# Using Web 2.0 tools and ELARS Recommender System for E-Learning

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*Abstract: The paper identifies possibilities of using Web 2.0 tools and ELARS (E-learning Activities Recommender System) in e-learning. Changes that are present in e-learning due to influence of Web 2.0 incited an approach of combining an LMS with Web 2.0 tools and educational recommender system. Some preliminary results of the research project "E-learning Recommender System" are presented. One of the main objectives of the project is development of didactical models for the use of Web 2.0 based e-learning activities (e-tivities) and ELARS system in different types of blended and online e-courses.*

*Key words: E-learning, collaborative learning, e-tivities, Web 2.0 tools, recommender system, ELARS.*

## INTRODUCTION

Early days of using computers in education were characterized by delivery of learning materials for students without any interactivity. During the learning process, students were passive recipients of knowledge without the possibility of viewing learning materials in order they prefer. This problem was solved by introducing web hypermedia paradigm followed by the development of web-based learning management systems (LMS) that besides delivering learning materials offer realization of complete e-courses with communication tools, assessment functionalities, monitoring mechanisms, etc. Some of these systems have additional functionalities that enable personalization of e-learning in the form of adaptive navigation and/or presentation of learning content (i.e. intelligent tutoring systems, adaptive hypermedia systems and recommender systems) [9]. Using an LMS, it is possible to deliver different types of e-courses: e-courses that combine face-to-face and online learning (blended learning [5]) or e-courses that are completely online.

Since e-learning is based on the Web, its development is going on in parallel with the development of the Web itself. Thus, e-learning is influenced by so-called Web 2.0 [1], an approach that promotes interactivity and interoperability. It is possible to observe changes that involve redefined roles of e-learning participants [2]. The emphasis in on collaborative learning based on constructivist approach, which assumes students in the centre of the learning process [12]. Learning environments are also changing under the influence of Web 2.0 [1]. They became distributed or include more loosely coupled Web 2.0 services (tools) [6], [10]. There is also a need for personalization of different aspects of e-learning process [13], [8] and not only learning materials, for which, in example, recommender systems can be used [7].

This paper presents work in progress in the context of the research project "E-learning Recommender System" aiming to develop didactical models for realization of e-learning supported by Web 2.0 tools and educational recommender system ELARS [7]. E-learning models will consist of activities workflows for different types of e-courses that will, besides reading lessons and solving online test for (self)-assessment, include personalized collaborative e-learning activities called e-tivities [12]. The goal of designing such models is to support students in acquiring knowledge according to constructivist theory of learning and using advantages of Web 2.0 technologies. Therefore, the paper identifies possibilities of using Web 2.0 tools for e-tivities as well as opportunities for personalization offered by ELARS.

The paper is organized as follows. Influence of Web 2.0 to e-learning is discussed in second section. Third section brings overview of the elements that constitute the basis for e-learning models development: e-learning activities, Web 2.0 tools and ELARS recommender system. The last section brings conclusions, some preliminary results, and future work plans.

## INFLUENCE OF WEB 2.0 ON E-LEARNING

Changes in the teaching and learning processes caused by the Web 2.0 are highlighted with the term "e-learning 2.0" [2]. Extension "2.0" indicates both, changes that can be observed from the pedagogical point of view and changes that can be observed from the technological point of view.

### Pedagogical aspects

When choosing a pedagogical approach to e-learning, it is necessary to include elements that are in line with different theories of learning: behaviourism, cognitivism and constructivism. However, e-learning 2.0 promotes constructivism according to which students should be active participants who do not remember teaching materials literally, but create their own versions of the course content by exchanging views and opinions with their colleagues [12]. The teacher is still an important participant of that process, although his/her main task is no longer transmitting the knowledge but guiding students in the process of acquiring knowledge [3].

Besides active participation, basic characteristics of e-learning 2.0 impose creativity, collaboration, personalization, flexibility, openness, as well as teaching materials which are combined from different sources (blogs, podcasts, etc.) and in creation of which students are involved. The learning process also assumes joining a community of practice or a learning network that allow individuals to be involved in the process of creating a collective knowledge regardless of whether they are beginners or experts [2].

Unlike traditional learning environments, the amount of available learning content and tools on the Web is almost unlimited and students can learn using resources that are located anywhere on the net. This environment demands new skills from students such as those for finding the necessary information, recognize relevant information, summarize data from multiple sources, express ideas using multimedia and share resources with peers [1], [2].

### Technological aspects

Changes from technological point of view can be observed regarding the structure of learning environments. Environments for e-learning 2.0 extend beyond the scope of closed systems, so together with functionalities of an LMS that are equal for all users, students can learn using appropriate third-party services available on the Web [6]. Accordingly, the environment for e-learning supported by Web 2.0 is comprised of a set of tools. Different students can use different tools and create their own personal learning environments (PLE) [2].

There are many web applications that combine the characteristics of Web 2.0 and can be used in e-learning (e.g. Blogger, Flickr, YouTube) [2], [4]. So-called Web 2.0 tools are services that combine Web 2.0 technologies and Internet standards, and their functionalities often allow interoperability [1]. Approaches to the development of such applications rely on AJAX (Asynchronous JavaScript and XML) and RIA (Rich Internet Applications) technologies that allow designers to create dynamic Web sites and rich user interfaces, which make Web 2.0 tools attractive to students. Generally, Web 2.0 applications should be programmed using lightweight approach which is based on simplicity and accessibility, and oriented to users and their needs. Such approach also enables Web syndication, using RSS for example [1], that makes is easy to track changes for some web resource or collect relevant information from different sources. When applying Web 2.0 tools for e-learning, the phrase "learning in the cloud" is also used. It emphasizes that learning environments use the Web as a platform [1] and are not related to an institution (e.g. university).

## MODELS FOR E-LEARNING

The Web 2.0 approach enticed the development of own e-learning models that can be applied to different types of e-courses. Our didactical models are based on observing the process of e-learning as a sequence of (collaborative) e-tivities, on using Web 2.0 tools for their realization, and on using ELARS recommender system [7] for personalization of e-learning process according to student's characteristics.

### E-learning activities

When discussing about e-learning 2.0, it is important to emphasize that the main task of the teacher is no longer creation of course learning materials. Increasing importance is given to the planning of e-tivities so instead of teaching paradigm (or knowledge transfer paradigm), learning paradigm should be emphasised [3] in the process of e-learning design. E-tivity can be described as interaction of student with other students and with the teacher with the help of the learning environment. It is focused on learning outcomes and occurs in response to a specific task [12]. Thus, elements of the context in which e-tivity occurs are: student, learning environment, other participants and learning outcomes [3]. Perceiving these elements is important for our research in order to include personalization within didactical models that are being developed.

The context of an e-tivity can be related with the Pratt's general model of learning [11]. Learning environment includes a platform for e-learning and resources available in the form of learning materials and tools. The resources required for e-tivity and desired way of interaction between participants are defined by the task. Teacher, as an important participant of the e-learning process, designs a task that is in line with chosen pedagogical approach. This includes defining whether the e-tivity is individual of group-based. For e-learning 2.0 particularly significant are activities in which the task is group-based and involves collaboration.

### Web 2.0 tools

Implementation of e-tivities can be well supported by Web 2.0 tools [10], [6] which, together with certain LMS, make e-learning environment. There are tools whose main purpose is to enable communication, exchange of knowledge and experiences between participants, as well as creating, storing, organizing, sharing and commenting multimedia content. Some tools foster creative learning, social bookmarking, or replace standard desktop applications [10]. Since the number of available Web 2.0 tools is constantly growing, teachers can often choose between several tools in the process of designing e-tivity. For example, when students are supposed to keep an online learning diary, they can write and publish their reflections using Wikispaces, Google Drive or Blogger, or they can record them and publish using YouTube. On the other hand, it is sometimes necessary to use a combination of tools in order to unite their features, for example, to share a mind map created using MindMeister with learning network in Diigo or Google Plus.

After exploring the possibilities of available Web 2.0 tools, a set of 10 tools with different purposes have been chosen. All chosen tools are free of charge (at least in a basic version with limited functionalities).

Additionally, all chosen tools were used in several e-courses and proved to be reliable. Table 1 shows the list of e-tivities designed for our e-learning models with corresponding Web 2.0 tools that can be used for their realization.

Table 1 – List of e-tivities with Web 2.0 tools that can be used for their realization

| E-tivities | Type* | Blogger | Google Drive | Wikispaces | MindMeister | Gliffy | Diigo | SlideShare | Youtube | Flickr | GooglePlus |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Taking notes | individual | + | + | + | | | + | | | | |
| Keeping learning diary | individual | + | + | + | | | | | + | | |
| Writing seminar paper | individual, group | | + | + | | | | | | | |
| Publishing presentation | individual, group | | + | | | | | + | + | | |
| WebQuest | individual, group | + | + | + | | | | | + | | |
| Creating mind map or concept map | individual, group | | | | + | + | | | | | |
| Creating diagrams or flowcharts | individual, group | | | | | + | | | | | |
| Summarizing learning content | individual, group | + | + | + | + | + | | + | + | + | |
| Collecting and sharing learning resources | individual, group | | | | | | + | | + | + | + |
| Brainstorming | individual, group | | + | | + | + | | | | | + |
| Ice-breaking activity | group | + | + | + | | | | + | + | + | + |
| Discussion | group | | | + | | | | | | | + |
| Group work planning and communication | group | | + | + | + | + | | | | | + |

\* individual activity    group-based activity

When designing e-tivities, it should be kept in mind that certain tools allow collaboration in the process of development of content while others tools foster collaboration by means of commenting and sharing created resources. This is important for the organization and planning of the activity itself. Tools like YouTube, for example, does not enable that a group of students collaboratively produce and publish a video content. Opportunities for collaboration with such tools are reflected in the fact that students can share created and published resources with peers (or interested users). In order to contribute to the own learning as well as learning of other participant, others are expected to comment (discuss) its content and further share it.

### Personalizing e-learning with ELARS

In development of models in line with the e-learning 2.0 characteristics, the need for introducing educational recommender system that will enable personalization of e-learning process was recognized. Since the goal is to personalize actions related to e-tivities recommender system ELARS [14], was also included in the learning environment [7]. ELARS is a web application that should be used in parallel with an LMS and Web 2.0 tools. After login into the system, students can overview e-courses that they are enrolled to, as well as course e-tivities structured into modules. The system provides recommendations of optional e-tivities included in the course workflow, Web 2.0 tools offered for certain e-tivity and possible collaborators – colleague students. The system also offers advice to encourage active participation in e-tivities [8]. Recommendations are presented to students as a list of offered items, ranked depending on the calculated utility [7]. Figure 15 shows student's interface with Web 2.0 tool recommendations.

Figure 15 – Recommendations of Web 2.0 tools in ELARS system

Personalization of collaborative learning implies adaptation to student's and/or group's characteristics. Therefore, following data is stored in the system's database: student's preference of Web 2.0 tools and learning styles, knowledge levels for course concepts, and activity levels for e-tivities. Activity level describes quantitative aspect of participation in the e-tivities and is calculated based on traces collected from the Web 2.0 tools. The collection is performed automatically within the ELARS module for data collecting via API or RSS, using adapters implemented for each service from predefined set of Web 2.0 tools [7].

Depending on these characteristics and criteria specified by teachers, it is possible to determine recommendations for individual students or groups in accordance with desired pedagogical strategies. For example, optional e-tivity that requires collection of additional resources could be recommended to the target student with a high knowledge level in order to allow him/her to expand his/her knowledge. On the other hand, optional e-tivity that requires summarizing lessons could be recommended to him/her in case of low knowledge level, allowing repetition of subject matter. Similarly, students with different learning styles could be recommended as useful collaborators for certain e-tivity in order to avoid that all group members have the same learning style preference.

### CONCLUSIONS, PRELIMINARY RESULTS, AND FUTURE WORK

This paper presents research towards e-learning models that will promote interaction of students with their colleagues and will ensure service that is not equal for all, but personalized to students' characteristics. It is based on approach of combining LMS with Web 2.0 tools and educational recommender system in order to foster e-learning process.

Tools for collaborative e-learning activities (e-tivities) are in some cases implemented in LMS systems, but Web 2.0 tools available on the Web often outperform their functionalities. In addition, tools available within an LMS represent a limited set of tools which can represent a drawback for the process of designing e-tivities. Further support can be achieved by using ELARS recommender system which enables personalization of optional e-tivities, appropriate collaborators, and tools offered for certain learning activity, as well as support in a form of advice during e-tivities.

For now, a prototype of the ELARS has been developed and used for two e-courses: 'Hypermedia in education' and 'Operational research' (42 students) with encouraging preliminary outcomes. Experiences gained after completion of qualitative and quantitative analysis of student's results will help us to continue our research efforts on developing e-learning models. Our future work will focus on further improvement of ELARS prototype and on creating and evaluating didactical models for the use of Web 2.0 based e-tivities in different types of blended and online higher education e-courses.

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**The paper has been reviewed.**