EduPunks and Learning Management Systems – Conflict or Chance?

Martin Ebner[1], Andreas Holzinger[2], Nick Scerbakov[2], and Philip Tsang[3]

[1] Graz University of Technology, Computing and Information Services, Division of Social Learning, Graz, Austria
martin.ebner@tugraz.at
[2] Graz University of Technology, Computing and Information Services, Institute for Information Systems and Computer Media (IICM), Graz, Austria
martin.ebner@tugraz.at
[3] Caritas Institute of Higher Education, President's Office HKSAR, China
ptsang@cihe.edu.hk

Abstract. The term Edupunk coined by Jim Groom defines a do-it-yourself concept of using the most recent Web tools available for teaching, instead of relying only on commercial learning platforms – it is the information, the content, the knowledge which matters. Technology itself does not make education valuable per se, it is the creation of individual knowledge which is of paramount importance. However, today, so much free technology is available, which can be used as hands-on tools to enhance learning and teaching of students. However, in this article, we demonstrate that such issues can also be included in a large university wide LMS, which has been developed at Graz University of Technology (TU Graz) during the last years. The development was initiated by the necessity to emphasize and implement three crucial factors for learning: communication, active participation and social interaction. We assess the potential of current Web 2.0 technologies for implementing such factors. We show that the development process was not technology driven; on the contrary, end user requirements of all end user groups engaged into university learning (students, teachers and administrators) were thoroughly investigated and mapped onto functional components of the LMS. Finally, we provide an overview of the platform functionalities with an emphasis on Web 2.0 elements and EduPunk concepts.

Keywords: EduPunk, Learning Management System, e-Learning 2.0, Web 2.0.

1 Introduction

E-learning technologies have changed significantly over the last 10 years - from the development of all kinds of Learning Management Systems (LMS) to the application of Web 2.0 technologies in educational settings. However the solution of a didactic problem is what ought to drive change in educational settings. Consequently Multimedia and e-Learning must be considered as one of many possible elements required to solve a didactical problem (Holzinger, 2002).

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Tim O'Reilly (O'Reilly, 2005) introduced the term Web 2.0, and described a "read-write-Web" that changes the Web landscape from a huge collection of individual documents to a set of interoperable Web applications. The role of a Web user switched from a passive reader to an active author/writer – as a thinker; and thinking is a central process for effective learning. Such significant changes in the whole Web concept inevitably affected the teaching and learning via Internet. Downes (2005) summarized educational activities by means of using Web 2.0 approaches and concluded that a shift from closed, rigid, passive systems to a more open, collaborative, communicative and sharing philosophy is required. Moreover experiments with Weblogs (Luca & McLoughlin, 2005), Wikis (Augar et al., 2004), (Holzinger, Kickmeier-Rust & Ebner, 2009) and Podcast (Evans, 2007) showed positive effects on Web-Based Learning – if it is used in an appropriate didactical setting. Web 2.0 technologies can be applied for the encouragement of reflective practices (Beale, 2007), or as a support to student-centred approaches (Motschnig-Pitrik & Holzinger, 2002).

In particular, Weblogs can facilitate and stimulate a more distributed learning behaviour, consequently they can be an appropriate instrument to improve learning performance by supplementing traditional lecturing (Holzinger, Kickmeier-Rust, & Ebner, 2009). Since e-learning can generally be defined as a computer-supported communication between teachers and learners, or learners and learners (Preece et al. 2002), new communication facilities have been examined; for example, as an application of microblogging in education (Ebner & Schiefner, 2008). The use of freely available Web resources by means of a combination of different Web applications, such as MashUps (Kulathuramaiyer & Maurer, 2007), (Auinger, Ebner, Nedbal, & Holzinger, 2009) or the utilization of different Web services are a promising approach to overcome the increasing problem of having too much information.

Although technological innovation plays a central role in e-Learning (Ebner & Schiefner, 2009), the success of any application depends on how fast and seamlessly these technological innovations are incorporated into a practical classroom setting. In this paper, we provide an overview on the Edupunk concept through the integration of open and large Web resources into a classroom setting. We present a specially designed and implemented technological solution for 10,000 students from the Graz University of Technology and demonstrate how various services are used in the daily educational practice.

2 EduPunk

On May 25, 2008 Jim Groom coined, on his Weblog, a new term: EduPunk[1]. With this term he expressed his anger about the rigidness and inflexibility of costly commercial learning platforms: "but that survival (of a LMS) is not necessarily dependent on a technology or an innovation, rather it is a means of taking the imaginative experimentation of others and wrapping them up as a product that can be bought and sold like a pair of shoes[2]". According to Jim Groom's Edupunk, there is a "necessity for a

[1] http://bavatuesdays.com/the-glass-bees/ (last visited: May 2010).

[2] http://www.downes.ca/cgi-bin/page.cgi?post=44760 (last visited May 2010).

communal vision of educational technology to fight capital's will to power at the expense of community". Stephen Downes[3], who coined the term e-Learning 2.0, expanded the definition into three facets (Rowell, 2008):

1. As a reaction against the commercialization of learning
2. To symbolize the do-it-yourself (DIY) aspect of educational technology
3. As a way of thinking for yourself instead of being told what to think and learning for yourself instead of being told what to learn

Consequently, Stephen Downes addresses elements of the anti-authoritarian education of the 1960s to be interpreted by the modern digital world of the present time. Gualtieri compared EduPunk with a kind of chaos, made necessary by a low budget. She asked whether chaos 'will ensue if all instructors do that?' (Gualtiere, 2008, Page ref). Some educational institutions provide appropriate, internal systems for their educational aims, however, there are lecturers who like to teach in different, unsupported ways. In the future, upcoming technologies may even broaden the gap between what is possible and what teachers want. Increasing mobility, a huge quantity of mobile devices with access to teaching and learning processes, as well as cloud computing, are trends strengthening the philosophy of distributed learning and the concept of EduPunk.

Consequently, rather than seeing EduPunk as a pure concept or theory, we have to see it as a possible way to foster and strengthen future approached to teaching and learning. Teachers will be able to consider learner individuality by integrating different Web resources; will be able to strengthen their own didactical scenarios by using the Web applications most appropriate for their needs; and, will be able to enhance education using the largest database that has ever been available. Obviously, there are opposing opinions, e.g. that not everyone wants to be an Edupunk as Mark Notess recently pointed out: 'cobbling together unique collections of social media tools to craft the customized toolset for each learning event. In fact, quite a few instructors prefer the technology of instruction to be as invisible as possible and do not themselves have the expertise, time, nor interest to make it so if they had to build their own learning environment (Notess, 2009)'.

Since teaching is also a form of learning for the teachers, as they acquire knowledge through new information, educational institutes have to think about how they can integrate Edupunks in an appropriate way.

3 The General Concept

Graz University of Technology can look back on a long history of technology enhanced learning generally and has profound experience in applying e-learning specifically. First experiments were carried out to enhance online education by developing special authoring tools (Maurer & Scerbakov, 1996) and information systems with a special focus on e-learning needs (Andrews et al, 1994) along with the general recognition of the enormous potential of the Web for higher education. Such experiences

[3] "Introducing EduPunk" http://www.downes.ca/cgi-bin/page.cgi?post=44760 (last visited: May 2009).

provided a solid know how for the development of a very large Content Management System (Kappe et al., 1994), followed by a recent Learning Management System, the "WBT-Master" (Helic et al, 2004). Initially, a database portal system, called TUGRAZonline was developed and deployed (Haselbacher, 2002) to support solely administrative tasks.

Typical administrative tasks are:

- Target group - students: Students are able to enroll for university courses and get a personal planer, where all course appointments are scheduled. Students may register for examinations, and practical exercises. Information about each student's progress according to courses is also kept in the database.
- Target group - teachers: Teachers define actual courses, provide course descriptions, including learning goals and prerequisites, and define course appointments.
- Target group – administrative staff: There are some further administrative tasks, such as booking rooms, handling exceptional enrolments for courses and examinations; and providing final student marks.

It was recognized that the existing administrative environment needs to be enhanced with a modern learning management system (LMS). Such a LMS should support innovative Web 2.0 technologies to encourage teachers to follow the Edupunk concept by using appropriate tools enhancing their didactical practice. For media didactics, the three following questions are particularly important (Holzinger, 2002):

- How should the communication space of a medium be designed, in order to secure and/or to increase learning success?
- Should the interaction by means of defined learning methods progress sequentially?
- Should the possibility of free movement within an open interaction space, in a net of informational units be given?

These questions have been intensely studied by media didactic researchers for some years. The decisive criteria for the structure of an interaction space can be summarized as follows:

Previous Knowledge: A cross linked communication room is of more use when the target audience has a basic knowledge of the subject (Holzinger, Kickmeier-Rust, Wassertheurer, & Hessinger, 2009). Learner can then freely select the information of individual interest.

Motivation: The term intrinsic motivation (Brehm & Self, 1989) is used when learners wish to know more of the subject as a result of a personal interest in the subject itself, rather than from a primary interest in the possible rewards of learning, such as good notes in an imminent examination. In the case of a sufficiently large intrinsic motivation, an open learning environment can be created.

Independent Learning: A strongly cross linked and open learning environment is suitable for learners accustomed to, or preferring, independent study. Learners who are, as yet, unfamiliar with this method require sequential learning methods at the beginning (Graf, Lin, & Kinshuk, 2008).

4 The Technological Solution

A Learning Management System (LMS) can be seen as a special type of Web based Content Management System (CMS) providing tools for uploading learning materials, access to such materials and special learning-oriented functionalities including communication, collaboration, and evaluation.

An LMS works in a rich Web context and obviously has to be integrated with general functionalities available on the Web. In former times, the LMS did not suffer from an isolation effect. That is, any materials available on the Web might be easily reused within an LMS simply by an URL – computer navigable links; similarly, documents inside an LMS were accessible via generic URLs leading to a particular document. However, the following Web 2.0 concept changed the connotation of the Web dramatically.

Instead of a huge number of individual documents interrelated by navigable links, we see now diverse Web applications. Such isolated systems such as CMS, LMS, Wikis, Blogs, Social Communities, Podcasts, and Image repositories, are accessible by means of Internet protocols. This situation resulted in a certain isolation of the LMS – rich functionality of modern Internet applications cannot be seamlessly integrated into an LMS, thus the content of an LMS becomes isolated from other systems.

4.1 Synchronous Web Services

A synchronous Web service can be defined as follows – a Web server (service-client) forms an XML encoded request to another Web server (service-server), and sends the package via an HTTP protocol to the service-server. Essentially, the service-client cannot continue the task and waits for a response from the service-server. Normally, the REST (REpresentational State Transfer) and RPC (Remote Procedure Call) protocols are used for such a communication. A precondition for using this architectural style is a short response time, (time needed to transfer and process a request).

Obviously, such a communication architectural style might be used very extensively, but we will point out only actually implemented tasks that have verifiably provided a robust functionality.

- Export LMS content as RSS (really simple syndication) feed; it has become almost a common way nowadays to inform users of latest modifications by dynamically generating topical RSS feeds and requesting them via a REST Web service.
- Export LMS content as RDF (resource definition framework) map. While RSS feeds provide information on latest modifications, an RDF map provides a standard structured view on a topical resource (say, a training course) that can be further integrated with other maps and browsed using third party applications. RDF maps can easily be requested via a REST Web service.
- Remote publishing. Needless to say that acceptance of almost any Web application essentially depends on the tools that are available for content authoring. It is also well recognized that from the user interface point of view, stand-alone applications on a user desktop have serious advantages in comparison with a Web interface. Simply speaking or authoring a document should be as convenient as, for example, as using a favorite text editor tool and uploading must not be more complex than

reshuffling files between local folders. RPC Web services are extremely suitable for providing robust interfaces between such stand-alone applications as remote WYSIWYG (What-You-Get-Is-What-You-See) HTML editors, as well as file managers, and a remote server. For example, we use well-known blog editors such as Windows Live Writer and ScribeFire as end-user authoring tools connected via an RPC Web service to the LMS system.

- Creating a personal portfolio. The LMS provides access to material that might be of interest to teachers. Very often, some materials are of a particular interest for a certain user and need to be kept in a way defined by that user; it might be a personal blog, a CMS on another server or even a special database application. In this context, an LMS must provide tools to export selected elements in the most convenient way. Obviously, using the RPC protocol with personal adjustments seems to be the simplest way to achieve this. For example, any document from the LMS server might be copied into a personal user blog with just one mouse click.
- Import RSS/RDF. This is an obvious task that allows a seamless integration of materials from another server into a training topic (training course). Using a REST Web service is almost a standard way of implementing such a task.

4.2 Asynchronous Web Services

The only difference between asynchronous and synchronous Web services is the behavior of the service-client that sends a package to the service–server, and continues without receiving data from the server. In this case, the client provides an additional entry where the server would send a response as soon as it is ready. Using asynchronous Web services becomes necessary when processing information, and creating a response by the server, may require substantial time.

Normally, so-called SOAP (Simple Object Access Protocol) is used for such communication. Asynchronous Web services are typically used for different types of automatic assessment of user uploads, for example, plagiarism control, compiling/running a programming source, and automatic essay grading.

Some typical e-learning tasks that have proved to provide a robust functionality by using asynchronous Web services are:

- Plagiarism control. Files are simply delivered to a server providing such plagiarism detection functionality, and final results (reports) are sent back afterwards to the LMS as the task is completed.
- Checking programming sources. Source texts along with selected test cases are delivered to a specially allocated Internet application where they are compiled and run. Reports on performing all the tasks are sent back to the LMS.
- Automatic Essay Grading. From a technical point of view, the process looks similar to previously mentioned usage of asynchronous Web services.

4.3 Mashup Technologies

The mashup technology relies on end-user client functionality. A user screen may be divided into a number of areas allocated for communication with different servers, and, thus, functionality of a number of applications is integrated (mashed up) on a single screen.

Note that applications used in such a way must provide a so-called JavaScript API to implement the necessary communication between the applications. Nowadays, providing such a JavaScript API is almost a hallmark for any more or less wide spread internet application such as Facebook, Twitter, GoogleMap, GoogleSearch, GoogleWave, Microsoft Bing, to mention just a few.

Mashup technology can be used within a LMS and in almost all settings.We have implemented so far:

- A Spatial Content Management training component where users can both provide and browse training content using a geographical location (Google Map).
- A geographical chat component where users can share information on their current location.
- Interface to Facebook allowing use of this huge social network for training purposes.
- Interface to Twitter to allow the sharing of twitter messages and discussions as a training component.

As new Web applications appear and gain wide recognition, this technology will attract more and more attention. Right now many experts have started experimenting with GoogleWaves and its JavaScript API; Microsoft offers Enterprise Mashups that would provide a possibility of reusing the whole Microsoft office and sharing its applications.

5 Discussion, Examples, Field Studies

Currently more than 500 training courses are implemented and deployed at Graz University of Technology to

- deliver online content to students;
- support different communication scenarios (forums, chats, announcements, emails, SMS-Service and push-notifications) ;
- provide additional functionality, such as online examinations, appointments and student upload areas.

Shown below are some examples of using Web 2.0 components by teachers in a real training context by means of the previously mentioned technological solutions. It is interesting to note that the teachers were not forced to use the technology just for the sake of technology; rather, they simply enhanced an existing didactic concept with technological innovations, hence, the teachers functioned as Edupunks. In a typical case, the teachers switched from isolated Web 2.0 tools to the same tools seamlessly integrated into the LMS. Personal feedback from students, including their motivation, which was gathered through an immediate feedback round, showed quite positive results. Our task was to integrate widely accepted and recognized concepts into a modern LMS so that teachers, as well as students, benefited most in their teaching and learning activities.

5.1 Integration of a Weblog (Synchronous Web Service)

The course "knowledge management" for students of Mechanical Engineering and Economic Sciences serves more than 30 learners each study term. Students are supposed to learn main concepts, methods and trends in knowledge management; its actual applications and benefits. Weblogs were traditionally used for practical exercises to reflect the lecture content, discuss results and support collaboration among students, teachers and especially invited experts. For example, the Weblog on "knowledge identification" is accessed at http://tugll.tugraz.at/wm09ident/Weblog/ (last visited: 25-02-2010). Since the teacher allocated five Weblogs on slightly different topics, students suffered from *lost syndrome* and often could not find a relevant Weblog.

In this particular case, the synchronous Web service "Import RSS" was used to integrate all different RSS feeds into a single course Internet panel (see Fig.1), and thus provide a convenient overview and access to the Weblogs.

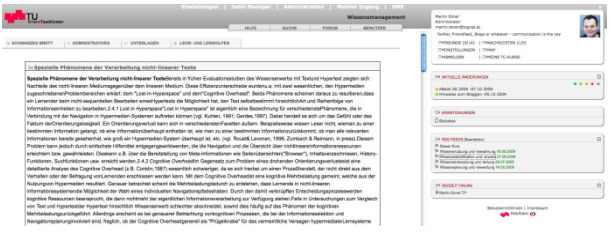

Fig. 1. Web service "Import RSS"

Fig. 1 shows the latest post in the Weblog "knowledge identification" as a component within the learning management system. There is a box "RSS Feeds" on the right side bar where numerous feeds can be imported. The content from an external resource (in this case a student's Weblog) is imported, parsed and finally visualized within the system by clicking on one Weblog title. Thus, students are provided with an overview of the online activity of their colleagues and teachers, along with basic functionality of the LMS.

Another important aspect of integrating training materials from different sources is the so-called homogeneous time line. All the material must be provided with a time stamp in the course context. Such time stamps are often used to access materials as "latest", "most recent", and "modified after my latest visit". Fig. 1 (German title "Aktuelle Änderungen"), shows that the imported feed elements are properly integrated into the course time-line and any changes in such blogs are marked as changes in the course materials.

Teachers of the course "Application Software and Programming" use the same technical concept in a slightly different way. They run their own Web server (separated from the LMS) and notify students on its actual content by generating a RSS feed that is automatically imported into the LMS. Thus, the content of those external servers is provided to students in the same way as usual LMS content. In this particular case, teachers use this feature to obtain the advantages of the LMS - use of online administration and online communication tools, along with their own proprietary programmed environment for uploading content from TEX-scripts.

5.2 Exporting a Podcast (Synchronous Web Service)

One mandatory course (*Strength of Materials*) in Mechanical Engineering and Economic Sciences, is attended by more than 250 students every year. This course is about stresses, deformations, material laws, normal stresses in bars and plates, bending of straight beams, torsion of straight bars, special problems in strength of materials, work and energy methods in elastostatics and buckling of materials. Traditionally, teachers of this course have used a tablet PC in combination with a projector and screen casting software to record the contents of the whole lecture and related exercises (Ebner and Nagler, 2008). The videos were supposed to be provided in different formats (.avi, .mp3, .mov and .mp4) to the students after each lecture (Nagler et al, 2008). The process of selecting an appropriate file format for a particular end-user device is far from a trivial one, especially for non computer-science students. The support of different and easily maintainable lists of podcasts for downloading to different devices or for online viewers is very much desired. For this purpose, the synchronous Web service "Export LMS content as RSS" is used to provide students with a facility to download files as special podcast series.

Fig. 2 shows a recorded lecture within the LMS. The listed files are provided through the RSS feeds, which can be booked on the right side ("RSS Feed", select "This course") and downloaded directly to a particular end-user's device.

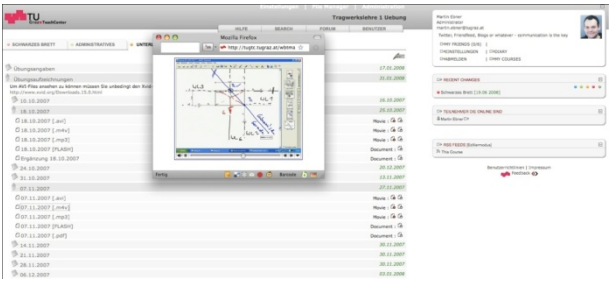

Fig. 2. Web service "Export LMS content as RSS"

5.3 Evaluating Programming Sources (Asynchronous Web Service)

The course *Programming in Fortran* is offered to students of Technical Chemistry, Chemical Process Engineering and Biotechnology on a voluntary basis. The course teaches students to perform electronic data processing by means of the Fortran programming language. Therefore, students have to develop small program samples on their own, testing them by compiling the source code and presenting it to the teacher for grading. In former times, the teacher needed to manually compile/run student sources on a local computer. Recently a special, asynchronous Web service was implemented to provide a consistent interface for students to compile/run their sources under teacher monitoring. Source texts, along with selected test cases, are automatically delivered to a specially allocated Internet application as a so-called SOAP package. A separate internet application (service-server) compiles and runs the files automatically. All reports (error messages or program output) are sent back to the

LMS, hence, the students see results as soon as the results are ready. An additional communication feature allows discussions/assessment of reports.

5.4 Integrating Live Web Streaming (Mashup Technology)

The course *Introduction to Structured Programming* is perhaps the largest course at the Graz University of Technology. Every year about 800 students are required to attend the lecture to get a first impression on C-programming. Since the largest lecture room of the university is designed for a maximum of 500 students, an alternative teaching scenario needs to be applied. Formerly, the lecture content was recorded and provided as podcast with some delay necessary to produce and deploy the video files.

To avoid this delay and provide students with a possibility of viewing the lecture and asking questions in real time, a live streaming broadcast was deployed. Thus, a special Web application (streaming server) with appropriate equipment has been installed to stream a lecture. The audio and video signals as well as slides from the desktop computer are sent directly to the Web streaming server which allows the lecture to be seen on demand.

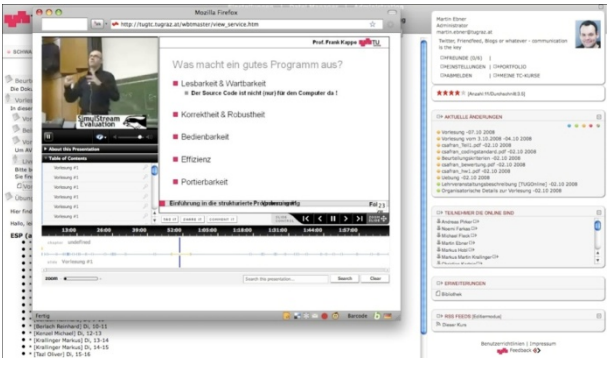

Fig. 3. Mashup Technology via embedded code

The streaming session is archived and made accessible for students as back-up after each lecture. Mashup technology is used to seamlessly integrate such live lecture recordings to the Learning Management System. Thus, the videos are placed at the streaming server and the integration to the LMS is achieved by reuse of a special JavaScript Code (Fig. 3). Similar to the world's biggest video platform YouTube[4], streaming videos are directly embedded into the existing learning context.

5.5 Integrating Blogs and Microblogs (Mashup Technology)

Since the geographic location of objects provides essential information in many training areas (for example, architecture, and civil engineering), embedding such information into an e-learning context constitutes an obvious need. A combination of pictures with global coordinates is called "geotagging" and gained significant interest once

[4] http://youtube.com (last visited May 2010).

mobile devices had GPS receivers on board. One interesting didactical scenario is that students take their pictures, combine them automatically with coordinates, upload them, for example, onto an adapted wiki site and collaborate further by writing essays about them (Safran et al, 2009).

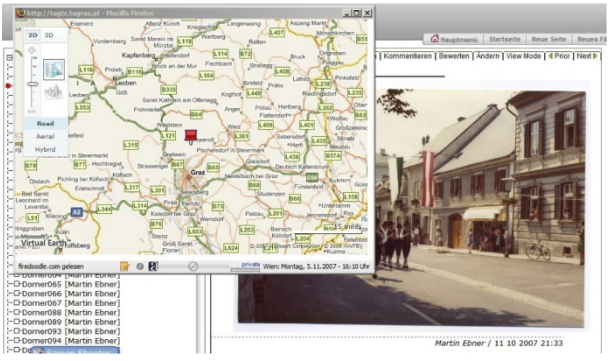

Fig. 4. Geotagging by using Microsoft Map API

The course *Urban development and town planning, history and theory* utilizes this scenario. Students have to choose an existing building and develop a project on renovation of that building or embedding new buildings into an existing architectural landscape.

Geographic coordinates are provided for each picture to show where the buildings are exactly located as well as what they look like from different perspectives. Fig. 4 shows an example of such a geotagged picture mashed up with a so-called "Microsoft Maps" application that allows zooming in and out or switching between map, satellite and a 3D view.

5.6 Integrating Widgets (Mashup Technology)

Another example of the integration of different Web applications was successfully implemented for the course *Social Aspects of Information Technology*. The course deals with different forms of communication (Weblogs, collaboration and microblogs) to reflect experiences and research results by students (Ebner and Maurer, 2009). Thus, eight student groups were supposed to use a Weblog server, and eight other student groups were established to work with the open-source microblogging platform called Laconica. Results of all the student groups needed to be integrated with the content of the course, providing inter-communication facilities for students from different groups.

Obviously, providing an overview on all incoming information is not a trivial task since more than 200 students are permanently working on their contributions, providing upwards of 100 microblogs and 160 Weblog posts each week.

Fig. 5 shows the multiple ways the different Web resources are combined and presented within the LMS course panel. Similar to the course *Knowledge Management*, the external Weblogs are integrated via RSS feeds. Furthermore, an upload possibility is integrated via an additional tool. Finally, the external microblogging activities are

implemented via a small widget. Widgets are tiny embeddable applications that can be included into an HTML code or even executed on a desktop. Such client side code can be simple JavaScript, Java-applets or anything that can be embedded into a valid HTML or XHTML document (Taraghi et al, 2009). The LMS was extended to accept small code parts and allow integrating external resources through the use of widgets. In this way, each student may access individual blogs or microblogs in the context of current course materials.

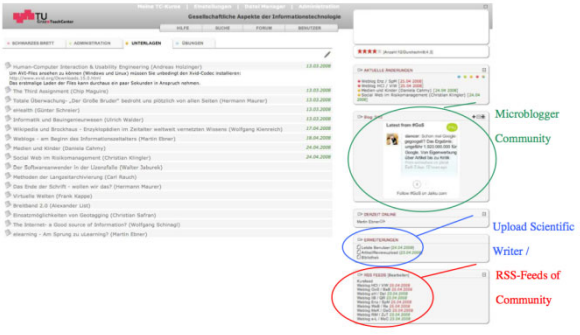

Fig. 5. Widgets use – another example of mashup technology

6 Conclusion

If we summarize our more than 10 years experience in the design, development, experimental and practical application of LMS, we can point out that a general LMS provides course administration, communication support and extended content management, online examinations, and upload possibilities. Most of the Austrian universities are running courses that have these functionalities. As Web 2.0 technologies become more and more wide-spread, teachers seek to enhance their teaching strategies with these functionalities. At Graz University of Technology, we permanently adapt the existing e-learning environment to the requirements, needs and demands of the teachers, following learner centered approaches (Holzinger & Motschnik-Pitrik, 2005). Synchronous/asynchronous Web services and mashup technologies are used to overcome information isolation of such an LMS and to avoid the endless reproduction of functionalities of already existing Web applications – not reinventing the wheel.

The power of a modern LMS must focus on the ability to implement a potentially large number of Web applications. Such distributed architectures may well equal rather ambitious goals that might be formulated as follows:

- Individuality: The large amount of online data will help to assist learner's individual learning needs. It is imaginable that in the near future students can choose any content from the Web that fits best.
- Creativity: The large number of tools allows teachers to create new didactical approaches and thereby enhance learner motivation.

- Live collaboration: One of the next major steps on the Web will be real-time collaboration as already implemented by tools like etherpad[5] or GoogleWave [6].
- Personalization: An LMS must be much more flexible and adaptable to user needs. A very first step has been made by beginning to develop a so-called Personal Learning Environment (Taraghi et al, 2009a). Based on a widget concept and distributed technology, learners should be able to choose their own different (learning) resources as well as to integrate their daily Web applications.
- Mobility: Access to Web resources tends to rely more and more on mobile devices. Since devices like the iPhone or netbooks allow constant internet access, it may be feasible that learners as well as teachers will learn or even teach on the move (Ebner et al, 2008).

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