E-Learning 2.0: Using Mashups in University Courses – a Croatian Experience

Nikola Vlahovic, Zeljka Pozgaj, Vesna Bosilj Vuksic

***Abstract* —** Introduction of Web 2.0 paradigm that changed the roles of Internet users in dissemination of information online. From the point of the learning processes, the way people learn has evolved from a mostly passive to a more active process thus making the transition form e-learning to e-learning 2.0. The new paradigm changes roles of participants in the learning process but also it changes the quantity and quality of the learning resources. As Internet users engage in creation and publication of new information, the quantity of available information becomes unmanageable. The need to verify and summarize information as learning resource becomes eminent. Also alternative presentation styles of information and knowledge need to be introduced in order to put this information into a manageable perspective. Goal of this paper is to present a possibly the most versatile solution to this problem called mashups. Mashups allow users to retrieve or extract the information they find useful using a number of possible presentation styles including multimedia. In this way they can select relevant facts from numerous resources and creating a new more useful resource for learning. In this paper we will present some of the mashups that are used as additional learning resources for students in courses at the Faculty of Economics and Business University of Zagreb, presenting the advantages they bring to the learning process and some of the new challenges.

***Keywords* —** E-Learning, Information Retrieval, Information Extraction, Mashups, Web 2.0.

I. Introduction

WEB 2.0 paradigm that changed the roles of Internet users in dissemination of information resources online has made a strong impact on education and the learning process. E-learning has evolved from a mostly passive concept of distribution of learning material and lectures in a one way communication act directed from teachers towards students. A more active process that resulted from added functionalities but also concepts that Web 2.0 introduced made e-learning transform into e-learning 2.0. Now all of the stakeholders within the learning process have to adopt new habits in learning if they are to take most advantage from embracing e-learning 2.0 [4]. Students take a more active role in all of the segments of the learning process, their interaction increases through interconnecting, cooperating, collaborating, creating and exchanging new knowledge. Educators' role shifts from a teacher to a mentor that serves as a mediator of the learning process encouraging students to interact and create new knowledge. One of the consequences of these changes and new tools available through the use of Web 2.0 services is that learning resources also inevitably change. Most important change is the fact that the available information is becoming overwhelming in terms of quality due to their creation dynamics. This increases the need for presenting learning material in alternative forms and multimedia.

Goal of this paper is to present one of possible solutions to this problem called mashups. Mashups allow users to seize far more control over what they do online by selecting relevant facts form a number of resources and creating a new more useful resource for learning. In this paper we will present some of the mashups that are used as learning repositories for students in a number of courses at the Faculty of Economics and Business, presenting the advantages they bring to the learning process and some of the new challenges. Another example that will be presented in this paper is the use of mashups in a student-centric setting where students themselves create mashups as a part of their course.

The structure of the rest of this paper is as follow. In Section 2 we will present the reasons that lead to development of e-learning 2.0 concept and some of the most notable challenges it creates for educators and students will be given. As the quantity of learning resources grows and the most critical challenges for educators and students is to be able to distinguish between useful and trustworthy information from the pool of all available content problems of information retrieval and changes Web 2.0 introduced will be presented in Section 3. In the following Section mashups as ultimate information retrieval concept will be described as well as some of the Web 2.0 tools that can be used to produce mashups but also RSS feeds and similar data typically used in creation of mashups. Here will be presented mashups that are used in current courses at the Faculty of Economics and Business University of Zagreb. Finally, conclusions will be given in Section 5 along with a few guidelines that can be drawn from the presented experiences of the authors.

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N. Vlahovic is with the Faculty of Economics and Business at the University of Zagreb, Trg J. F. Kennedyja 6, 10000 Zagreb, Croatia (phone:+385-1-2383-333; fax: +385-1-2335-633; e-mail: nvlahovic@efzg.hr).

Z. Pozgaj is with the Faculty of Economics and Business at the University of Zagreb, Trg J. F. Kennedyja 6, 10000 Zagreb, Croatia (e-mail: zpozgaj@efzg.hr).

V. Bosilj Vuksic is with the Faculty of Economics and Business at the University of Zagreb, Trg J. F. Kennedyja 6, 10000 Zagreb, Croatia (e-mail: vbosilj@efzg.hr).

II. E-LEARNING 2.0 AND ITS CHALLENGES

Web 2.0 services have brought about a range of new possibilities that have significantly changed the realization of the learning process in terms of quality. Recent Internet developments such as expansion of social software and novel tools supporting new ways of communicating and networking present new possibilities as well as challenges focused on the dimensions of education and learning [12]. All of the stakeholders involved with the learning process are affected by these new possibilities, but directly and mostly affected are students and educators [10]. Some of the challenges of the new technologies are the same for students and educators.. Learning to use and adopt social software tools and their application in developing the e-learning process represent the fundamental challenge for both educators and students. In order to use these new tools they need to learn about the characteristics of the social software and learn how to use it. Because of that, both students and educators need to dedicate some of their time for "learning to learn" [8]. Within the learning process the tools that posses the greatest potential for improvement of the learning results include tools that enable participants to engage in various types of collaboration in developing the learning material, exchange ideas and attitudes (such as wikis and blogs), web sites that enable sharing of photos, videos, bookmarks (like YouTube, Flickr and Delicious), social network platforms (like Facebook and MySpace) and tools for developing 3-D virtual world like Second life that facilitate synchronous group discussions and meetings [11].

The use of social tools in the course development for E-learning 2.0 requires a new way of teaching and learning. It needs to break from the constraints of conformity and allow for differentiation by focusing on individual identity development within each individual's own context, culture and ability [9]. Unified, formal and closed-up approach to learning associated with traditional learning and earlier stages of e-learning development is being abandoned. From the point of current capabilities of e-learning, traditional learning process is formal and closed system where finalized static learning material is made available to students using Web allowing students only to passively participate in the rest of the learning process. Pedagogically, E-learning 2.0 represents the qualitative shift in accepting the learning process from a closed and passive role of participants towards an open system of learning where learning is situated or located within individualised contexts, providing opportunities for creation of PLEs (Personal Learning Environments) [9]. From students' point of view, PLEs help them to take control of and manage their own learning, managing both, content and process, in order to achieve learning goals [5]. C. Dalsgaarda [3] points out that social software tools can support a social constructivist approach to e-learning by providing students with personal tools and engaging them in social networks. Freedom of direct participation and influence on the flow of the learning process itself according to individual interest of students, creating new knowledge and contributing to the pool of learning content empowers students with new competences, but also responsibilities for the results of the learning process. This novel and dynamics approach to learning is continuously developing and refining in order to take as much advantage as possible from the potentials of social software. Social software is also changing and re-innovating new functionalities which creates a number of challenges in implementing e-learning 2.0 for both educators and students. Most of these challenges are mutually interconnected but nevertheless they can be grouped depending on whether they are focused on educators or students.

A. Teachers' challenges

Key challenge for educators is adjusting and changing the way they teach. The educators' role shifts from being a teacher in traditional sense in terms of straightforward presentation of learning material and sole evaluator of students' efforts in accepting this knowledge. The traditional exclusiveness over knowledge and finite learning content but also absolute authority within the learning process is taken away from the contemporary educator. The educator becomes a mentor. He is a mediator between the learning process and students, his role is to help students with advice, track their progress and guide students through the learning process. He becomes an active member of the students' social community using social software tools. This is a very broad issue for the teachers as all of the aspects of teaching must be adjusted and the applied solutions must meet the expectations of students.

Accepting a role of a mentor opens up a number of specific challenges for the educator:

- challenge of acquiring new technical skills and understanding new software tools;
- adequate adoptation of existing learning materials using new capabilities of social software;
- discriminating between trustworthy information resources that he and his students find published on the Web;
- effective encouragement of students to actively participate in social communities using selected social tools;
- recognising student effort in their activities in social comunities and adequate evaluation of these activities;
- establishing and maintaining continuous interactive communication with students;
- spending additional amounts of time for monitoring student activities and direct involvement in their students online work; etc.

B. Students' challenges

The most important and potentially overwhelming change for students who first begin using E-learning 2.0 is the sole fact that they become active participants and creators of the learning process. They themselves decide: (1) where , when, how long and how much they will learn; (2) what type of e-

learning they will select for themselves (what web 2.0 tool or service they will use, how much will they participate in student groups online social community, creating and exchanging learning materials, their own knowledge and experience). One of the most important challenges for students as active participant in the learning process is developing new, more responsible and more critical attitude towards learning and towards their own learning outcomes. This means that the practice of reflection becomes important for students (as well as it is important for educators). Reflection is a form of mental processing that one use to fulfill a purpose or to achieve some anticipated outcomes [7]. At the beginning of learning it is useful for students to reflect on what they don't know, what they would like to learn and how they want to go about it.

Using new capabilities supplied by social software additional challenges for students arise. The most important challenge is collaborative and peer to peer learning. There is a number of issues for students that stem from this challenge:

- challenge of choosing an appropriate web 2.0 tool with adequate multifunctional capabilities suited to their individual needs;
- efficient usage of the Web 2.0 tool (in terms of registering with the service, „learning to learn", active participation by introducing new topics to the learning group, and encouraging active responses from their peers);
- challenge of distinguishing between trustworthy information sources and inadequate ones (even though teachers can alleviate this challenge for students considerably with their advices);
- recognizing new types of feedback about their efforts from educator but also from peers;
- challenges that are connected with authoring of ideas in in terms of presentation of their own idea and borrowing ides from others;
- challenge of maintaining an adequate level of privacy of information, either their own or those of other participants

III. Trends in Information retrieval after Web 2.0

Information level of contemporary society has elevated considerably over the past 2 decades. The increase of information dynamics within societies on a global scale can be observed as information need less time to become recorded, published and available to an increasing number of individuals. Modern media and information and communication technology – primarily the Internet and mobile technologies – have fuelled these processes on a global scale creating the fastest globalization process in all of recorded human history. The level of information that is being exchanged in a boundary-free environment has become an advantage in most of human activities especially in business and politics but also in education and entertainment [14].

On the other hand the quantity of information is becoming more and more overwhelming. Even at the beginning of the Web in 1995. serious considerations were made about developing new tools to deal with this amount of readily available information. The main issue with a huge collection of available information on the Web is the process of identifying documents that can meet information needs of any particular Internet user. With a growing quantity of information the process of identifying relevant documents becomes time consuming and the overall use of the web inefficient. Therefore information retrieval (IR) can be defined as a set of methods and techniques for formulating information needs of the users in form of queries. The query is then used to select a (hopefully) relevant subset of documents from a larger set i.e. the web [6]. There is a number of challenges for information retrieval systems that are solved and implemented in contemporary search engines such as Google search or Yahoo!search: (1) employing an efficient method of describing content of documents (such as indexing) and storing this information in local database, (2) efficient matching of keywords from user with terms contained in index in order to maximize the number of retrieved relevant documents – (also described as a ratio of retrieved documents and all relevant documents – i.e. recall [1]), (3) eliminating the number of retrieved documents that are falsely identified as relevant (measured as a ratio of retrieved relevant documents and overall retrieved documents – i.e. precision [1]) and (4) updating the databases with newly published web content.

Sometimes users are not interested in retrieving whole documents but part of the documents and particular data contained in documents. In this case information extraction is used. Information extraction denotes any activity which goal is to automatically identify and acquire pre-specified sorts of information or data from natural language texts, aggregate them and store them in a unified and structured database. The process of information extraction is twofold: firstly, precise and robust access to particular data needs to be established and secondly gathered data is structured and stored automatically in a database. The complexity of employed methods for information extraction depends on the characteristics of source texts. The method can be rather simple and straightforward if the source is well structured. If the source of information is less structured or even plain natural language, the complexity of the extraction method becomes high as it includes natural language recognition and similar processes.

Even though these two processes for accessing information intertwine in many areas there are significant differences between information retrieval and information extraction. Goal of information retrieval is to search for documents with information relevant to given query. The user can then access the document and find particular information on his own. The goal of information extraction goes a step further because it tries to find particular data within the content of a document. Information retrieval finds relevant documents on the web while information extraction finds relevant information in documents [6]. Both methods together make up powerful tool for accessing and organizing web information.

With the introduction of Web 2.0 paradigm the importance of these methods grows even more. As we have shown Web 2.0 allowed that Internet users achieve more direct communication among themselves, reducing the role of middlemen. In order to achieve this, Web 2.0 services are intrinsically required to use highly structured data, content and procedures in order to keep the overall information well organized and useful to their users. Information retrieval and especially information extraction significantly benefit from this fact. Information extraction procedure becomes less complex if the extraction is done using fully structured information source. On the other hand the created databases with repositories of extracted information can be used online or even created on-demand. The implementation of RegEx pattern-matching is also more efficient in semi-structured information sources, and features of Web 2.0 paradigm make these complex methods readily available to end users in visual and user-friendly interfaces.

Final outcome is that by information extraction allows average internet user to personalize and customize available information resources and use information sources more efficiently while still creating new context for information and enrich the quality and content of the Web even further.

Some of the services and methods that are made available through information extraction or are benefited by information extraction are given below:

A. *RSS feeds*

RSS is a collection of Web formats used for publishing updates of dynamic web sites, portals and services such as blogs entries, headlines, audio and video, and other resources, in a standardized format. The abbreviation itself can be explained in several ways [18]. First of the two most common explanations is that it stands for Really Simple Syndication due to the fact that is often used to publish updates on newsportals and blogs. In stead on the characteristics of the use, the second explanation is related to the origin and composition of the technology itself as the RDF Site Summary. RDF (Resource Description Framework) is a family of World Wide Web Consortium Specifications that were originally designed as a metadata data model. By implementing RDF as a model for describing summarized site updates the model was accepted as a general model for conceptual description or modeling information that is implemented in web resource. The specification is based on XML where all relevant information about each entry is described along with additional metadata. A set of entry descriptions are usually ordered chronologically by the date of publishing forming a feed that can be subscribed to by the end users and read by using a specialized application or web service called a RSS reader.

The advantage of RSS feeds is that it can be automatically generated during the publication of an article, and therefore it is readily available to all of the subscribed users [16]. In terms of information extraction, as it is concerted with the WC3 Specification and therefore XML it creates fully structured information sources that is easily accessible by the automated processes of information extraction tools.

B. *Folksonomies*

Term folksonomy was first coined by Thomas Vander to denote a bottom-up social classification [17] that was arising with the increasing popularization of Web 2.0 services such as Flickr and Delicious among others. Folksonomy can be considered an evolutionary product of social or collaborative classification of public digital content. The classification is performed by a group of people that may share common interest over certain topic or information resource by adding metadata to publish information. The process of adding metadata describing the content is repeated by all of the users and the taxonomy involving meaning of a particular information resource evolves over time. By reviewing classified content users develop a collective understanding of each term by examining the way other users use it. Finally for each describing term (usually using tags and tagging) a folksonomy is formed that promotes useful uses for each describing term and eliminating terms that are not as useful for describing content [15].

A well established folksonomy can increase the precision of information retrieval from the repository of information sources that are classified. The main characteristics of a folksonomy is that it is always created bottom-up therefore lacking any hierarchical structure, there is public availability of tags and metadata for each classified resource, and there is also social context.

Folksonomies are used for tagging many different types of content available online, such as hyperlinks to web sources (like social bookmarking service Delicious), videos (like video sharing service YouTube), pictures (like Flickr) or even retail products in online shops (like the Amazon online store).

The advantages of folksonomies for information retrieval and information extraction relate primarily to the possibility of enhancing precision of search results that is achieved outside the retrieval process. This is because information sources are better described by metadata that is indexed through the collective intelligence of users. Also similar web services can be approached through same folksonomy so that the final results are more comparable than if they were not evaluated by overall users of the web service.

In e-learning there is a number of ways folksonomies and social bookmarking can be used. When working on a joint project over a period of time, a group of people can bookmark information sources and share the burden of researching new sources with the group. Less experienced individuals can benefit from bookmarks made by more experienced users. Teachers can share their bookmarks with other teachers in the field and update their teaching materials more efficiently than working alone.

C. *Mashups*

A mashup in web development represents a web application, web portlet or even complete web page that combines

information from different information sources, reconfigures or processes them in some way and presents them in a new personalized, customized way usually revealing new context and new facts about the retrieved information. A mashup can be considered a new view on available information [2] that would be otherwise hard to realize because of lack of connection between information resources and their original presentation format, etc. The idea of mixing different content to form new aggregated or summarized information resource was brought about by the increase of published information online and the need of Internet users to stay on top of information updates. First mashups were readily available for end users such as Havarian Information Service - Alert map (fig. 1) that uses data from more than 200 resources about different disasters being reported in real time all over the world and show this information on a world map. Most

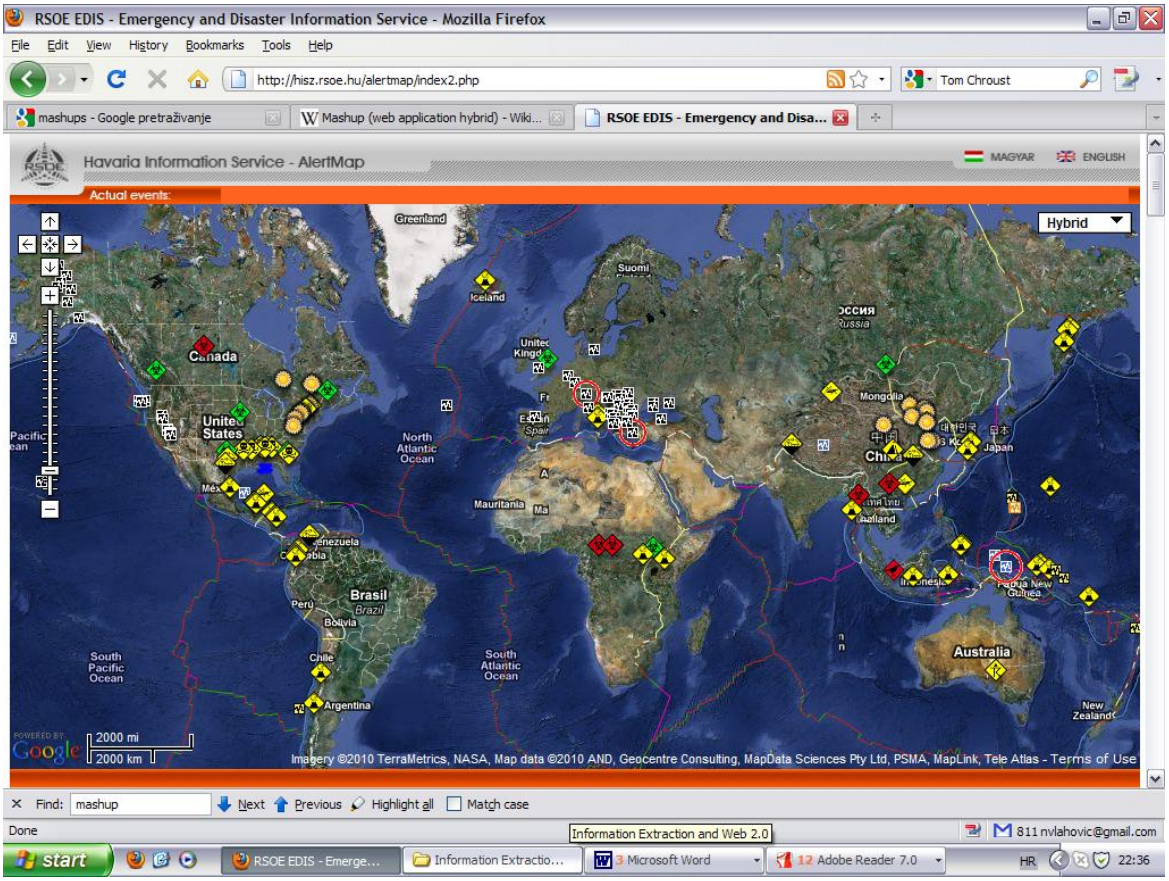

Fig. 1. Havarian Information Service Alert map

available mashups are related to mapping information, photos, searches or video production.

The technology itself uses APIs (Application programming interfaces) in order to retrieve information from different online sources, redistribute it in a new context unforeseen by the original owners of these information sources (mashups and internet content). This is why Web 2.0 was important for creating a more stabile and structured environment that could allow for the data interchange required by mashups. Lately there is a considerable effort for creating tools that can allow end users with no particular programming skills to create their own mashups [13]. Even though over the last 3 years a number of tools and development environments were introduced but also discontinued or replaced (such as Popfly by Microsoft or QEDWiki by IBM) there are a few that are being used and are given to public use while still being successfully developed further in order to provide more functionalities at a better quality. One of the most successful are Yahoo!Pipes, but there is also Gepetto developed by Consumer Computing Laboratory of the University of Zagreb.

In terms of information extraction a mashup can serve as an information extraction tool that can create a list of extracted information and store it online, or even create a customized RSS feed using extracted information. Also mashup can be used for pattern matching using RegEx codes in order to extract even more detailed data from available natural language sources.

In relation to e-learning mashups hold the potential of becoming one of the most powerful learning tools, further advancing the learning experience towards massive personalization. The implementation can be either teacher-centric or student-centric [7]. Teacher-centric implementation means that the teacher retains control over the learning process by designing applications himself and making them available

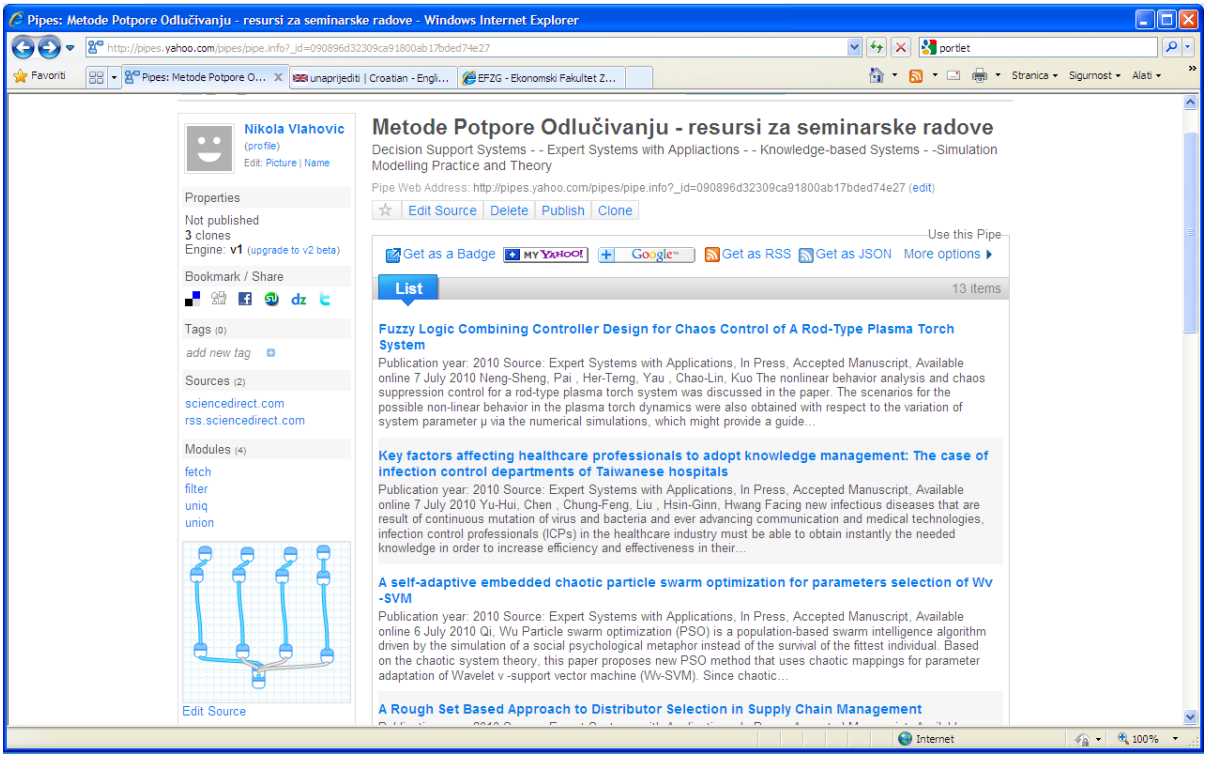

Fig. 2. A Mashup with currently published scientific papers that can be used by students for their individual and team work efforts.

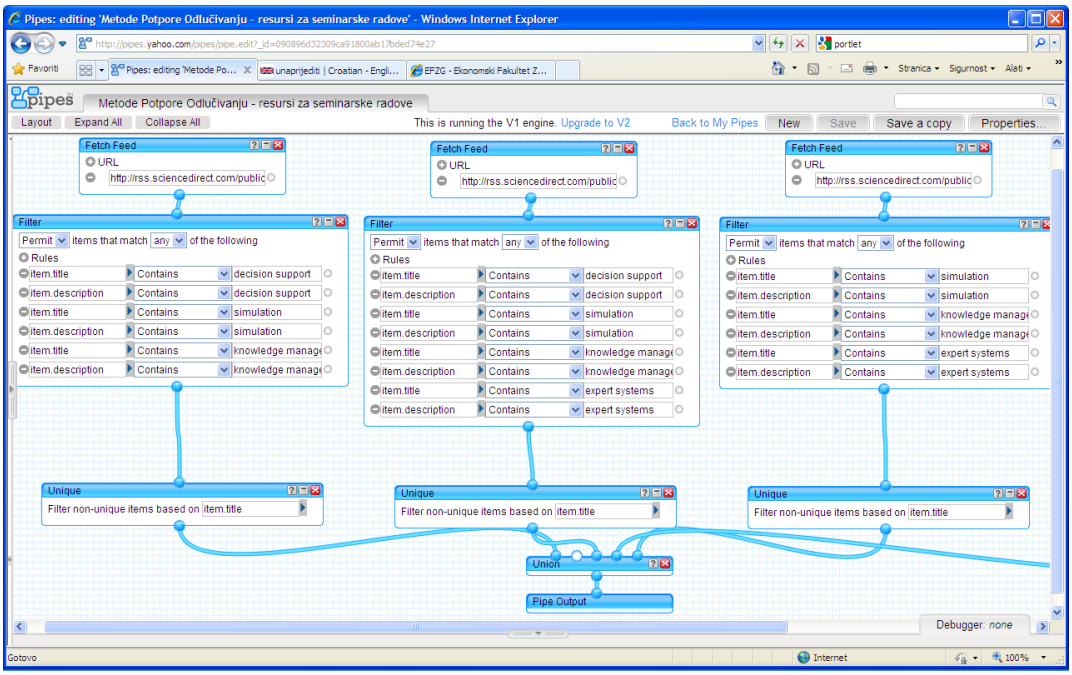

Fig. 3. Yahoo!Pipe Source of the mashup for "Decision support methods" course at the Faculty of Economics and Business in Zagreb

to students. Student-centric implementation allows students to use the tool for creating mashups themselves, empowering their creativity while discovering new information and then summarizing it for the whole class.

IV. Application of Mashups for E-learning in Faculty of Economics and Business University of Zagreb

In this section we will present mashups that were developed for a few courses in the study of Managerial Informatics major at the Faculty of Economics and Business University of

Zagreb. There are few tools that were used for the development of these mashups, namely RSS, Yahoo!Pipes and Dapper.

Both possible types of mashup designs – teacher-centric and student-centric are used. Examples of teacher-centric mashups represent the creation of a list of additional literature for a number of courses. Student centric examples refer to the creation of hand-on student work as project teams where each team has to create their own set of mashups relevant to the course topics.

A few mashups were created for the purpose of developing a list of suggested scientific articles for student seminar papers and paper reviews. These mashup were created as lists of relevant articles that are automatically updated as new volumes and issues of relevant publications become available online (fig. 2).

Mashups are created using Yahoo!Pipes service that uses a visual interface where information is flowing through different elements that are used to analyze and process retrieved information. Defined process intuitively appears as a workflow diagram to the end-user [2], and each workflow ends with the output element that can create a list of items, present the data on a map or in some sort of multimedia (fig. 3). Final definition of the retrieval and summarization process is called a pipe.

One undergraduate course offers this type of a teacher-centric mashup (entitled “Information System Security”) and three graduate courses entitled “Business process management systems”, “Internet technologies for business” and “Decision support methods”. The basic structure of most of these mashups is given in fig. 3.

In fig. 3. we can see the pipe flow where information about published articles is obtained using RSS feeds from three different scientific journals. Each RSS feed is then filtered using keywords relevant for course topics. The results are then combined into a single list (that can be seen in fig. 2).

For publications that do not have RSS feeds available a RSS feed was developed using a web 2.0 tool called Dapper. Dapper is a visual tool for creating RSS feeds and other types of codes by selecting parts of a page that can be extracted as list items. These items can be described using a number of fields. Once created the list of items, called a dapp, dynamically changes to reflect the changes on the original web site pages. Dapp can be converted in a number of interchangeable formats (such as XML, RSS feed, HTML, CSV, etc…). For creating the mashup for a course called “Business process management systems” three different dapps were created (fig. 4).

For each dapp and each web site relevant pages that publish the list of articles were selected. After that fields of the RSS feed were created (title field, author field, publication field where available and description field) the feed is previewed and saved. In fig. 5 we can see the selection of the title for each entry in order to create a title field of a RSS feed for the

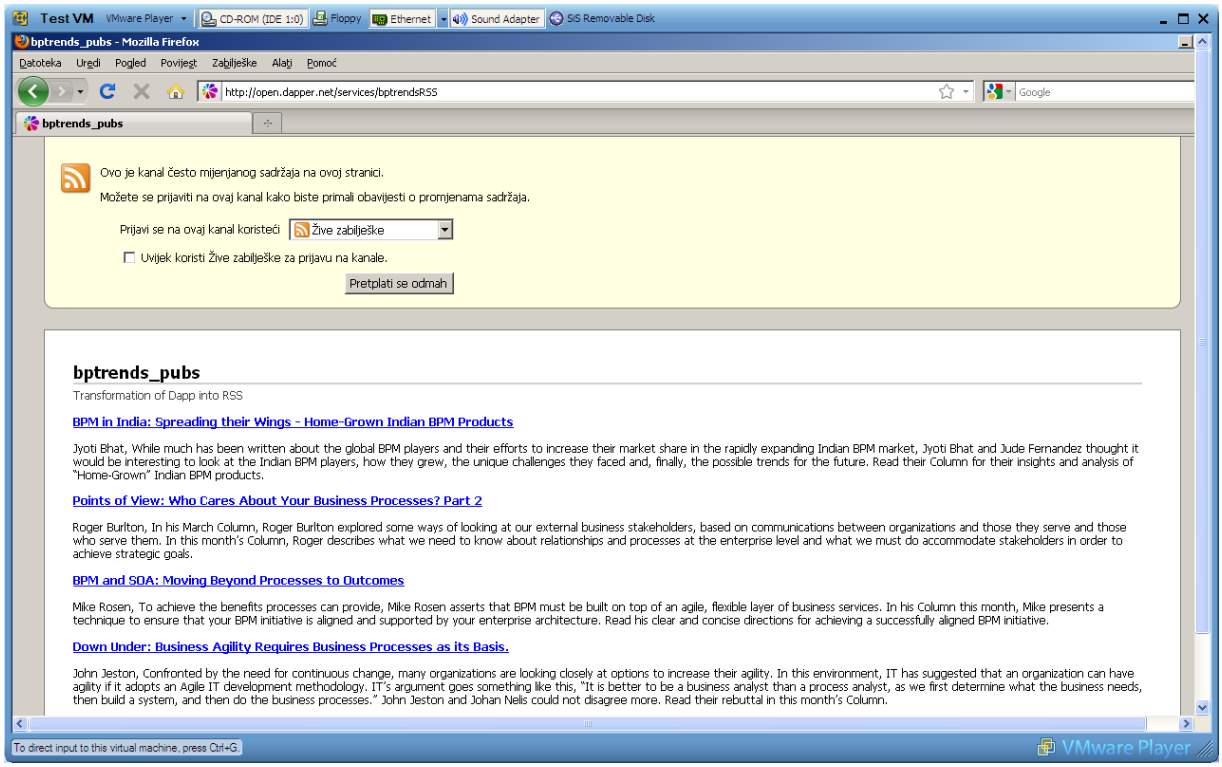

Fig. 4. RSS feed created using dapp for the site www.bptrends.com that offers no RSS feeds on published articles.

web resource www.bptrends.com.

This process was repeated for two more Internet resources on business process management and innovation. Resulting RSS feeds were then included in the Yahoo!Pipe for the "Business process management systems" course mashup.

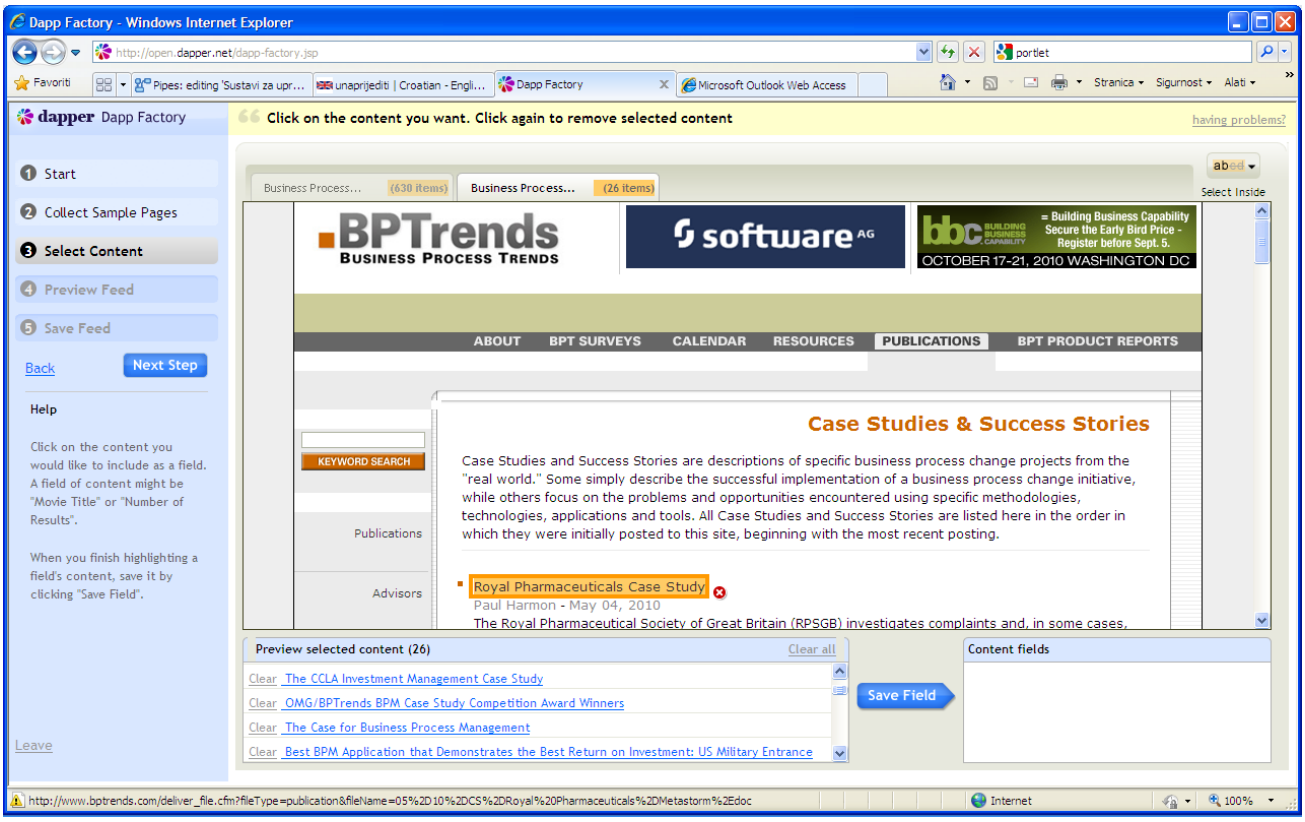

Fig. 5. Creating a RSS feed using Dapper Factory tool at http://open.dapper.net/.

For the course "Internet technologies for business" a student-centric approach to creating learning resource mashup was used. Students were divided into teams. Each team had to register with the Yahoo!Pipes service. After that they had to decide on making useful mashups using Yahoo!Pipes which were relevant to the topics of the course. Each team's effort was evaluated according to the complexity of the mashup and precision of generated results. Student feedback was highly positive and the tool was well accepted, while more than 45% of students decided to use this tool in the future (both for personal and professional use).

V. Conclusion

Web 2.0 served as a catalyst for a variety of recent trends that can be observed in web publishing, Internet and Internet services. The quantity of information that is shared among individuals across globalized society has drastically increased with the incentive Web 2.0 provided by promoting peer-to-peer creation of Web content that leaves out the traditional middlemen, such as editors and traditional content providers. One of most important aspects that rely on Web content is education and learning. In this paper we present the changes that this higher level of information, but also added functionality of Web 2.0 tools initiated within the learning process. The changes in the roles of educators and students that emphasize the need to interconnect, collaborate and communicate created a new paradigm called e-learning 2.0.

The goal of this paper was to show that most of the challenges for all of the participants in the learning process are connected with the overwhelming quantity of information resources. The only possible approach to dealing with these challenges is to use tools that are also enabled and supplied by the same concept – Web 2.0. For the purpose of this paper mashups were presented as a possible solution for combining and selecting relevant information in order to further improve the learning process and the outcomes of learning while using e-learning 2.0. Some of the experiences with mashups that are used at the Faculty of Economics and Business University of Zagreb are also presented. The feedback received from students that were given mashups as part of their learning material resource shows the positive attitude being fostered. The learning outcomes have also presented positive changes in terms of higher competences and adding new competences to the learning results. All of these conclusions represent a strong incentive for further implementation of mashups in courses of the faculty but also introducing the implementation of other Web 2.0 tools.

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