

Web 2.0 technologies in university education

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Abstract - This paper presents an overview of popular Web 2.0 technologies and a review of research related to their use in education. A survey of the use of Web 2.0 technologies was performed by university students with a high level of ICT skills and access to the Internet. For selected Web 2.0 technologies and services the students were asked how frequently they use them and for what purpose. Web 2.0 technologies are suitable for communication between the instructor and the students, for collaboration among students, and for peer-to-peer learning. They can also support novel forms of technology use in education and innovation in instructional design.

I. INTRODUCTION

In recent years, we have witnessed a rapid increase in the use and development of interactive web based applications [4]. Web 2.0 is a new approach to web applications development with an aim to examine, predict and satisfy needs of targeted group of users. Mentioned approach enables integration of advantages of desktop applications and web pages into simple web applications to which user can accede always and from any computer worldwide.

E-learning 2.0 is a term for new generation of e-learning that is based on Web 2.0 principles. This concept completely changes approach to the already known e-learning process. Students are encouraged to be more than passive consumers and information recipients by actively participating in content development, supplementation, modification and transfer. Instead of student's usage of contents developed by their educators, they create new knowledge through interaction and exchange of experiences and information. One of the most important characteristics of new approach to learning process is duplex communication where students provide educators with a feedback that leads to increase in quality of learning contents. Furthermore, many of web technologies that are involved into learning process are not primarily aimed to be used for that purpose (e.g. wikis are being used to support community in learning activities [12]).

There are many examples how Web 2.0 technologies can be integrated in e-learning process (e.g. [2][19]). In this paper we will briefly describe all technologies and applications that are part of E-learning 2.0 approach, give some examples of their usage in learning domain and present results of a survey according to cognition and usage of E-learning 2.0 technologies and applications by university students.

II. WEB 2.0 TECHNOLOGIES FOR E-LEARNING ACTIVITIES

Every web application that can be used for e-learning activities has implemented some or all technologies of Web 2.0 paradigm. In this section we will describe these technologies and give examples of their applications in e-learning field.

AJAX (Asynchronous JavaScript and XML) is a term that describes new and different approach to using number of existing technologies including DHTML, XML and XMLHttpRequest object [18]. It enables dynamic and simultaneous information update and retrieval without reloading the entire page. This makes Web-based applications more interactive, customizable and responsive to user actions.

Audio podcasting refers to a process of recording and distributing electronic audio files online. Most popular audio podcast web service is *Odeo* where educators have an ability to record their lectures and publish them on the web. Students can reproduce mentioned digital files directly on the website or download them on the computer or mp3 player. The main benefit of podcasting is that it allows students to decide where to listen, what and how [20]. Moreover, it is a great example how students and educators can share their work and experiences with other colleagues worldwide.

Blog or weblog stands for a frequently updated journal or diary published on the web. Blogs are powerful tool because they allow publication and sharing of personal thoughts, experiences, ideas and web links in chronological order to people from the entire world. Furthermore, there are millions of people who will read those blogs and respond on them. Today, blogs are increasingly used in an e-learning process and they allow both students and educators to interact more effectively [9]. Students can use blog for asking questions, comment on topics, publish additional resources or links, etc. On the other hand, educators can use it in order to publish newest information and practise examples, set tasks, etc. The main advantage of blog is that interaction between writer and readers results with exchange of different points of view that can be used for better concept understanding or as a help in problem solving.

Mashup is a web technology that combines features, functions or information from more than one source with an aim to create original content. One of today's most popular examples of mashup is *iGoogle* that brings together a range of information from various different sources by using pieces of pre-built programming modules. Furthermore, mashup approach can be used as a base of

creating a supportive environment for e-learning by combining web-based tools and learning content (for more information see [14]).

REST (Representational State Transfer) refers to an architectural style of large-scale networked systems that often describes how distributed data objects (resources) can be defined and addressed and how they can be transmitted over HTTP without the need for additional messaging layers or session tracking. Since REST exploits HTTP and XML, it can be used for publishing syndicated contents (RSS). Moreover, because browser can access any application and data resource, REST requires less software at client side than other approaches do [17].

RSS stands for Really Simple Syndication and it is an XML-based content-syndication protocol and standard that allows the user to aggregate information from many different web sources depending on his interests (e.g. blogs, news feeds, etc.). The RSS newsreader or aggregator will usually check each feed several times per hour and when new content is added or replaced, it will report this change to the user. The main advantage of using RSS is that user doesn't have to visit each web page in order to scan for new content. However, if user wants to read entire article, he must follow link to the original web site. RSS can also be used in educational purposes. Students can use it for their individual studies or for collaborative projects on a shared blog (for more information see [6]).

Social bookmarking is a web-based service where students and educators can organize their favorite resources and share them with others [16]. This kind of web service can be used in process of e-learning with an aim of collaboration and content supplementation among individuals who have particular interests. *Del.icio.us* and *Ma.gnolia* are today's most popular web services for personal favorites classification and sharing.

SOAP (Simple Object Access Protocol) refers to an XML-based communications protocol that lets applications to exchange information over HTTP. Since it can be built on top of every transport layer, SOAP is ideal for implementation of XML Web services that can be called from almost any environment [1]. In order to describe mentioned web services, SOAP uses XML format that is called Web Services Description Language (WSDL). WSDL file describes network services as a set of endpoints or ports that operate on document-oriented or procedure-oriented SOAP messages [8]. This means that WSDL document describes everything required to write an application that will work with an XML Web service.

Tag cloud stands for a visualization of content tags used on a website where tag size reflects its popularity [3]. By clicking on the word (link) in the tag cloud, user can see all items on the website that contain clicked tag. Since the font size of a displayed tag usually shows the relative importance of the tag, students can be, in educational tagging, motivated to contribute tags in order to change the appearance of the tag cloud.

Video podcasting (vidcasting, vodcasting) is the process of creating and publishing video files that students can download and watch on their computer or some portable video player. On the other hand, vlogging is a video form of blogging where every blog post is a video entry. Educators can use mentioned two Web 2.0 concepts to record their lectures with an aim of visualizing some aspects that

cannot be explained by words. Furthermore, when video presenter is not required, educators can produce video materials by combining audio lectures and slides [11]. Although the learning benefits of video materials, educational use of video podcasts is much less usual than audio podcasts [7]. Most popular web applications for video records publishing are *YouTube* and *Google Video*.

Virtual world refers to distributed and computer-based virtual environment where users can inhabit and interact with other users, objects or computer agents by using avatars. Special type of virtual world is social virtual world which main purpose is education and community development. *Second Life*, one of most popular 3D virtual worlds is used at several universities around the world [10] because it allows students to develop communication skills and creativity. Furthermore, *Second Life* is applicable for adult education (see [13]) and scientific research.

Wiki stands for an asynchronous collaborative website where users are allowed to create, edit and delete web page content, including the work of other authors, using their web browser. Educational use of wikis is growing and there are examples how it can be implemented at university level (e.g. [5]). In a wiki environment both educators and students are able to create collaborative documents and perform discussions by posting signed messages [15].

III. E-LEARNING 2.0 APPLICATIONS

Web services that have implemented Web 2.0 concepts are backbone of a new approach to e-learning process. In this section we will briefly describe mentioned web services, divide them into several categories and give examples of their application in the e-learning field.

Photo management and sharing applications are web services whose main advantage is facilitated organization and access to number of photos. Students are able to securely and privately share photos with their colleagues worldwide. Moreover, students can find photos in one place and use them for their homework, presentations, blogs, etc.

Social networking and communication applications stands for web services where students can create a community and share resources, thoughts and experiences with people that have same interests.

Collaboration and creative learning applications refers to web services that are developed to help students involved in common projects to achieve their goals and learn new things in an active and creative way.

Learning materials development applications are web services where educators and/or students can develop, organize and customize learning materials and contents with an aim to present information in a most appropriate way and thus satisfy consumers' needs.

Replacement for standard desktop applications refers to web applications of certain characteristics and high quality implementation which can completely replace desktop applications for word processing, spreadsheets, presentations and diagrams creating, etc.

Learning management systems with a 2.0 suffix are LMS of new generation that presents integration of several or all above mentioned concepts and technologies.

Depending on their purpose, web services for e-learning activities can be classified into several categories, as shown in Table 1.

TABLE I
CATEGORIZATION OF WEB SERVICES FOR E-LEARNING ACTIVITIES

Category	Name	Purpose
Photo management and sharing	Flickr	Photo searching, sharing and organizing
	Zoto	
Social networking and communication	Facebook	Networking people that have the same interests
	MySpace	
	YackPack	Audio conference
	Chinswing	Audio forum
	Yaplet	Portable chat room
Learning materials development	Slidestory	Integration of slides and audio records
	Nanolearning	Separation and organization of audio and video lectures
	Bubbleply	Adding notes into video records
	Mojiti	
	Veotag	Organization of video and audio lectures
Replacement for standard desktop applications	Zoho Writer	Creating and sharing textual documents
	Writeboard	Web word processing
	ThinkFree	Web alternative for MS Office
	Xwiki	Documents organization and sharing
	Spresent	Flash web service for presentation development
	Gliffy	Diagrams development
	Editgrid	Web service for spreadsheets development
	Thumbstacks	Presentations development and sharing

TABLE I CONTINUED

Category	Name	Purpose
Learning management systems	Elgg	Integration of weblogs, audio records, etc.
	Nuvvo	Creating and attending commercial e-courses
	Digication	Experiences and knowledge exchange
	Chalksite	Users networking
	Haiku	Integration with Flickr, Odeo and Youtube
	Vyew	Teleconference using for media sharing
Collaboration and creative learning	Bubblus	Mental maps development
	Thinkature	Interactive board for ideas exchange
	NoteMesh/Etoody	Notes and lectures sharing
	JotForm	Web forms generating
	LetterPop	Brochures development
	Bubblr	Comics development
	Imagination Cubed	Drawings and ideas sharing

IV. TECHNOLOGIES AND APPLICATIONS USAGE SURVEY

The main problem of this research was to determine cognition and usage rate of Web 2.0 technologies and their application in e-learning domain. For that purpose the data was collected from 415 university students of information systems aged 19-35 years, of which 76% were male and 24% female. Furthermore, 23.8% of the participants were students of the second year, 50% attended lectures of the third year and 26.2% were students of the fourth year. More than 80% of them stated that their knowledge of computers and the Internet was in the range from “good” to “excellent”. In general, as shown in Figure 1, knowledge about Web 2.0 technologies seems to be relatively low. The analysis of the answers showed that REST, mashups and tag clouds are at least known among the survey subjects. While this was expected for REST, we were quite surprised when analysis showed that more than 73% and 58% of participants, respectively, have never heard for mashups

and tag clouds. On the other hand, survey reflected that blogs, wikis and virtual worlds are the best known by majority of participants.

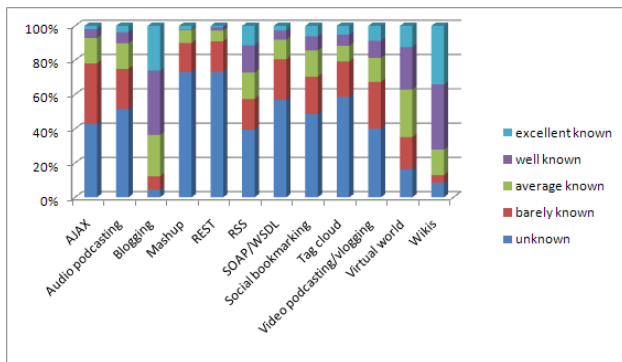


Fig.1. Knowledge about Web 2.0 technologies

As far as active and passive use is concerned, wikis and blogs are most frequently used Web 2.0 technologies. It is important to emphasize that students use technologies more often in a passive (for reading) than in an active (for writing) way. For example, blogs are read by 77.11% of participants while only 18.80% write their own blog. Furthermore, 89.40% subjects read wikis but only 21.93% participate in wikis writing. While video and audio podcasts are relatively popular, only 12.05% of participants use video and 10.60% use audio podcasts at least once a week. More than 90% participants stated that they have never used REST, SOAP and WSDL. According to survey results we can conclude that technologies are, in most of cases, used once or twice a week. Figure 2 shows the complete use frequencies of Web 2.0 technologies.

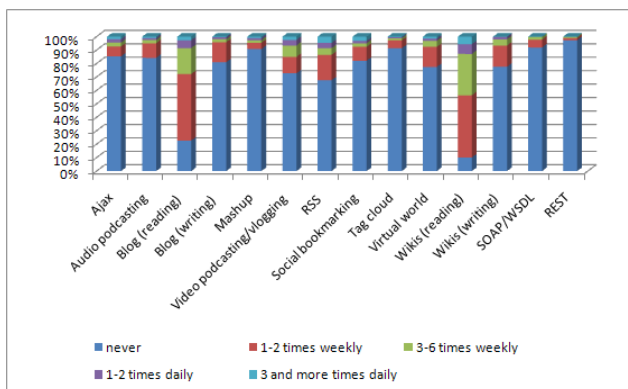


Fig.2. Use frequencies of Web 2.0 technologies

As shown in Figure 3, the research on use Web 2.0 applications in learning activities indicated that most often used applications are from social networking and communication (41.51%) and photo management (38.07%) domain. In contrary, web applications for collaboration and creative learning (26.08%) and learning management systems (21.76%) are at least used by study participants. Figure 4 shows use frequencies of E-learning 2.0 applications. Only YouTube, Google Video, MySpace/FaceBook and iGoogle are used by a significant number of the participants. All other web applications are rarely used with Bubblr, Chalksite and Digication not being used by 82.41% of the study subjects.

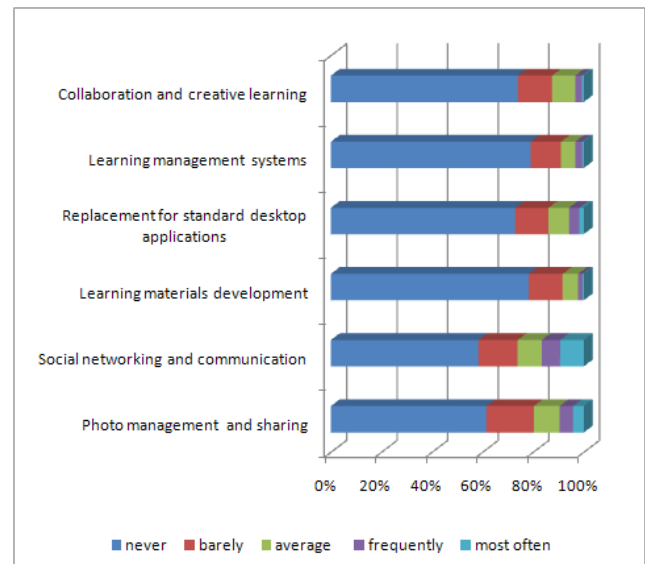


Fig.3. Use frequencies of E-learning 2.0 applications categories

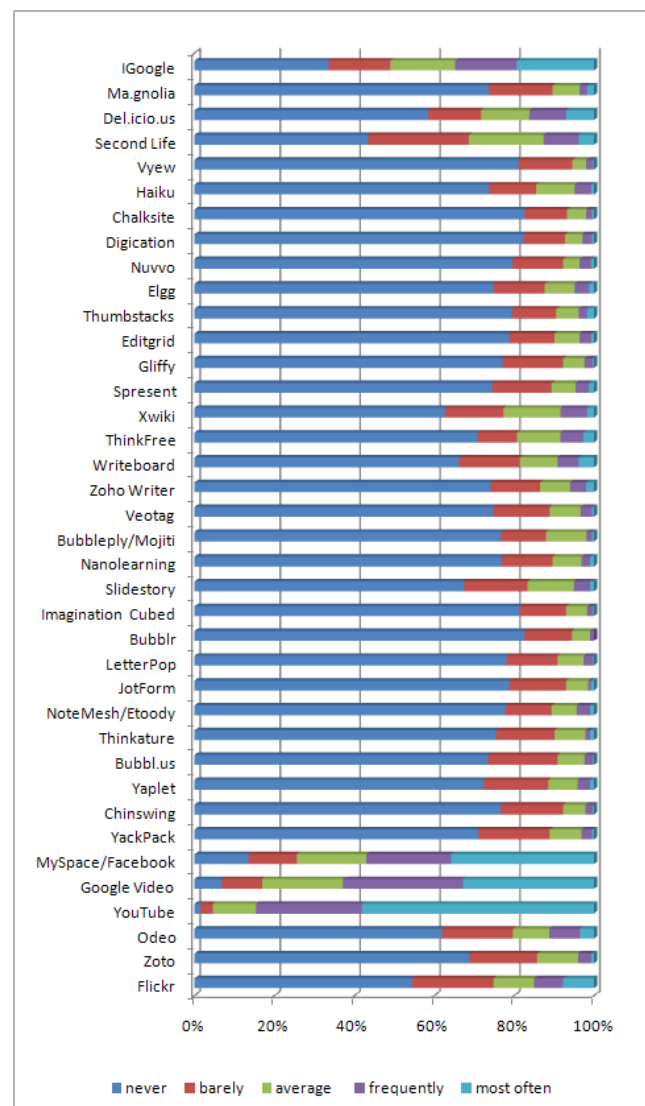


Fig.4. Use frequencies of E-learning 2.0 applications

V. CONCLUSION

With an integration of Web 2.0 concepts into e-learning domain, a number of new web services that facilitate access to information and knowledge absorption have occurred. Rather than being passive content recipients, students are becoming knowledge creators. The main characteristics of new e-learning era are collaboration, networking, interaction and resources sharing. Traditional learning management systems have evolved into social networks for learning where students in one place have access to all web services and resources. Except specialized e-learning platforms, one part of E-learning 2.0 are web services whose primary functions is not e-learning activity, but can be used for that purpose. These applications are used with aim of better content presentation and more quality knowledge absorption.

Despite all mentioned advantages of E-learning 2.0 technologies and applications, our research has shown not so good results. University students of information systems have very little knowledge about the majority of Web 2.0 technologies. Only blogs, wikis and virtual worlds are known by a significant number of students. As far as use frequency is concerned, many of E-learning 2.0 applications are not used at all or are used in very small quantity. Only blogs and wikis are often used Web 2.0 applications in e-learning process. Furthermore, students are more interested in passive than active use of mentioned web applications.

In our further research we will try to figure out factors which had influence on such low usage rates. Moreover, we will, within twelve months, monitor the same group of students in order to detect changes in E-learning 2.0 applications cognition and usage.

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