Scenario-based orchestration of Web 2.0 applications in university teaching and learning processes: a case study

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Abstract: In the context of Computer-Supported Collaborative Learning (CSCL), Web 2.0 applications are increasingly being used for Technology-Enhanced Learning (TEL). The paper presents the main principles of Web 2.0 and develops the hypotheses derived from the central aspect of collaborative learning. These hypotheses refer to the significance of Web 2.0 for the technical support of various collaborative teaching/learning scenarios within the TEL approach. With an example scenario, the paper demonstrates how Web 2.0 applications can be orchestrated to support a CSCL scenario in face-to-face classes and the effects that this will have on the cooperative learning process of students.

Keywords: computer-supported collaborative learning; CSCL; technology-enhanced learning; TEL; electronic learning; e-learning; Web 2.0; web based communities.


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1 Introduction

In contrast to the first years of e-learning, the focus of computer-assisted learning falls once again on learning. In the early days, this focus fell on technology and teaching/learning scenarios were oriented by the development of technical tools and their possibilities and limitations, whereas now, the central question concerns which technical props can optimally support a specific didactic scenario of a learning process. European research shows that this change of perspective has resulted in a new concept, verbally known as Technology-Enhanced Learning (TEL).¹ It offers teachers the possibility to flexibly compile technical applications for each individual didactic requirement and apply them to different phases of the teaching/learning process. Classical learning environments can be used here in the same way as social software and applications, which trade under the name of Web 2.0 (O’Reilly, 2005; 2006).

From a didactical and theoretical perspective in a TEL context, teaching and learning scenarios where students process knowledge with the support of computers and other students (Computer-Supported Collaborative Learning or CSCL) are especially interesting. This perspective is based on an assumption supported by (among others) constructivist learning theories and the recent approaches of cognitive psychology that through the co-construction of knowledge in the group, a deeper understanding of the subject matter can be achieved (Carell, 2006). Within this context, the role of teacher has often changed over the past few years into a coach, mentor or presenter (e.g., Blom, 2000; Graf, 2003; Salmon, 2000; Schenk, 2004; Schlienger-Merki and Schauer, 2004) who accompanies the learning group through the joint learning process. Their role as the ‘arranger’ of the technical learning environment that supports the collaborative learning process was, until now, only focused on the content and organisational preparation of a specific learning environment. Also, the variety of learning environments was often limited to the Learning Management System (LMS) installed in the university campus. With the launch of Web 2.0 applications and social software,² we have a new and wider variety of possibilities, above all in the compilation of technical support for different collaborative activities within one or more teaching/learning scenarios.

Within the framework of TEL applications, the future will be focused upon attaining a suitable orchestration of the collaborative ways of learning and its technical support. The aim of the following article is to demonstrate, using one example scenario, how Web 2.0 applications can be orchestrated and employed in universities to support and accompany collaborative learning in face-to-face classes and courses. Firstly, the basic principles of Web 2.0 will be presented and the theories on the significance of Web 2.0 for computer-supported learning will be derived. Exactly how Web 2.0 applications can be combined with university face-to-face classes to support collaborative teaching/learning processes will be demonstrated with the scenario. To conclude, recommendations for the suitable orchestration of Web 2.0 applications for teaching/learning processes based on the results of the case study will be presented.
2 Web 2.0 and computer-supported collaborative learning

2.1 Main principles of Web 2.0

The term ‘Web 2.0’ subsumes the ‘second generation of internet-based services’. Behind this term, which has by now become a buzzword, one finds no new technology, but rather a combination of specific principles and related services that have to be made possible and supported by technologies such as Asynchronous Javascript and XML (AJAX) and Really Simple Syndication (RSS)\(^3\) (Koch and Richter, 2007). Several principles also concern Web 2.0:

- **Service orientation** (freely accessible web services instead of downloadable software applications)
- **Data orientation** (data that aggregate and prepare applications are fundamental, as well as the combination of various databases)
- **Architecture of participation** represents the most important principle of Web 2.0 and is often characterised by terms such as “Interactive/Participatory Web”, “Everyone is a publisher” or “Wisdom of the Crowd” (Hatscher, 2007).

Through these architectural principles, cooperation and sharing possibilities as well as the collaborative drawing up of information are created. However, this was not possible within the framework of Web 1.0. Web 2.0 applications such as wikis, blogs, online communities (e.g., XING,\(^4\) Facebook\(^5\) or StudiVZ\(^6\)), RSS feeds\(^7\) and social tagging\(^8\) are only some examples of a huge variety of applications through which people can exchange web-based information and create mutual knowledge. However, Web 2.0 applications were not primarily developed for use in teaching/learning events, even if they are closely related to this context. In the following article, the potential of Web 2.0 based on the abovementioned principles (especially for CSCL) will be reflected. This specific form of cooperative learning will now be considered.

2.2 Computer-supported collaborative learning

Following Roschelle and Teasley (1995), the term ‘collaborative learning’ can be understood as a specific form of mutual learning in which participants try to work out a mutual solution to a problem or theme within a group. A minimally prestructured task definition is essential for this type of learning, where students determine their goals and paths independently to a large degree while the teacher (as coach or adviser) stands to one side. In contrast to cooperative learning, collaborative learning is about strongly interrelated and interwoven learning. From a didactic point of view, such teaching/learning arrangements offer students the possibility to acquire not only subject-related knowledge, but also knowledge that they will retain their whole lives (Konrad, 2005).

In CSCL, the collaborative learning process is supported by a technical system (Lipponen, 2001). In the last few years, the focus lay on the development and evaluation of technical tools especially designed for CSCL processes (Lipponen and Lallimo, 2004). Here, one can differentiate between the generic applications that can be flexibly applied to different learning scenarios and subject matter and those that are designed specifically for certain applications (Dawabi, 2004). As well as these specifications...
primarily developed for research purposes, university teachers are generally provided with LMSs (e.g., Blackboard, Moodle, Clix). These LMSs are intended to provide wider support for university teaching/learning events. Collaborative teaching/learning scenarios present only one of many application possibilities. LMSs make tools available to support the communication, coordination and cooperation of learning groups, but these tools are not necessarily those that meet the requirements of collaborative teaching/learning processes. For example, the LMS Blackboard offers students the possibility to communicate asynchronously with each other via a discussion forum; however, no direct reference to connected material can be made. But contextually related communication is regarded as significant for successful collaborative learning scenarios: they can look for a suitable, specialised learning environment and implement it themselves or use and arrange the LMS made available to them by the university.

CSCL cannot be regarded as automatically worthwhile when accompanied by the right tools – it relies much more on the high self-regulation abilities of students and the autodirection of the learning group (Dillenbourg et al., 2007). Minimal participation, high drop-out rates, the lack of participatory motivation and superficial discourse are ever-recurring problems within CSCL (Carell, 2006; Renkl et al., 1995; Lipponen et al., 2002). To remove these problems within the framework of CSCL research, a series of strategies (e.g., scaffolding) was developed (an overview of this is offered by Dillenbourg et al., 2007; Carell, 2006). Within the possibilities of Web 2.0, we see opportunities to partially overcome the described technical restrictions and the problems of participation and motivation. In the next subsection, we will discuss the theories on the significance of Web 2.0 for CSCL.

2.3 Theories on the significance of Web 2.0 for computer-supported collaborative learning

The significance of Web 2.0 applications for computer-supported teaching/learning processes is seen mainly on the grounds of the following five principles and aspects derived from the general principles of Web 2.0 (Section 2.1):

1. **Co-activity** – An essential principle of Web 2.0 is active participation. The central element is the support of the “Me-Mentality” (Koch and Richter, 2007, p.7). Several people use one application for their personal aims (e.g., administration of literature, photo filing) whereby a collaborative surplus value is created by the co-activity of other users. In this way, an individual can, for example, organise and archive his/her literature or photos effectively and label them with so-called *tags*. When others do the same, he/she receives tips on who apart from himself/herself is interested in the same literature, which tags have been used by others for these literary sources, *etc.*, and thus acquires a multitude of new tips, cross-references and references to his/her sources. The overlapping of the ‘We-Mentality’ in collaborative learning through the emphasis on the individual user could contribute to a higher participatory motivation.

2. **More access to the learning scenario** – Through the use of Web 2.0 applications, people who do not actually belong to the learning group itself can be integrated into the learning activities without needing any great technical background knowledge. This makes the exchange of knowledge between experts and lay people much easier and, thus, can create new knowledge sources.
Participation as key principle – As a so-called ‘Interactive/Participatory Web’, Web 2.0 stands for the participative acquisition of content and knowledge. The participant becomes a ‘prosumer’, in other words, the consumer and producer of content. This principle supports the paradigm change in university didactics and CSCL, which is characterised by the term “From teaching to learning” (Barr and Tagg, 1995). The teacher becomes the coach and adviser and takes a step away from his/her role as subject content expert (see Section 1).

Simple manageability and use of applications – Web 2.0 applications are freely accessible and usually simple and intuitive to use so that no great training or preparation is necessary.

Flexibility and integration – Depending on the didactic teaching/learning scenario, pre-experience on the part of the teacher/student and the learning goal that they strive to achieve, various technical applications can be flexibly combined with one another: in this way, a wiki can be used to produce mutual content and then have it embellished with blogs, podcasts and bookmarked reading recommendations. The integration of RSS feeds makes it possible to provide up-to-date information about current alterations.

As far as our experience goes, until now, Web 2.0 applications have been integrated into teaching/learning processes mainly as single applications. The use of wikis (as communal knowledge collection) and blogs (e.g., learning diaries) rank highly. The orchestration of different Web 2.0 applications in the context of collaborative teaching/learning processes is, by contrast, still far less common. Regarding this point, the question is which Web 2.0 application is suitable for which teaching/learning scenario. In the following section, we will present a teaching/learning scenario in which we combined different Web 2.0 applications with each other during a face-to-face intensive course intended to support collaborative learning. The course took place at the Ruhr-University of Bochum, Germany.

3 Case study

The background of the development of the teaching/learning scenario was the question of how, in which form and in which combination Web 2.0 applications could be introduced into teaching at the Institute for Applied Work Science of the Ruhr-University of Bochum and what effect this would have on the students’ collaborative learning process and the internal teaching process itself. The scenario was conceived and based upon the main principles of learning with Web 2.0 detailed in Section 2.3 and is part of a Web 2.0 blended learning scenario that will be introduced into the Department of Information and Technology Management in the future.

At the Institute for Applied Work Science, modules in seminar form are offered as part of the further education programme ‘Master of Organisational Management’, which requires that people must have at least two years of professional experience. In these modules, the students work independently on selected themes under the direction of the teacher. The module ends with a one-week-long practice period, during which the students have to develop a solution to a problem set for them by a company. The teaching/learning scenario described on the next section was used as a case study for this one-week practice period.
3.1 Description of the teaching/learning scenario

The case study took place in the one-week practice period of the module ‘Promotion of Creativity in Organisations’. During this week, nine students (five female and four male students) are given the preset task of designing a new laptop bag, for which they have to collaboratively produce a solution in a face-to-face situation. Concurrently, they had to reflect their creativity process. For the project, the students are provided with the usual media (PCs, beamers, white boards, etc.). All students have university degrees in the arts, engineering or computer sciences. They all are habituated in working with computers, but have no experience in handling Web 2.0 applications. Therefore, they received a short introduction to the relevant Web 2.0 applications that should be used during this one-week practice period. The choice of applications for this particular teaching/learning scenario was guided by the five principles of the significance of Web 2.0 applications for computer-supported learning (Section 2.3): which applications may support best the functional requirements to meet the unique demands resulting from the transfer of the five principles to technology support in consideration of the short time period of the practice week and the initial knowledge of the students? An overview of the Web 2.0 applications selected for this special purpose is provided herein. First, the students get access to a Netvibes site (Figure 1). The Netvibes site is simple, manageable and intuitive to use. Depending on the specific learning scenario, all the necessary applications can be flexibly combined so that the students have access to all Web 2.0 applications via the PCs in the lecture room. The Netvibes start page is preconfigured by the teacher and already contains the relevant services and modules for the practice period: access to current literature through a ‘BibSonomy feed’ depending on the module theme, an adapted web and picture search (RSS feeds from Google and Flickr), the RSS feeds from published project diaries and individual learning diaries and an application for the administration of the project’s group tasks. Over and above this, the students have the possibility to subscribe to new content and add them to their Netvibes start site should they be of interest or necessity (e.g., theme-specific lectures and articles as SciVee podcasts).

As well as the Netvibes start site, the teachers set up two blogs via WordPress: a semipublic blog as a project diary and a learning diary to which only the students and teachers have access. WordPress supports the main principles of co-activity and participation for computer-supported learning: except for the corporate creation of content, blogs enable a collaborative surplus value by the co-activity of other students (as described below). Another benefit is that people who do not actually belong to the learning group, e.g., the project leader of the involved company, can be integrated into the learning activities as experts.

The purposes of the blog ‘Project Diary’ are to document the progress of the project and deposit and discuss the documents produced during group work. The documents are cooperatively drawn up through the Web 2.0 application Google Docs and linked up to the project diary. Selected users are invited to join this blog and given the opportunity to comment on the group’s work during the practice week. In this way, the company representatives can be involved in their respective areas much more intensively than was previously possible and can also act as mentors. Of course, the same is true for the teachers: the project’s progress becomes more comprehensive, especially through the project reports that are available online – the project diary thus becomes a project
platform. This blog also supports asynchronous work (e.g., mutual agreements on appointments and teachers being able to continue coaching without being present by making relevant comments on the individual project results).

Figure 1  The Netvibes project start site

![Netvibes project start site](image1)

Figure 2  The WordPress blog ‘Project Diary’

![WordPress blog ‘Project Diary’](image2)
The learning diary (the blog ‘Individual Knowledge Pathways’) supports the students by formulating their individual learning goals and their expectations of the project and, through this, acquire their personal knowledge pathway. At the start of the project, it is the teacher’s task to agree with the students upon the rules for running the learning diary so that quality assurance is agreed.

During the practice week, each student documents his/her impressions and learning experiences in the blog at the end of each day. In this way, his/her learning path becomes visible and can also be commented upon by other students and teachers. Each individual learning process becomes comprehensive and offers each student the opportunity to reflect. By publishing the learning diaries as blogs, the students have the chance to take note of the experiences of others and integrate them into their own reflection process.

Thus, the teacher can conduct his/her coaching more intensively by being able to add to the actual activities. The services and applications are made available to the students for a determined period of time after the practice week.
3.2 Evaluation results

The scenario described previously took place and was evaluated in a one-week practice period. At the end of the project, a qualitative questioning of all students was carried out. We classified the students’ statements as categories and assigned them to the five principles of Web 2.0-related learning, as outlined in Section 2.3. It should be pointed out that this assignment is ambiguous. Table 1 gives an overview of the developed scheme.

**Table 1** The relation between Web 2.0 learning principles and the categories of verbal interviews

<table>
<thead>
<tr>
<th>Web 2.0 learning principle</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Co-activity</td>
<td>Motivation through the activity of others</td>
</tr>
<tr>
<td></td>
<td>Comprehensibility of learning events</td>
</tr>
<tr>
<td>2 Access to the learning scenario</td>
<td>Participation of invited external users</td>
</tr>
<tr>
<td>3 Participation</td>
<td>Continuous documentation</td>
</tr>
<tr>
<td>4 Simple manageability and use of applications</td>
<td>Integrated learning portal</td>
</tr>
<tr>
<td></td>
<td>Easy use of provided tools</td>
</tr>
<tr>
<td>5 Flexibility and integration</td>
<td>Implementation of applications</td>
</tr>
<tr>
<td></td>
<td>Unused/Used applications</td>
</tr>
<tr>
<td>6 Others</td>
<td>Aspects of privacy</td>
</tr>
</tbody>
</table>

From the feedback, the following results were obtained.

### 3.2.1 Co-activity

**Motivation through others**

Only half of the participants intensively took advantage of the personal blogs to document their knowledge path. Those who did found the blogs very useful as tools for reflection. They particularly emphasised that they were encouraged to reflect further by reading others’ comments, but made hardly any comments on others’ contributions themselves. The teachers’ comments were found to be extremely useful. Those students who did not use a personal blog were critical of writing a learning diary and did not see the sense in doing so. For them, it would have been very difficult to sit down in front of the computer in the evening after the seminar was finished. One participant would have preferred to have a notice board in the seminar room where he could have put up any comments at the end of each day of the project. Regarding the question of whether it would have made more sense to make individual contributions directly after the end of each seminar, all students except one disagreed. They said they needed the time to assimilate the experiences and impressions made during the day. ‘Time to let things sink in’ was a widely used expression here.

**Comprehensibility of the learning events**

The teacher found the project blog and individual blogs very good because she was informed about the course of the seminar as it took place (the minutes had to be done twice daily) and could, therefore, react correspondingly. With the individual knowledge
paths, she had the additional possibility to react to the other mentioned aspects of the seminar, *e.g.*, one student explained that although she found the learning experience positive, she did not know how she could transfer this to her normal working day. The teacher was able to concretely approach these aspects the following day. The problem could also have been solved via e-mail communication. The teacher found it especially good that all students’ knowledge paths were stored together and, because she did not have to download them to her PC, she always had all the contributions in view at the same time and was able to quickly jump from one contribution to the other. Her comments on individual knowledge paths could be read by others.

3.2.2 Access to the learning scenario

*Participation of invited external users*

The integrated ‘Project Diary’ was opened for selected external users. They were asked to join the blog and give comments and feedback during the practice week. These persons used the blog occasionally to inform themselves about the ongoing group work and the results obtained so far. However, they did not leave any comments for the group since they were short of time, not for technical reasons.

3.2.3 Participation

*Continuous documentation of results*

The project reports were entered on the project blog on a daily basis as the students came to a mutual agreement to store them there.

3.2.4 Simple manageability and use of applications

*Integrated learning portal*

The students found it helpful to have a successful learning portal for the Web 2.0 applications and, through the possibility of direct access via the PCs in the room, were motivated to use the links, services and applications of the Netvibes site. The preconfigured Google Search was used, particularly during the first phase of the practice week.

*Easy use of provided tools*

Only a short introduction of the provided tools was given to the participants. Neither problems in using these tools nor other technical difficulties were reported. Moreover, the external users invited found the tools quite easy to use, even without a training session.

3.2.5 Flexibility and integration

*Unused/Used applications*

The Web 2.0 application Google Docs was largely unused. The students did once distribute work tasks where the texts were produced in Google Docs; however, this was done only by two students. The others used Microsoft Word and then sent the document via e-mail. This process was justified by saying that they were under pressure and preferred to select a tool that they could ‘use with their eyes closed’. The use of Google Docs was said to be comparatively complicated. Because the group worked synchronously on the spot for the most part, they principally used Microsoft Word and then brought the documents together.
Simple implementation

The short introduction to the implementation of the tools at the beginning of the project was found very useful by the students; especially at the start of the practice week, they were very busy with the task regarding content and the organisation of the group process. Intensive concentration on the tools would have overloaded them (cognitive overload). The short explanation of the applications was useful in this case, as the tools were all easy to implement and were actually used during the seminars. In this way, the students were able to reciprocally help each other, which worked very well. Besides this, the blog was relatively error-tolerant: one student always used her learning path as a commentary – a commentary which, despite her error, could be found and read by all students.

3.2.6 Additional aspects

Aspects of privacy

In reference to privacy, the students had a relatively critical opinion of the general business regulations of the used services (especially Google Docs, where data could be passed on to third parties and combined with other data – this being in accordance with US regulations). If several tools are used, the students are obliged to register with different services and agree to the general business regulations. For this reason, the photos taken during the seminar were not uploaded in Flickr as originally planned, but conventionally stored on a CD-ROM and distributed among the students.

4 Recommendations for the use of Web 2.0 applications in the context of computer-supported collaborative learning

The aim of this paper was to explore how Web 2.0 applications can be orchestrated and integrated into collaborative learning in face-to-face university seminars. Firstly, theories on the possibilities of using Web 2.0 in CSCL were developed. From these theories, a case study was carried out, in which we combined different Web 2.0 applications to support a problem-based teaching/learning scenario. Based on its evaluation, the following recommendations for orchestrating Web 2.0 applications were derived:

- Co-activity – The implemented Web 2.0 applications were used less to encourage communication and exchanges within the group and much more to make specified research and document the group process and the individual knowledge paths possible. This took place face-to-face. The use of the tools was sensible within the framework of the problem-solving process and they offered the possibility for individual and collaborative reflection. Web 2.0 applications should be thus arranged so they are useful for solving the problem, but also on an individual level. The perimeters and types of applications should be adapted to the perimeters and types of teaching/learning scenarios.

- Participation – The participants generated new knowledge while acting as prosumers: they used the information available on the web and provided new information through the project blog and individual learning diaries. The available tools should make interplay possible between the content consumer and the content producer.
• Access to the learning scenario – In the presented case study, the invited external experts merely acted as consumers. To emphasise them acting as an additional resource of knowledge, their role as prosumers should be made clear in advance.

• Simple implementation – Using the provided technical tools should be possible without any complex training period. The more complex the task to be undertaken by the group, the more natural and casual the use of the tools must be. Their continual presence during the face-to-face learning process and the communal practice with them within the group supports the simplicity of their implementation.

• Flexibility and integration – Simple and clear access to the different Web 2.0 applications via a communally or individually adapted Netvibes site was seen by the students as a great advantage. Access to the applications should be made ‘joint’ and as simple as possible.

Moreover, the applications provided should be seen as an ‘offer in progress’. Therefore, both the addition of applications and the substitution of tools by the participants should be possible.

Summing up, we suggest for a face-to-face problem-based learning scenario the pattern of orchestration in Table 2.

Table 2 The pattern of orchestration for Web 2.0 applications

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning scenario</td>
<td>Problem-solving learning, project-based learning</td>
</tr>
<tr>
<td>Mode of task</td>
<td>Design task</td>
</tr>
<tr>
<td>Mode of learning</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Length of the learning session</td>
<td>One week</td>
</tr>
<tr>
<td>Role of technical support</td>
<td>To enhance the collaboration process during the face-to-face sessions and beyond</td>
</tr>
<tr>
<td>Web 2.0 applications</td>
<td>Tools to allow an easy and integrated access to all the applications used (i.e., Netvibes)</td>
</tr>
<tr>
<td></td>
<td>Blogs to document both individual and group learning pathways</td>
</tr>
<tr>
<td></td>
<td>Applications to search literature (Google Scholar, BibSonomy)</td>
</tr>
<tr>
<td></td>
<td>A common text editor to store the results of the group’s work</td>
</tr>
<tr>
<td></td>
<td>Applications to administrate group tasks</td>
</tr>
<tr>
<td></td>
<td>RSS feeds</td>
</tr>
</tbody>
</table>

The results of the case study show that Web 2.0 applications can positively support cooperative work and learning in face-to-face classes. It was also noticed that with regard to the publication of individual work processes and results, a change of thinking pattern has to take place on the part of both students and teachers. Those involved in the teaching/learning process have to decide on the perimeters and extent of the openness of the learning process and which pieces of information must be passed on to others, without considering their individual needs, to support them in their learning process. The problem of data protection also plays a role here. Sufficient solutions to this problem have not yet been found.
The case study and the described teaching/learning scenario within it represent the first step of the evaluation of a Web 2.0 integrated blended learning scenario. The results from the post-project questioning completed by the students from one module were verified by further case studies and used in wider teaching/learning scenarios.

References


Notes
2 The term ‘social software’ includes those internet-based applications that support conversational interactions between individuals or groups, social feedback and social networks. “Social software allows us to create new social groupings and then new sorts of social conventions arise” (Boyd, 2006).
3 RSS is an electronic news format that allows the user to subscribe to website content or news in a condensed form.
4 XING is a community platform with search and contact management functions for business people: www.xing.com.
5 Facebook is an English-language social networking site for students and university employees all over the world: www.facebook.com.
6 StudiVZ (Studentenverzeichnis) is the same as Facebook and is offered in different languages.
7 Data preparation in RSS format is known as RSS feed.
8 The term ‘social tagging’ stands for common indexing and/or free invention of catchwords for, e.g., blog entries, photos or bookmarks on the web.
9 Netvibes is a web service through which the user can summarise his/her self-created services, as well as modules like, e.g., RSS feeds, e-mail messages, podcasts, bookmarks and other dynamic content on one site: http://www.netvibes.com.
10 BibSonomy feed makes it possible to simply and comfortably administrate and share bookmarks and publications online.
11 Flickr is a Web 2.0 application that allows users to post digital pictures with comments and news on the web, making them available to other users: http://www.flickr.com.
12 SciVee is a portal where scientists and teachers make their current findings, lectures, articles, etc., available to be discussed by others in the form of videos and podcasts: www.scivee.tv.
13 WordPress is a weblog publishing system used to produce weblogs (public websites or for selected user groups as diaries): http://wordpress.org.
14 Google Docs makes possible the production of and working on documents, tables and presentations online and in real time by several people.