

Web 2.0 Learning Environment: Concept, Implementation, Evaluation

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Summary

This contribution presents and evaluates a new learning environment model based on Web 2.0 applications. We assume that the technological change introduced by Web 2.0 tools has also caused a cultural change in terms of dealing with types of communication, knowledge and learning. The answers given by eLearning scholars who intend to use the creative options offered by Web 2.0 in institutional learning are summarised in the first part of the paper. In this theoretical overview we introduce the concepts of eLearning 2.0 and Personal Learning Environments, along with their main aspects of autonomy, creativity and networking, and relate them to the didactics of constructivism and connectivism. The requirements and basic functional components for the development of our particular Web 2.0 learning environment are derived from these.

The learning environment we present consists of several components (modules) that are well-known Web 2.0 applications such as wikis, weblogs, social bookmarking services and RSS feeds. The section describing the implementation of the environment in a use case at the Darmstadt University of Applied Science focuses on the specific didactic contribution the particular learning modules render towards the entire learning arrangement. The article explains the didactic potential of the wiki platform in more detail, since it serves as the integrating module (or learning centre) of the learning arrangement.

Our learning environment was tested and evaluated during the “Social Software” seminar held in the information science study course at Darmstadt University of Applied Science in 2007/08. A questionnaire-based survey reveals interesting facts regarding the success of the practical implementation of the Web 2.0 arrangement with respect to the motivation and learning outcome of students. The survey was supplemented with some non-formalized feedback in a concluding discussion. With these results in mind this paper finally provides some remarks on the potential of the learning environment in broader educational contexts.

Keywords: eLearning 2.0, learning environment, platform, use case, Darmstadt, learning model, Learning Environments, constructivism, connectivism

1 Concept

1.1 Changing Technologies and Educational Change

Web 2.0 means a qualitative leap in web technologies that have made the internet more creative, participative and socializing. But has this development also triggered a revolution in learning? Do education and learning require re-thinking in view of the continuous change of information and communication technologies, and do we need new concepts and designs for respective working and learning environments? The thesis that “Web 2.0 instruments (social software) become increasingly relevant as because they further the exchange of knowledge and the development of competencies in networks and beyond the net in an optimal way”

(Erpenbeck & Sauter, 2007, 162) is widespread in many varieties amongst scholars and educators concerned with the design of learning environments and e-learning.

In their map of internet-based learning, Hornung-Prähauser et al. (2008) assume that new interactive and collaborative web applications such as Wikis and blogs are particularly suitable for participative definitions of objectives and governing learning processes as well as for collaborative production of knowledge within the framework of self-organised learning. In their opinion self-organised learning as such constitutes the adequate learning strategy for the educational policy objective of lifelong learning.

In addition the Trendmonitor of the MMB-Institut für Medien und Kompetenzforschung (2008) states that social software constitutes the most important topical trend, especially learner communities and wikis as learning tools - besides semantic technology. Following this assessment, Wikis or social networks are particularly apt for preserving and organising knowledge, with knowledge management and learning coming closer via the shared use of tools.¹

But how can the didactic potential of new technologies be put to use for learning processes in the knowledge society, wherein the increasingly important competencies, such as methodological and media competencies should be acquired apart from knowledge itself?

In his illuminative and trend-setting lecture, "A Portal To Media Literacy" the cultural anthropologist Michael Wesch (2008a) assumes that the information and communication culture of students has changed due to new web technologies. He contrasts them to the anachronistic conditions and teaching concepts existing in educational institutions and states the hypothesis that learners (would) well be able to effectively acquire the knowledge they require by applying the media they use anyway. However, this requires that appropriate learning and teaching settings enable them to develop the media literacy they need for knowledge acquisition as well as methodological competency - particularly as regards self-governing and productive learning. According to Wesch, the main future challenge to learning is "creating platforms for participation that allow students to realize and leverage the emerging media environment."²

This view is also prominently held by Downes (2005) who coined the term *E-Learning 2.0* conceived as an "interlocking set of open-source applications. [where] *learning is becoming a creative activity* and that the appropriate venue is a *platform* rather than an application."³

Jadin & Wageneder (2007) provide the following extended definition of *E-Learning 2.0* with reference to Downes: "We can talk of e-learning 2.0 applications if users apply Web 2.0 media, i.e. social software, such as wikis, weblogs or RSS in collaborative learning activities for autonomously producing their own learning contents and use them for their own learning objectives. This definition clearly outlines a central feature of a eLearning 2.0 setting: learners are autonomous in acquiring knowledge."

The implementation of collaborative and activating applications of the Social Web for E-Learning 2.0 purposes refers to the related model of personal learning environments (=PLE). At a descriptive level abstracting from particular implementations, a PLE allows learners "to access, aggregate, configure and manipulate digital artefacts of their ongoing learning experiences" (Lubensky, 2006). As regards Web 2.0 tools, this implies a "collection of free, distributed, web-based tools, [...] linked together and aggregating content using RSS feeds and simple HTML scripts." (Fitzgerald, 2006)⁴ In an interesting hypothesis leading further, Downes

¹ The close relationship of knowledge management in its collaborative shape with social learning processes is described in detail by Griesbaum et al. (2008) and evaluated in its practical use by Griesbaum & Rittberger (2005).

² Wesch, 2008a, 27:30.

³ Emphasis by the authors of this article.

⁴ For a description of PLEs see also Bernhardt & Kirchner (2007), pp. 27ff.; further PLE's sources are Downes (2007), Attwell (2007), Wagner (2006) and van Harmelen (2006); an early model for PLE known

(2007, 19) formulates that the values the Web 2.0 and the idea of PLEs are essentially identical, namely “the fostering of social networks and communities, the emphasis on creation rather than consumption, and the decentralisation of content and control.”

Hence, there is a trend in contemporary learning towards more activity, self productivity and self governing, to networking learners and their learning spaces and to a shift of accentuation in the character of learning from the product towards the process. These developments are expressed by the learning theories of constructivism and connectivism. From a *constructivist perspective*, learning is a constructive, active, emotional, self-organised, social, situational process.⁵

Siemens 2004 introduces a further significant aspect of learning in his learning theory termed *connectivism*. As Wesch has diagnosed earlier, the technological change has resulted in different information and communication habits with a strong influence on particularly the media culture of younger generations. The information sources and communication channels of the so-called digital natives or net generation nearly all exist online, in digitised form. As far as educational institutions are concerned, an insufficient competency education regarding new media is problematic in as far as these are made productive for learning. The requirements of a changed knowledge society and the educational policy goal of lifelong learning raise the demand for an e-media-literacy, which should be taught even more so if social web instruments are implemented in learning scenarios (Hornung-Prähauser et al., 2008, 20; Kerres, 2006, 7; Erpenbeck & Sauter, 2007, 160).

A further focal aspect of connectivism concerns the use of networks. According to Siemens, successful learning outcomes depend on the setup of appropriate networks containing *distributed knowledge bases*. Learning in the connectivist sense requires open learning environments that enable connections and exchanges with other network partners, who will build up productive *learning communities*.

“Hence, connectivism constitutes a pragmatic conception of learning that actively draws upon the societal changes to learning and consequently integrates them into learning processes. Web 2.0 (social software) instruments hence become increasingly relevant as they promote perfectly an exchange of knowledge and the development of competencies in networks and on the web.”⁶

1.2 Requirements of a Web 2.0 Learning Environment

The idea of “learning networks” leads us from connectivism back to Wesch’s demand for a concept of learning portals. According to Downes (2007), the fundamental concept of *learning networks* unites the above-mentioned common values of Web 2.0 and the idea of PLE’s. The pedagogical approach associated with PLE results in the notion of a *portal* as particularly apt for model of designing learning environments.

“The ‘pedagogy’ behind the PLE - if it could be still called that - is that it offers a *portal* to the world, through which learners can explore and create, according to their own interests and directions, interacting at all times with their friends and community.” (Downes 2007, 23)

This portal concept for learning environments is now further explicated by Kerres (2006a).

A vast number of high quality information, media and resources for learning exist on the internet, as Kerres (2006a) emphasises along with Wesch (2008a) and Hornung-Prähauser et al. (2008, 14f.), the latter mentioning a “Wissensallmende”, i.e. “a commons of information and

as “Future VLE” can be found in Wilson (2005). An overview of the different types of PLEs can be found in LTC (2008).

⁵ See Erpenbeck & Sauter, 2007, 157. On the relationship between theories of learning: instructional design, cognitivism, constructivism and connectivism cf. the overview in Erpenbeck & Sauter, 2007, 152, following Baumgartner and Kalz, 2004.

⁶ Erpenbeck & Sauter, 2007, 162.

knowledge”.⁷ Attwell (2007, 1) also regards the information stored on the internet as a potential “ecology of ‘open’ content, books, learning materials and multimedia [...]”

Bearing these aspects in mind, Kerres believes it is anachronistic to separate learning platforms from the cornucopia of knowledge resources and useful tools provided on the internet, and then equipping them with specially developed learning content and tools. The perspective for e-learning 2.0 lies in the adaption of the portal concept. An e-learning 2.0-environment would thus be a signpost to finding proven quality learning contents on the internet. Besides containing metadata and references to online resources, the learning portal or learning environment can also deliver self-produced learning contents or online tools suitable for learning. Furthermore, the learning environment should offer a “mechanism” for collecting and integrating contents and tools in a goal-oriented way. (Kerres 2006, 6)⁸

Following Kerres’ (2006a) essentials of a 2.0 learning portal and his guidelines for “an elearning scenario following a “Web 2.0” approach” (Kerres, 2007), a clustering of characteristics results in the following four requirement groups for a Web 2.0 learning environment:⁹

Openness, permeability :

- The learning environment is not an isolated island, but a learning portal.

Participation:

- Learners and teachers actively participate in the development of the learning environment. Learners can integrate known instruments that are already in use.
- Learners and teachers work with the same platforms and tools, for preparing units of learning, working on them and distributing them.
- The participants use a free choice of tags and they incrementally develop a folksonomy, reflecting their stock of interests and knowledge - the learning units are thus structured and made navigable.

Motivation:

- The learning environment should make the individual engagement of every learner visible in a transparent way.
- The learning environment should advance the setup of a learner community, where learners and teachers can introduce one another in person.
- Teachers show their presence in the learning environment: they deliver resources, make contributions and suggestions, for instance by participating in discussions.

Monitoring, feedback, evaluation:

- Teachers trace /pursue individual and shared learning activities.
- Teachers offer regular feedback and assess contributions in an appropriate fashion apt to encourage motivation.

In the course of the subsequent argument analysing our use case in paragraph 2) it is shown how these requirements are fulfilled by the learning environment modules.

1.3 Functional Elements of the Web 2.0 Learning Environment

The use of Web 2.0 tools is in many cases selective in suggestions for learning scenarios, each of them excluding the other¹⁰. As correct and inspiring these concepts might be with regard to

⁷ The idea of a portal-type learning environment working with freely accessible knowledge leads to a discussion on open content and open educational resources (=OER), which cannot be further pursued here. For a definition of OER see Atkins, Brown & Hammond, 2007, esp. p.4; and also OECD, 2007.

⁸ This integrative mechanism is also named as essential to a well-functioning PLE by Siemens 2004, Downes 2005 and 2007 and Attwell 2007.

⁹ The requirement clusters outlined here are additionally supported by the „*semantic principle*“, consisting of four parts“, which Downes (2007, 26) establishes for *learning networks*: encompassing diversity, autonomy, connectedness and openness.

¹⁰ For an overview and literature, see. Erpenbeck & Sauter, 2007, 242ff.

particular tools in question, they nevertheless leave aside synergies that might be derived from using and networking different tools and their specific functions in a learning portal or a PLE.

A Web 2.0 learning environment can be implemented in a variety of ways. The decision for certain implementations often depends on individual software experience, learning objectives and existing media competency. We believe that in comparison to the prototypes proposed by Bernhardt & Kirchner (2007) and Wesch (2008a) respectively, a wiki as a central module offers the same integrative power as well as a more flexible adaptability to learner requirements, as it can be individually hosted and configured, and it is moreover possible to tag and categorise wiki contents, thus achieving a higher degree of structure and navigability.

The unpredictable character of developments in the area of specialised stand-alone software solutions implies that “learning environments should be realised independent from specific tools” (Kerres, 2006, 7). Hence, a modular concept with more abstract definitions of the functional areas of a learning environment seems appropriate, which in the learning setting here are put into practice with exemplary applications that are interchangeable with equivalent functions. The functional areas of the model of a Web 2.0 learning environment introduced below are then:

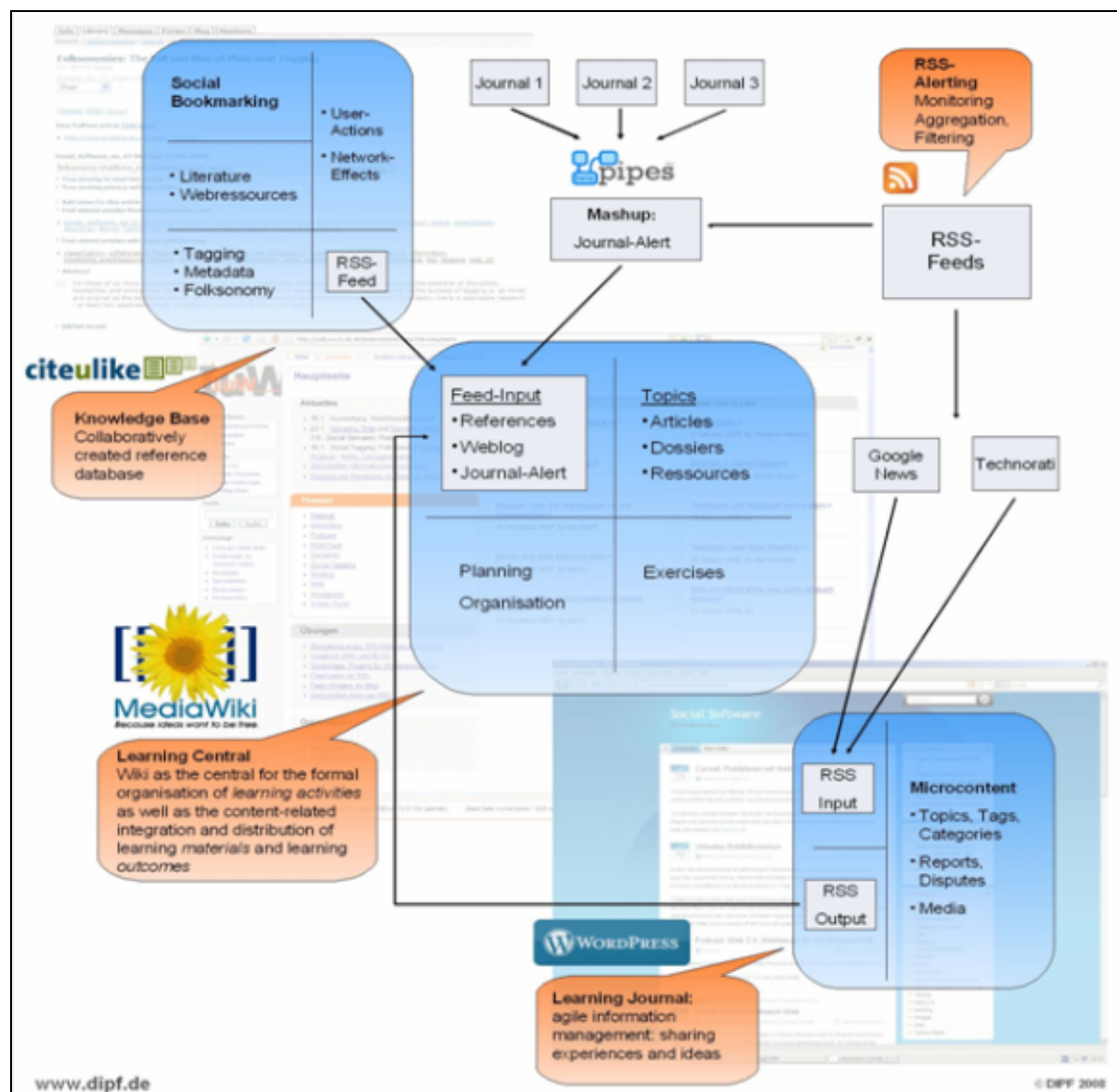


Figure 1: Overview of the Learning Environment

- *Learning centre*: for the formal organisation of learning activities and the Integration of contents and distribution of learning material and outcomes. The contents of supplementary modules are rendered accessible in the learning centre by means of RSS feeds. The learning centre is implemented in a wiki platform, in this case a MediaWiki (2.1).
- a *knowledge base*: all kinds of resources including texts and audiovisual media are collected here, i.e. their metadata are stored and indexed by means of tagging. The process of tagging results in a folksonomy for the domain of interest. The common use of an online knowledge base leads to networking effects, communities of interest are thus reciprocally informed about their knowledge stores. Implemented by means of a social bookmarking service, in this case citeulike.org (2.2).
- a *learning journal*: here, the learners can raise interesting encounters with the thematic areas without having to meet the formal requirements of working in the learning centre and the knowledge base, that is any kind of short contribution including, e.g. announcing interesting links or texts or inserting audio and video contributions, with the option of commenting or tagging them by using the folksonomy terminology. Implemented in a weblog, in this case WordPress (2.3).
- an *alerting service*: a number of different information providers is continually checked for updates, which are aggregated and filtered by certain thematic areas. The output of such procedures can be delivered to different modules depending on interests and requirements. The RSS format functions as a descriptive language for the exchange of data. RSS also offers the integrative mechanism necessary for a learning portal (2.4).

The learning environment is part of a blended learning arrangement, i.e. comprising a number of presence phases as well as media-based phases in an online environment.¹¹ For an improved integration into the learning arrangement and motivation, 1) elements of the Web 2.0 learning environment, particularly the wiki platform, are used in both the online *and* the presence phases (Cubric, 2007), and 2) the learners are actively involved in conceptualising, developing and implementing the learning environment - hence one of the requirements, namely participation, is already put into practice.

2 Implementation

This section explicates the just outlined four functional areas of our Web 2.0 learning environment wherein the Wiki is described in more detail, owing to its central role and broader didactical scope.

2.1 MediaWiki as a Learning Centre

The Wiki platform constitutes the learning portal that integrates learning contents from all of the learning modules in the learning environment, making them accessible in a structured way. It does not only serve as knowledge repository, but also as working environment. The Wiki is an activator in the learning and teaching setting in terms of blended learning - in both phases of online and actual presence. This paragraph describes how the Wiki can be utilized as an apt instrument for the active, flexible and social construction of knowledge thus allowing for problem-oriented, explorative learning.¹²

The particular functions a Wiki can fulfil in its role as a core module in a Web 2.0 learning environment shall be described below by three aspects, which will be further illustrated by practical examples relating to (2.1.1) *learning matters in the Wiki*, (2.1.2) *learning activities* and (2.1.3) *the roles or tasks of learners and teachers* for designing a successful learning process in a Wiki learning portal. These aspects of Wiki-learning were experienced in the introductory referred to use case realized in the seminar "Social Software" held in the information science

¹¹ On the didactics of blended learning see Erpenbeck & Sauter, 2007, 162f., as well as Kerres, 2002 and 2006.

¹² For the problem orientation and closeness to reality of learning and acquisition of competency see Erpenbeck & Sauter, 2007, 163.

study course at Darmstadt University of Applied Science in 2007/08. Our findings are reinforced by other studies about the practical use of Wikis in academic learning scenarios as is indicated. To begin with we show the starting page of our Wiki learning centre to give a first impression and for later referral in the course of our explication.

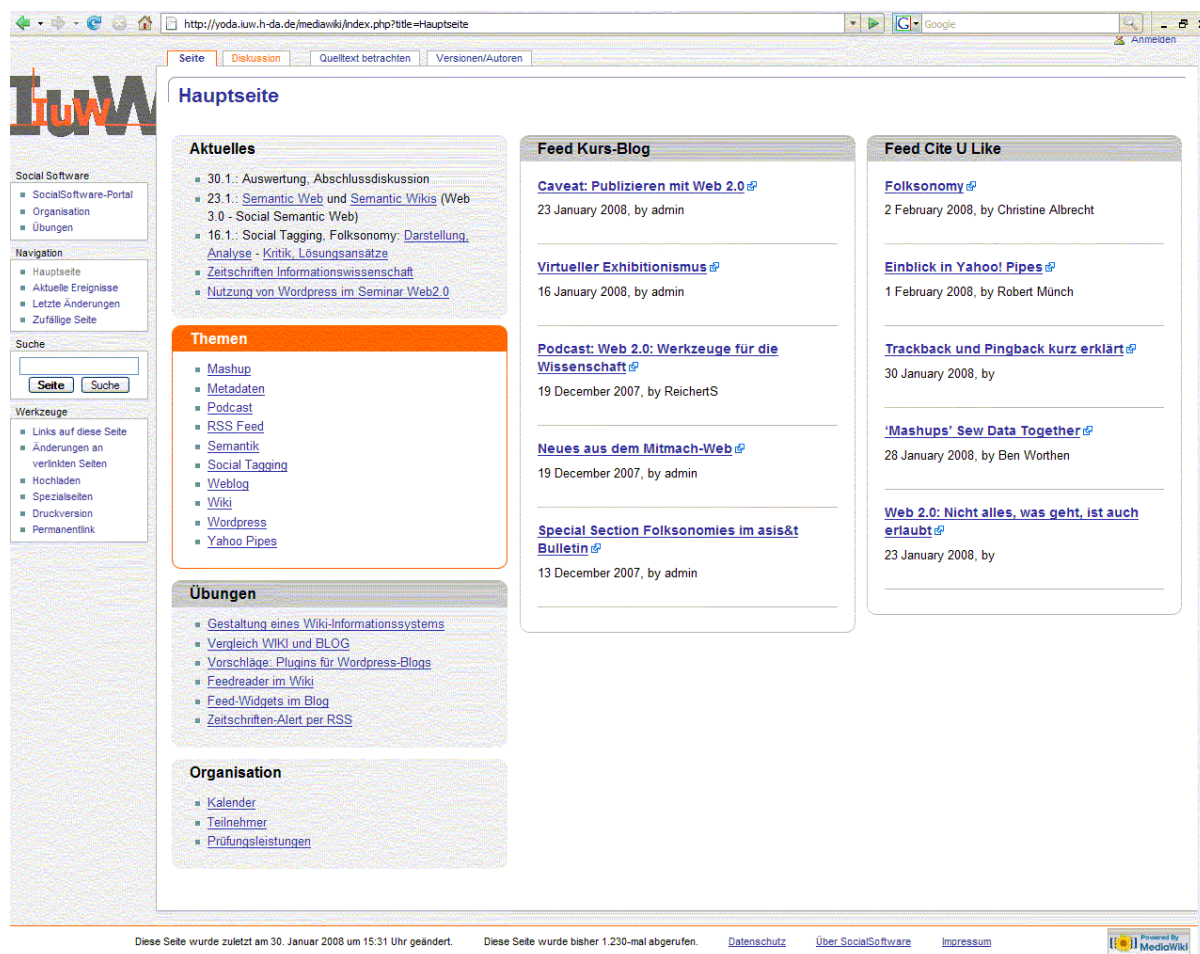


Figure 2: Wiki Portal Starting Page

2.1.2 Learning Matters in the Wiki

The Wiki can be extensively designed as a comprehensive and complete document and media repository providing all of the learning material in a clear and freely accessible way (Kepp et al., 2008; Himpf, 2007).

These kinds of learning material consist of learning resources that are available on the Internet (as elucidated above) including literature - bibliographic meta data or full texts uploaded into the Wiki - web resources and audiovisual media. Depending on server capacity, the latter can either be directly uploaded into the Wiki or stored on a separate file server. In any case, the media can be directly played in the Wiki itself once the respective technical extensions have been installed, which, like the Wiki as such, are available as Open Source products (Reinhold & Abawi, 2006; Blees, Reinhold & Rittberger, 2008). - The wide-spread opinion that Wikis are exclusively or predominantly limited to working with texts is ill-founded (Erpenbeck & Sauter, 2007, 247): Wikis have nowadays been so far developed that they are suitable for implementation in multimedia learning environments.

The outcomes of the learning processes themselves, i.e. the (interim) results of learning activities, are aggregated in the Wiki in terms of an e-portfolio (Salzburg Research, 2006; Schaffert et al., 2006). The Wiki presents test tasks and solutions, presentations, graphical

images, minutes, reports and transcripts of interviews the learners have conducted themselves and tests carried out in projects, categorised by fields of work.

The distinction between external learning contents and those contributed by the users themselves corresponds to static and dynamic contents. While static contents include all the items accessible by external links and uploaded items linked up to Wiki documents and media, the dynamic contents constitute the actual Wiki sites themselves where collaborative writing processes are trained and “learning contents” are practised. The flexibility of the overall structure of a Wiki, however, allows for characterising all learning objects as dynamic, as basically all of the contents can be changed by means of linking. Owing to the principles of dynamic generation and change, at both levels of individual objects and their organisation the Wikis are highly interactive, thus “making a crucial difference to the quality of learning”¹³

2.1.3 Learning Activities

The learning activities aim at thematic, subject-related activities as well as at training methodological and information competence.

The Wiki accompanies all learning activities as a communication platform, thus offering the possibility of a message board where current news and events can be published. Furthermore, a commentary site is maintained in parallel for each Wiki site, where discussions can be held regarding the contents of any of the pertinent Wiki sites. The Wiki moreover allows for sending e-mails to individual group members directly that cannot be inspected by others.

a) Knowledge Acquisition

The actual thematic learning activity starts with practical tasks and complex real-life problems; learners have to search, evaluate, select, aggregate and order relevant material they can use for building up a knowledge base. Besides an occupation with existing learning material, the Wiki pays particular attention to a production-oriented approach. The learners produce learning materials themselves while dealing with actual problems, such as texts or audiovisual media that are used by other learners in a seminar: each user can learn something from the contributions of others, thus the reciprocity of learning, that is social learning, is advanced (Schaffert et al. 2006).

b) Acquisition of Competencies¹⁴

The super-ordinate process in a Wiki accompanying all learning concerns project management. It comprises planning, organising, controlling and feedback as well as a progressive documentation of project courses. On its homepage, the Wiki offers direct access to current news, a list of personal pages of all participants including the teachers, with pictures, a short self-portrait and a link to the topic of choice, the general course plan with links to individual topics and editors, an option to edit Wiki articles by thematic areas and a separate area where the tasks and results from group work carried out during the seminar are collected (see figure 2). Since the project management in the Wiki is transparent to all of the students and they participate in it to a certain extent, they improve their methodological competency with regard to planning and organising complex project-based tasks.

The learners moreover train their information and media competencies by using the Wiki for building up hypertext structures and working on collaborative scientific text production (Thelen & Gruber, 2003). The students can successively practise the fulfilment of quality standards for scientific writing which are precisely formulated by the teacher at the beginning, and best documented in the Wiki itself as an orientation for the process of writing. The learners can

¹³ Schulmeister, 2004, 13.

¹⁴ A typology of competencies is given by Erpenbeck & Sauter, 2007, 63ff.

continually render their written work more stringent and refine it, and train for improving the plausibility of their texts, use references and appropriate terminology.

c) Progression in Learning

Furthermore, the collaborative level of the Wiki enables users to formulate and deal with (constructive) criticism. The contributions of learners undergo several feedback loops in order to optimise the texts. The process character of learning and its progression are thus rendered far more transparent not only for the learners as individuals and as a group, but also for the teachers. Students of information science at Darmstadt University of Applied Science used a Wiki to continually process and improve their thematic work. The different versions of individual Wiki articles reveal the progression in learning: more and more relevant sources are tapped, documented and integrated into the students' work; the initially crude and sketchy understanding of a topic is rendered more and more differentiate, more precise and completed. The structuring options of the Wiki software enable students themselves to develop a clear structure for an agenda of learning objectives.

2.1.4 Roles/Tasks of Learners and Teachers¹⁵

a) Learners

As touched on above, learners are expected to identify complex, real-life problems on their own and to actively construct and structure knowledge for processing them. In a Wiki learning environment, learners are asked to take on certain tasks or roles. Learning processes are participative, that is learners are integrated into formulating and reflecting learning objectives. They need to deal with the complexity of real problem scenarios and apply their methodological skill to transferring them into work packages that can be solved.

b) Teachers

In a Wiki learning environment, teachers act as coaches or moderators in the process of learning and teaching (Bernhardt & Kirchner, 2007, 47) by introducing and pre-structuring, particularly in the beginning. All of the supportive measures offered by teachers should aim at a "target-group specific balance between the organising support offered by the teacher and the autonomy of the students". (Erpenbeck & Sauter, 2007, 150)

i) Curricular Integration

The basic idea derived from constructivist learning theories is to allow students to learn in a self-regulatory and explorative manner. However, despite the expected autonomy and responsibility of learners, the teacher should ascertain the successful learning outcome by contributing supportive measures to the learning activities (Koubek, 2008). For instance, the setting for learning and teaching requires a clear structure of the topic in question as well as a clear distribution of tasks for individual and group work, and the clarity of (part) achievement expected in the course process. Furthermore, the students should be made fully aware of the assessment value of working with the Wiki for grading and consequently put into practice (Cubric, 2007; Reinhold & Abawi 2006).

ii) Orientation, Structure and Examples

Research in the implementation of Wikis in learning environments points out that learners require an established framework for beginning and continuing to work successfully with a Wiki.¹⁶ The necessary supportive measures of teachers further include the good examples a teacher has prepared for the tasks he or she expects the students to fulfil as well as guidelines providing the students with a framework for orientation and making it easier for them to produce scientific texts according to criteria of plausibility, clarity, stringency, including references and their quality. The type of presentation should make use of all the designing options provided by

¹⁵ For the complementary roles of learners and teachers cf. the "cognitive apprenticeship" in Schaffert et al., 2006, as well as Erpenbeck & Sauter, 2007, 158f.

¹⁶ Reinhold & Abawi, 2006; Cubric, 2007; Erpenbeck & Sauter, 2007, 151.

The total number of tags on a Bookmarking platform is known as a folksonomy (folk + taxonomy). Networking effects among the users constitute an additional value to the pool of indexed contents. As each source lists all of the users who have saved it, a user receives relevant information as to the individuals or groups working on the same topic hence the platform supports the discovery and setup of virtual communities of interest.

CiteULike was selected in our context because it specialises in the bibliographic reference of scientific online resources -though principally these platforms allow for the aggregation and enrichment with metadata of any kind of reference including audiovisual media. Our work with CiteULike aimed at a jointly created course bibliography which mainly listed scientific publications on the topic of "Web 2.0/Social Software". This services offers an option for setting up work groups whose collection are optionally accessible by the general public or only the members of the group and. Each of the individual user activities is logged so that the contributions of members can be assessed individually. The achievement of learners consists of selecting relevant sources with proven quality and their correct indexing. This requires a continuous monitoring and feedback by the teachers with regard to the selected material and its quality, completeness, appropriateness and coherence of indexing. As a result, the students have set up a collection of 150 records referencing scholarly literature enriched by formal and content-related index terms supporting navigability of the collection. Furthermore, the tagging process and the resulting tag clouds made students aware of thematically relevant terminology and of the topical focus of their work.¹⁸

Folksonomies: The Fall and Rise of Plain-text Tagging
by: Emma [Tonkin](#)
Ariadne, No. 47, (April 2006)
Plain

[\[Delete\]](#) [\[Edit\]](#) [\[Copy\]](#)

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- <http://www.ariadne.ac.uk/issue47/tonkin/>

Social_Software_ws_07-08's tags for this article

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▼ Abstract

For those of us more accustomed to dealing with formal classification methods, folksonomic tagging brings the potential of disruption, headaches and annoyance; how are such techniques supposed to fit into our tidy world? As unexpected as the success of tagging is, as novel and original as the technique seems, can we do anything but wait and see what the future will bring? Fortunately, there is applicable research - at least two separate strands of research - pre-existing on similar topics.

► [BibTeX record](#)

Figure 4: Typical citeulike entry with semantic and social relations

Figure 4 displays a typical bookmarking entry showing that the platform offers enhanced browsing options in addition to the search in the users' own collection; content-related search items are collated, thus the entire platform can be searched. The figure also demonstrates how networking is promoted among the CiteULike users. An overview is offered with links to the respective user groups collecting records that are thematically related.

¹⁸ <http://www.citeulike.org/group/2924/library>

2.3 Weblog Learning Journal

The open source software *Wordpress* allows students to set up their own learning journals (Mosel, 2005; Williams & Jacobs 2004; Lujan-Mora 2006). While Wikis are more focused on setting up and maintaining a knowledge base in a systematic and coherent way, blogs contain rather simple units of information, so-called micro-content, permitting a more agile management of information. The focus lies on a low threshold to interaction and communication, the exchange of experience and the collection of ideas growing from the course topics. News and debates can also be collected and discussed here. Even though the contents are primarily presented in (reverse) chronological order in a blog and a focus lies on the direct exchange of experience and comments, contributions can be thematically sorted by categories and tags that are based upon the Wiki categories mentioned above and the CiteULike folksonomy in order to provide easy orientation within the entire learning environment.

Functional extensions by so-called wordpress plug-ins are easy to implement. One such plugin is highly attractive to the learners: an easy-to-use media player, enabling the integration of common types of compressed audio and video formats into the journal. Learners are obviously particularly motivated by this option for publishing their own media productions. The subject of podcasting and all of its hard- and software requirements, was put into practice by producing a podcast that can be played or downloaded from the blog and so be re-used as a source of learning any time. The process of production itself is documented in a Wiki article giving detailed instructions for podcasting.

2.4 Alerting Service: RSS Feed Technology

Via the news feed format RSS (Really Simple Syndication) internet users can subscribe to the pure content of many websites without receiving the additional ballast of layout information and without having to visit each of the sites s/he is interested in and checking it for updates. This way, users can create their personal alerting services from different information channels and different types of resources (Nagler et al., 2007; D'Souza, 2006). RSS feeds are normally used by means of diverse feed reader applications, e.g. as desktop programmes, in a web browser as so-called dynamic bookmarks, or as web services specialised in the easy-to-use, clearly structured composition of personalized feed subscriptions, e.g. Netvibes.

With a web application like Yahoo Pipes comes a tool that enables a high degree of aggregation and filtering from a multitude of feed sources. Customised feed processing can intuitively be realised due to a graphical editor. The subscriber to feeds receives in that way an added value in terms of customised information with a high coverage. The pipes were used in our context for creating a journal alert covering current publications in information science, filtered by the search terms "Web 2.0" and "social software" and immediately displayed in the learning environment be it in the Wiki or the Blog. Here, too, feeds for nearly any number of resource types - not only text documents, but also images and other media - can be combined, filtered and displayed by the service.

And finally, the feed technology takes over the focal function for the content integration of all the Web 2.0 modules applied here. In Downes' (2007) words: "Contents syndicated in RSS become part of other contents, and this interaction occurs seamlessly, with no conscious intervention on the part of the creator needed to make this happen. A learning environment that contains RSS feeds becomes dynamic; the contents of those feeds are what makes it dynamic." How the diverse sources of information are integrated by means of RSS can be well understood by means of figure 1, showing the information flow between the modules. Since there exist respective plugins (named "extensions" in the context of MediaWiki) for integrating feeds into the Wiki, the continually updated contents of the other modules are presented on the Wiki learning centre homepage and directly accessible from there by hyperlink (see figure 2 above).

3 Evaluation by Students: Learning Outcome and Motivation

3.1 Questionnaire-based Evaluation

The questionnaire-based survey of the seminar “Social Software” held for the study course of information science at Darmstadt University of Applied Science in the winter semester of 2007/08 provides some insight into the success of blended learning by means of a Web 2.0 learning environment. The course’s membership was heterogeneous: of the total of 13 students, 8 attended the diploma course, while the other 5 students are in the bachelor degree course. 6 of the diploma course students and 4 of the bachelor degree students can look back on a working experience. According to their self assessment, their skill in working with computers and electronic environments respectively ranged from 1 (=very low) to 5 (=very high) on a pertinent scale with the mean at 4.08.

A majority of 8 persons assessed the blended learning approach as good (5 abstentions), which corresponds to the statement of a preference for a combined learning method comprising instructional learning, group work and discussion as well as individual learning in virtual environments.

The use of a Wiki as a platform for the collaborative acquisition of knowledge was estimated as good by the large majority of 11 students (2 abstentions). The use of the Wiki as a server for file sharing was assessed as good by 9 students (3 abstentions). There were no negative votes here, even though the students normally work with the alternative Blackboard LMS. All of the participants without exception gave a positive assessment of the fact that the contributions of others are freely accessible by all. This correlates to the positive statement that contributions of others are taken into account; the mean on a scale from 1 to 5 was 4.15 here.

The virtual asynchronous discussion platform the students could access via the blog was estimated as good by 6 persons and as bad by one person (6 abstentions): this ambivalent vote probably results from the voluntary character of entries in the blog and the respective low participation ratio here.

The setup of a collection of references to scientific publications by means of a social bookmarking service was assessed as good by 8 persons and as bad by 3 persons (2 abstentions). This negative vote is surprising given the output of this module, which resulted in 150 bibliographic records of proven quality and a rich set of metadata. A possible explanation might be the additional regular workload the students had to cope regarding the continuous search for information and the setup of the bibliography.

Despite the positive assessment of the good accessibility and use of the Wiki content, questions regarding the effect of the Wiki on learning outcomes and motivation revealed only mean results of 3.42 for motivation and 3.17 for the learning outcome. The influence of the Wiki platform on communicative competency and information competency was estimated as rather low, too, with 2.6 for communicative competency and 3.08 for information competency.

3.2 Oral Interviews: Feedback

The latter four scores named in the previous paragraph are, however, corrected in a positive way when taking into account the oral feedback from a concluding open discourse. Here, the students explicitly stated it was positive to work on learning contents themselves. They emphasised that the Wiki content provides a useful overview on the subject area and yields a good knowledge repository they can refer to beyond the context of the seminar. Feedback was also positive with regard to the development of competencies: the students agreed that they had been able to increase their technical and media competencies by using the Wiki software and the other Web 2.0 tools integrated into the learning environment. They also stated that the writing of Wiki articles, together with regular feedback from the tutor, had improved their text writing competency.

Even though the support of learning activities by regular feedback was recognised and appreciated, the supportive measures of the tutors were subject to criticism. For instance, some of the students stated that they had not been sufficiently introduced to the topic of the seminar, as the objectives and structure had not been outlined clearly. This criticism seems ill founded at first sight: a presentation was given during the introductory phase and the structure of the entire seminar and its agenda was outlined in writing in the Wiki, which the students could readily access throughout the semester. Furthermore, precise tasks had been assigned to the students for particular sessions.

4 Discussion

4.1 Learner Motivation and Learning Outcomes

Both of these surveys revealed positive results. The following explanation might be given for the points of criticism raised by the students. The explanation and resulting recommendations should, however, be subject to further assessment following a modification of the learning environment.

Since the students are familiarised with several Web 2.0 tools in such a seminar and have to work with them, we cannot always rely on the necessary degree of awareness. Regarding the design of the Wiki learning environment, we can infer that important guiding meta-information needs to be presented more conspicuously and with even more redundancy. In analogy, this also concerns the students' wish for enhancing the communication functions of the learning environment. A course blog was set up especially for making a regular and on-time exchange easier. Even though the students themselves had configured the blog and the blog contributions were integrated into the wiki platform by RSS feeds, the communicative function of the blog was not satisfactorily perceived.

We can thus give the pragmatic recommendation for a Web 2.0 learning environment that only those system components should be integrated for which the contents are graded for assessment - the vast workload students are confronted with hardly allows for an intrinsic motivation to engage in optional work.

Despite partial lacks of motivation the learning setting described here has proven highly productive. The social bookmarking module has generated a comprehensive, thoroughly indexed collection of scholarly resources that is available online - meanwhile several requests have been made by members of the citeulike community for admission into the course work group: this tool is thus adequate for realising the networking approach. The written works the participants have published in the wiki are mostly of good to very good quality with regard to both formal and content criteria. Hence, the wiki shall lead to an online publication delivering an introduction and overview of the focal topics of Web 2.0 and thus further being used as a resource for learning.

The maintenance workload of the here introduced learning environment is comparatively high even though distributed contents are collated in the wiki learning centre and the respective modules provide protocols and monitoring options for teachers: the activities need to be continually observed and feedback must be given, content structures need to be adapted to newly added content. On the other hand, Kerres' (2006a) statement is true that the students recognise and appreciate the additional work of the teachers and regard it as a source of motivation.

4.2 Model Character

As we have already pointed out the learning environment presented here is principally suitable for any kind of course subject, topics, learning matters, and (electronic) media, i.e. the model introduced here can, if it is modified accordingly, be transferred to other learning contexts such

as continuing vocational education, or learning at the workplace. The use of Web 2.0 tools does not only contribute to building up necessary knowledge autonomously in terms of content, but users also train the media and information competencies required for working with the respective tools. This includes searching, selecting and filtering, as well as structuring and presenting knowledge, all of these skills are central to lifelong learning and an autonomous and successful engagement in future professional tasks and projects.

Since a Web 2.0 learning environment is browser-based, working with Web 2.0 applications is either already familiar or can be acquired quickly and intuitively. Therefore, it can be integrated into existing workflows more easily than proprietary learning software. The model presented here may provide an orientation as to where a plethora of available web applications can be implemented as functional equivalents of modules in a learning environment. Furthermore, simple XML exchange formats exist besides RSS and some applications offer APIs for using contents elsewhere. In any case, the learning environment offers all of the prerequisites to carrying out seminars across the borders of subjects, disciplines or universities and in this way establishing networks.

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