in a relatively large extent) control over the behaviour of the users. The *hybrid cloud* model is a combination of the first two models and depending on the particular case, it benefits from their advantages or suffers from their disadvantages.

Thanks to their dynamic scaling and the possibility to use virtualised resources as a service over the Internet, cloud computing is becoming an adaptive technology for a lot of processes and activities in business organisations. We believe that cloud computing is an excellent opportunity for education in general and e-learning in particular. *The advantages apply both to users and e-learning providers* (see Table 3).

³⁵ See **Emilova**, P. *Technologiya na oblachnite izchisleniya v upravlenieto na biznes protsesite.* // Narodnostopansli archiv, issue 3, Svishtov, 2013, p. 29.

Table 3.
Advantages of cloud-based e-learning

For users

- cloud-based e-learning as an auxiliary business process in organisations. It helps business users of educational services to realise benefits, the main among which being *the transformation of capital expenditures into operating ones*
 - cloud-based e-learning from the point of view of the individual. The user of educational services has the possibility to *create their personal environment* for learning and collaboration, etc.
 - *The elastic property of the service*. This is the possibility for the resource to be adapted quickly, easily and step-by-step according to the current needs of the users and to pay only for the resources actually used. Thus, in reality the activity and the respective risk resulting from the accurate planning of the necessary resources are transferred to the provider, while the user has the illusion that they have access to an infinite volume of computing and information resources. The organisations using cloud services are greatly facilitated when commencing new initiatives since the risk and losses in the case of failure are at a lower level.³⁶
-

For the cloud service providers

- separating the owners of computer and information resources from their users. This allows *computer infrastructure to turn into goods*, sold at retail prices with pricing models resembling those of electricity, water, etc. In addition, to have the mass accessibility, clear and stable pricing, as³⁷ well as established characteristics which are all very valuable for the users.
 - The development of cloud-based e-learning as a main process in the educational institutions. Possibilities to generate *economies of scale* are created for the providers of educational services (provision of academic resources, research applications, educational and research tools, etc.).
 - Decrease in costs both for initial investment and for implementation of new services. This is the result of creating a stable virtual architecture of the resources used, which allows a higher³⁸ level of *unification and rationalisation of the development of new applications*.
-

³⁶ See **Boyanov**, K., Todorov, D., Turlakov, H. Osobenosti na izpolzvaneto na virtualizirani razpredeleni komputarni resursi. // Godishnik na sektsiya "Informatika" Sayuz na uchenite v Balgaria, Volume 3, 2010, pp. 3-11.

³⁷ See **Michael** A. and all. "Above the Clouds: A Berkeley View of Cloud Computing" – Technical Report No. UCB/EECS-2009-28, 10 February 2009. Electrical Engineering and Computer Sciences University of California at Berkeley - Reliable Adaptive Distributed Systems Laboratory, <http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.pdf>

³⁸ See **Boyanov**, K., Todorov, D., Turlakov, H. Osobenosti na izpolzvaneto na virtualizirani razpredeleni komputarni resursi. // Godishnik na sektsiya "Informatika" Sayuz na uchenite v Balgaria, Volume 3, 2010, pp. 3-11.

The technology of cloud computing can give the organisations the functionality that they need in the form of services, thus providing them with convenience and time to concentrate on their main business processes. The use of cloud services for e-learning provides elastic scaling and as a result – a significant decrease in the costs for education for the organisations. At the same time, organisations may benefit from: the opportunity to reach a new level of cooperation between people and between processes; sharing of common informational and computing resources between individuals and organisations; conditions for the creations of collective intelligence, etc.

The use of cloud services in the field of e-learning currently faces *issues* of different nature. The more significant technological problems are connected with the provision of the necessary levels of security, reliability and productivity.

4. Models and strategies for development of e-learning in business organisations

4.1. Collaborative learning, supported by cloud services

A special environment is needed for the realisations of collaborative e-learning – *collaborative learning environment*, which can be effectively and efficiently supported through the cloud service technologies³⁹. The technology facilitates and stimulates trainers (lecturers, instructors) in two directions. Firstly – to focus the attention and efforts on the learners instead of on the contents, and secondly – to focus on collaboration within the group instead of on the separate individuals. The positive effects of cloud services on learning in collaboration happen in several directions⁴⁰:

³⁹ See **Li Jian**. “On Computer-supported Collaborative Learning Under the Support of Cloud Computing”. // Journal of JIXI University, Vol. 11, pp. 5, October 2011.

⁴⁰ See **Huang, L., Liu, C.** Construction of Collaborative Learning Environment Supported by Cloud computing. // The 2nd International Conference on Computer Science and Electronics Engineering (ICCSEE 2013), pp. 1322-1325.

- *Supports and even encourages learners to create an environment for online learning in collaboration.* Learners can use free platforms and software, provided by cloud service providers (PaaS) and on their basis they can develop online platforms for collaboration and a rich environment with resources and collaborative work. Practice shows that the development of such platforms does not require code writing, but is limited to a simplified work in windows for editing that are easy to set up.

- *Effective integration of the educational resources network.* The use of Infrastructure as a Service (IaaS) provides the users with an access to large-scale high-speed computer clusters, devices for mass storage of data, high-speed traffic. These resources support the provision of rich educational content, as well as quick and convenient search for learning resources. The services provide tools for blog searching, image search, web search, book search, search for educational institutions, code search, personalised search, academic search, SMS search. These tools help improve the efficiency of collaborative learning.

- *Efficient ways of collaboration.* Access to cloud services through a wide variety of devices and more specifically of smartphones, PDA, netbooks and others frees the learners from the dependence, space and the requirements for a high level of client configuration.

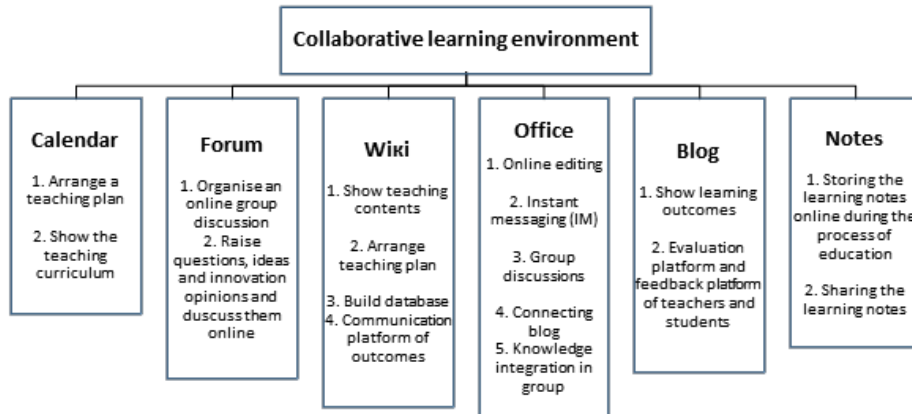
- *Equivalent roles of trainers and learners.* Collaborative learning activities can be initiated and organised by both parties.

- *Possibility for a fair and impartial assessment.* The cloud-based collaborative learning environment gives an opportunity to store online records of each learner's profile as a form of evidence and basis for assessment in the learning process. There is also a possibility for assessment among the trainers and learners, among the groups of learners, etc.

Figure 1 shows the functional components of a collaborative learning platform⁴¹. The separate components can be provided through services of cloud-based environment for collaborative learning.

⁴¹ See **Huang, L.**, Liu, C. Construction of Collaborative Learning Environment Supported by Cloud computing. // The 2nd International Conference on Computer Science and Electronics Engineering (ICCSEE 2013), p. 1325

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Source: Huang, L., Liu, C. Construction of Collaborative Learning Environment Supported by Cloud computing. // The 2nd International Conference on Computer Science and Electronics Engineering (ICCSEE 2013), p. 1325

Figure 1. Functional components of cloud-based collaborative learning platform, using Web 2.0 toolkit

4.2. Model of cloud e-learning ecosystem

According to the technological, staffing and financial capacity of organisations, and taking into account the specific conditions, the organisations can use cloud services for the needs of the e-learning ecosystem in the following three directions:

- *Infrastructure as a Service (IaaS)* – development and use of e-learning ecosystem on the provider's infrastructure, use of space for storage of information, etc. Users of this service are IT specialists who support the ecosystem. The use of this service improves productivity and increases operational efficiency by reducing the initial capital costs.
- *Platform as a Service (PaaS)* – development and functioning of the e-learning ecosystem, based on interface for development, which is property of the provider. Users of this service are the software developers of the ecosystem. This service allows them to benefit from tools for development, automated service management and to use the globally accessible data centres. Thus, the developers can use on their own

systems Visual Studio or C#, and the Microsoft cloud platform, for example, can provide them with the tools Windows Azure, Windows Azure AppFabric and SQL Azure as a service.

- *Software as a Service (SaaS)* – using an e-learning ecosystem provided by the service provider. Users of this service are all living components of the ecosystem (learners and other stakeholders). Thanks to this service, they do not waste time and money to overcome operative operational obstacles, but instead they focus on their main activities and the process of learning.

* * *

The new e-learning systems establish themselves as a key management tool in business strategies for human resource management, for improvement of the efficiency of the processes for staff professional development and for the development of corporate knowledge. Thanks to concepts such as e-learning ecosystem, collaborative learning, lifelong learning, ubiquitous learning, etc., as well as to technologies such as Web2.0, mobile technologies and cloud services, the traditional learning systems adapt themselves to the modern requirements of business environment. As a result, organisations achieve high efficiency, develop workforce productivity and generate positives like new knowledge, collective intelligence, etc.

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