

Integration of a Wiki for Collaborative Knowledge Development in an E-Learning Context for University Teaching

Birka Jaksch², Saskia-Janina Kepp¹, and Christa Womser-Hacker¹

Hildesheim University, 31141 Hildesheim, Germany
Institute of Applied Linguistics (IfAS)
Information Science

¹ {keppsa,womser}@uni-hildesheim.de,
² birka_jaksch@hotmail.com

Abstract. E-Learning, which is technology-enhanced learning proved to have potential for adding value to education. Recently, with the shift of the World Wide Web to a more interactive web through the introduction of social software, the term E-Learning 2.0 was coined, indicating that the potential influence of social software on E-Learning has been recognized. This paper investigates the potential of integrating a wiki into an E-Learning module and the impact this integration can have on self-directed, collaborative and responsible learning in an E-Learning setting. Therefore, the focus is set on the integration of usability aspects and the surrounding didactic conditions that need to be considered when social software is to be embedded into learning scenarios. First evaluation results of the wiki-based glossary demonstrating this potential will conclude this paper.

Keywords: Social Software, Web 2.0, Wiki, E-Learning, Collaborative Knowledge Development.

1 Introduction

The explosive appearance of new web services and applications such as weblogs, wikis or other social software technologies shifted the World Wide Web “[...] from [a] static content-based web to a dynamic communication-based web.” [1]. This trend, which is often referred to as the Web 2.0, is characterized amongst others by participation and user-generated content. As a result of this, in contrast to the Web 1.0 where users would only consume, social software applications enable anyone on the internet to create content, share information and connect with other users. This is expressed by [2] by characterizing the Web 1.0 as following a top-down approach while “web 2.0 takes a more bottom-up approach” where content creation doesn’t require the use of code and new applications support “greater social interaction and collaboration”.

This shift of the World Wide Web to a more interactive web through the introduction of social software has also led to discussions about E-Learning 2.0 indicating that the potential influence of social software on E-Learning has been recognized. This

paper will investigate the potential of integrating social software into an E-Learning module and to what extent this integration can have an influence on self-directed, collaborative and responsible learning in an E-Learning setting. The focus of this investigation lies on the integration of usability aspects and the surrounding didactic conditions for the embedment of a wiki into a collaborative learning scenario.

Section 2 describes social software in general and wikis in particular along with their potential for E-Learning. Section 3 gives a detailed overview of the instructional design process framework for the integration of a wiki into a course about North American Culture conducted at the University of Hildesheim that participates in the CELEB project [3;4;5]. The empirical evaluation of the deployment with special focus on usability issues will be outlined in section 4 before an outlook concludes this paper.

2 Social Software in Education

Social software applications are web-based and therefore are accessible from anywhere at any time [6]. Hence, users have the option of working synchronously and asynchronously on the same content, which enhances online collaboration. Additionally, for the purpose of this paper, “[...] social software is defined as a tool that must meet at least two of the three following conditions:

1. It allows people to communicate, collaborate, and build communities online.
2. It can be syndicated, shared, reused, or remixed, or it facilitates syndication.
3. It lets people learn easily from and capitalize on the behavior or knowledge of others. “ [6]

Furthermore, social software is characterized by their concentration on data that leads to rather simplistic interfaces with reduced functionality that lower the threshold for using the software [8]. As a consequence of these characteristics, the usability of this software is enhanced, because users are able to quickly understand and become capable of using the applications [6].

The following section describes wikis as one particular social software application and its potential for usage in educational scenarios.

2.1 Wikis

Wikis seem very helpful if there is a need for a platform that enables online collaboration and the creation of a knowledge base that can be accessed and amended by anyone on the World Wide Web. In fact, one of the first thoughts that probably come to mind in association with wikis is the free online encyclopedia Wikipedia¹, which has developed into a well-known online knowledge base based on wiki technology. Even though wikis were already in use long before the appearance of this free online encyclopedia, Wikipedia increased their popularity and made media pay attention to them [10]. Articles composed in more than 250 languages can be found on Wikipedia and as of June 2008 the English-language Wikipedia alone has accumulated 2,425,913 articles since it was launched in 2001 [11]. The concept of a wiki, openness as one of

¹ <http://www.wikipedia.org>

its biggest challenges, and the usage of wikis in education will be described in the following subsections.

2.1.1 Concept of a Wiki

The meaning of the word wiki refers to the main characteristic of this software application. Wikiwiki is Hawaiian and stands for quick. Ward Cunningham² coined this term and chose it because of the quick and easy changes that can be made to wiki contents [12]. While the online encyclopedia Wikipedia is well known to Internet users the concept of a wiki deserves some explanation and discussion. In general, one could say that a wiki enables creating a website where every user can get involved. [12] define wikis as “[...] web-based software that allows all viewers of a page to change the content by editing the page online in a browser.” This means that every user can obtain author and editor privileges, which makes the wiki truly democratic [14]. Therefore, in contrast to weblogs where one author or a predefined group of authors owns its contents, “[i]n a wiki, no one person owns the content – and yet, everyone owns the content.” [6].

A wiki consists of several interlinked web pages that can incorporate text, sound, images and videos. Apart from that, each wiki can look different, because a wiki has no predefined structure. Wikis therefore represent a multi-faceted repository, which may at the same time serve as a space for asynchronous as well as synchronous collaboration or collaborative activities. The changes that are being made are shown instantly. Since every user can post, edit or delete contents a version control is usually implemented so that malicious or incorrect changes can be made reversible.

The next paragraph will discuss openness as the main challenge in connection with wikis.

2.1.2 Openness of Wikis as a Challenge

The number one reason why wikis are so popular in the first place is also the number one reason for others to react critically to the concept of wikis: openness. The freedom of author and editor privileges, which also includes the right to delete or edit someone else’s content, seems to be a major issue. For newcomers, the ingrained norm of authorship creates objections to wikis. “The notion of private property is so deeply embedded in our society that it’s difficult to imagine going onto someone else’s Web site and changing its content, even when you are invited to do so.” [6]. This concern appears mostly with regard to public wikis that are open to all users on the World Wide Web. Nevertheless, also people who are working collaboratively toward a specific goal in closed groups need to overcome this barrier. More urgently, this openness creates a security gap for vandalism. Spammers are given the opportunity to maliciously delete contents or publish false information. One attempt to minimize this vandalism is some kind of version control in which all edits are made visible. This way, malicious changes can be made reversible. However, in communities that show strong commitment to their wiki, vandalism is usually removed quickly. “The community enforces behavioral norms so that the wiki doesn’t become a free-for-all, an example of self-organizing group behavior in action.” [6]. Still, if lack of interest and commitment prevail, the wiki concept will not work.

² Ward Cunningham developed the first wiki in 1995 [13].

Another concern in connection to a wiki's openness regards the quality of the contributed articles in wikis. Since there is no authority that approves and double-checks the content with respect to credibility and objectivity, "[m]istrust is directed at the question as to whether or not the masses even have enough knowledge to produce something trustworthy." [12]. Until now it seems that there is not a satisfying solution for this problem. However, the lack of a single authority that approves or rejects contents is exactly what allows a topic to be described from many different angles. It "[...] reduce[s] regional and cultural bias found in many other publications." [15]. Also, it enforces the quick appearance of articles that reflect thoughts about current events. In the long process of many changes, articles tend to represent the collective perspective in the end [14].

The last critical aspect of a wiki's openness is its lack of a predefined structure imposed from an authority that makes keeping track of the wiki's contents challenging. "The search function and the 'Recent Changes' page are useful, but without some sort of organization - just as with the World Wide Web as a whole - some pages may never be found, except by their author(s)." [6]. However, this does not mean that there is no possibility of creating structure in a wiki. It is the users' decision to add some sort of structure such as hierarchies, table of contents or assigned categories. Even though it might be challenging to maintain this structure since users can add or edit contents constantly, many existing wikis still incorporate structure for better navigation.

All in all, trust seems to be a possible solution to the challenges that arise with a wiki's openness. Restricting a wiki's openness leads to a reduction of its advantages like the possibility to describe certain aspects from different perspectives and the independence from imposed structures from a higher authority. Instead, the concept of trust should be embraced. In order for the wiki concept to succeed, the participating users need to overcome their ingrained norm of ownership and instead trust their peers in creating correct entries.

2.2 Wikis in Education

Despite the challenges, wikis are convenient tools for collaboration, collection and reflection and therefore are applied in numerous different ways at educational institutions [25]. They are considered a tool that "[...] facilitate[s] collaborative finding, shaping, and sharing of knowledge, all of which are essential properties in an educational context." [23]. Whether for assembling a syllabus, for collaboratively building an annotated bibliography or a knowledge base, for group authoring of documents and presentations [9] or for collaboration on projects [7] there is a variety of applications for the use of a wiki in education. In the literature many more examples can be found that offer simple guidelines on how and in which educational scenarios wikis can be applied [9; 35]. Other authors investigate further into the didactic aspects of using wikis in a collaborative learning setting, e.g. [7]. Then again, since wikis are information systems, there is also a need to consider usability aspects [25; 36; 37]. However, the didactics and usability of a learning tool or setting have not yet been analyzed in an integrated fashion.

The purpose of this paper is to integrate didactic as well as usability aspects in order to design a wiki as well as the appropriate learning scenario it is embedded into.

But first of all, this section will discuss why wikis have become more and more popular in academic settings but it will also point out the challenges that still remain to make wikis productive in that specific domain. The following section will then introduce the process design framework that is based on the ADDIE model and considers usability as well as didactic aspects.

One of the reasons why wikis are applied more frequently in educational institutions is the ease of use and the low cost. It is fairly easy to learn how to use a wiki, it is generally free to use for it is an open source application and does not take a lot of time to create new contents. Therefore the focus remains on the contents and not on the software itself. Wikis provide everyone with direct access, “[...] which is crucial in group editing or other collaborative project activities.” [14]. As a result, all participants are equal in the sense that anyone can add or edit the contents at any time. However, it is possible to assign different levels of access and control to participating users in order to influence the teaching and learning experience. “A wiki’s versioning capability can show the evolution of thought processes as students interact with the site and its contents.” [14]. It therefore provides a visible state of the changes in dealing with a certain topic for students and teachers. Nevertheless, there is the possibility of creating different levels of access both to content in general, and to content editing functions. Sometimes these different levels of access are required, for instance, when the educators feel the need for a more controlled environment. However, [16] opposes that “[t]o really use a wiki, the participants need to be in control of the content – you have to give it over fully.” In literature, it is emphasized that too much control in a wiki diminishes the effectiveness of this tool. counter

An invaluable implication for teaching and learning with wikis besides the opportunity of developing and enhancing general writing skills is “[...] teaching the rhetoric of emergent technologies.” [17]. [18], a hypertext theorist, refers to this as “[...] network literacy: writing in a distributed, collaborative environment.” Wikis provide an opportunity to enhance writing for public consumption. Working within a wiki enables anybody to review the contents and therefore the awareness of the authors is increased.

In addition, the wiki technology also enables the integration of multimedia such as podcasts. In this respect, podcasts (provided by news services such as CNN³, etc.) could be embedded and aggregated in the wiki via RSS for discussions about current events in politics viewed from different perspectives. The wiki can be accessed at any time from anywhere, which ensures that the content can be updated constantly by the participating students and therefore guarantees topicality as well as authenticity. While the content of a course is emerging during the semester the students can expand the wiki’s content autonomously. Over time a repository of shared knowledge develops, which “[...] facilitates writing as a process rather than a product.” [19].

Added value also results from teaching information literacy, which is described as the “[...] ability to locate, manage, critically evaluate, and use information for problem solving, research, decision making, and continued professional development.” [20]. In connection with the concept of wikis, which was discussed in section 2.1.1, information literacy plays an important role. Reviewing critically the peers’ contributions that were added to a wiki, for example, improves the quality of content. [21] underlines that teaching information literacy especially in conjunction with what

³ <http://www.cnn.com>

students learn in a course, motivates the students to learn these skills and enables them to become independent thinkers and lifelong learners.

Furthermore, the wiki can be used as a repository for learning resources, which would also enable the interdisciplinary addition, exchange and commenting of learning resources across institutions in a university context. This way the sustainability is ensured and the wiki can be used in different contexts. Thus, the sustainability of the wiki's content can serve as a source of information and knowledge. The wiki can be used continuously in the following semesters or by other institutions at a later time. The perspective of not only writing for the teacher but for a wider audience promotes collective authoring, which involves peer editing [19]. Especially with a wider audience in mind the students are required to critically read their peers' contributions in order to ensure authentic information. All in all, a wiki hosts an environment for collaborative and cooperative knowledge development since it enables all participants to work together on its content. The wiki does not only allow its users to absorb but also to develop knowledge actively and collaboratively.

One major challenge that remains for educators who work with wikis is tracking their students' work. Depending on the size of the course this might "[...] become a logistical nightmare." [17]. Anybody can edit at any time and as a result educators might face many changes in content. In addition, the attribution of individual work becomes very challenging as the contents are continuously changing. Changes made by individual students are again reviewed and edited by other students. Therefore, the end product will be the work of many different students. From there it might be difficult to assess which work was done by whom. "If people need to take credit for the things they write, a wiki is probably not the best tool." [6]. However, an approach towards the problem of attributing individual work is by having the students register. In that way the educator can identify the author of the recent changes being made [17]. Additional to the difficulty of taking credit for the users' individual writing is the issue of intellectual property. The anonymity of users and the lack of references turn this to an even more complicated matter [17]. Several policies have been introduced to address this issue, yet no approach has proven to be satisfying in all circumstances. Another issue often reported when introducing new technologies (in this case a wiki) to courses is the students' participation. Evaluations showed that the students' contributions made in course-based wikis are not sufficient if there are no incentives given [22]. This issue can be addressed, however, by creating incentives such as giving students credit points towards their exam for active participation.

As a consequence of these advantages and challenges, usability and HCI aspects like interface design, navigational and content structure as well as the embedment into the existing E-Learning infrastructure have to be considered in addition to didactic conditions like the different roles in learning contexts as well as the motivation of learners and teachers. The next section describes these facets as part of the instructional design process framework for the implementation of a wiki-based glossary in higher education.

3 Instructional Design Process Framework

According to the ADDIE model, which is a systematic approach to the instructional design process [24], there are five different phases that have to be considered in creating

E-Learning content. The first phase is the analysis phase that is followed by the design phase. The designed product will then be developed and implemented before it will be evaluated. The following subsections describe the essential steps of these different phases, beginning with the analysis of the basic conditions and how they have been carried out at the University of Hildesheim for developing a wiki-based glossary for integration in blended learning scenarios.

3.1 Basic Conditions

3.1.1 Target Group

The primary target group consists of students who are in their first year of a teacher training course for the subject of English. The number of students attending this course is estimated to be 20 and up. The students are approximately between 19 and 24 years of age and it is assumed that their previously obtained computer literacy skills are only basic. Through surveys carried out at the beginning of each semester these assumptions could be verified to a large extent. While all of the students possess a computer with access to the internet and use both nearly every day their usage habits are concentrated on basic applications like word processing software and communication tools like instant messaging and social networking platforms. Services like wikis or weblogs are mostly only consumed or not known very well and therefore not used. This information was obtained through a survey that was conducted at the beginning of the course.

3.1.2 The Course and Teaching Content

The course where the glossary is applied is based on a blended learning concept and consists of an introduction to the culture of North America focusing on the USA. The objective is to give an overview of North America (Canada, USA, and Mexico) relating to history, politics, culture, literature, educational as well as media systems. A focus is set especially on how these aspects collude within American culture. Current texts, audio and video files will therefore be used in order to discuss the consequential effects. As a result of the assumed little computer literacy on the part of the students, no advanced computer skills are required as prerequisites.

3.1.3 Objectives of the Application of a Wiki-Based Glossary

A general objective of all E-Learning modules created within the CELEB project is to improve the quality of teaching and to enhance the individual study as an additional support to the present teaching. In this respect, special attention is paid to the content development of the E-Learning modules in consideration of adding value facilitated by the integration of interactive multimedia. The E-Learning modules shall provide students with access to the learning resources independent of time and place and facilitate the process of learning from each other through knowledge sharing and knowledge creation.

The field of Cultural Studies is especially relevant in the training of students who want to become prospective English teachers. Constant changes in politics, social and cultural processes, which sometimes call for daily updates of the learning and teaching resources, are characteristic in the field of Cultural Studies. As a consequence, a learning environment, in which the content can be easily kept up-to-date, needs to be

provided in order to ensure authenticity and topicality. By accommodating the changeability of learning and teaching resources the learning and teaching quality can be enhanced. In the context of the E-Learning Module *Cultural Studies*, the introduction of social software components and multimedia-based elements is intended to accommodate these requirements. Authenticity can be guaranteed, for example, by providing students with access to authentic audio recordings, which will give them the opportunity to listen to the pronunciation of native English speakers and therefore enhance the students' auditory understanding. Additionally, the benefit of learning independent of time and place creates a more learner centered approach. In respect to audio recordings, for example, the students can choose to repeat listening to them as many times as they need to fully understand. In addition, this will also contribute to their training in articulation. Topicality can be ensured by social software components, because they enable easy updating. In consequence, the content can be adapted to current events and supply the students with interesting newsworthy information. Expert interviews that have been recorded and show new developments in the students' field of study, for example, can be made available to them online in the E-Learning module. The module therefore allocates learning and teaching resources that are more current than those in textbooks.

Other objectives regard the development of certain competencies like social and communicative competence as well as information and media literacy in addition to the active knowledge construction about North American culture. The development and training of these competencies shall equip students with the necessary skills for the knowledge society that calls for life-long learning.

3.2 Usability Issues and Wiki Design

Due to the importance of authenticity and topicality as well as for the training of the above mentioned competencies it is important that the students don't just receive information but actively develop their knowledge. Therefore, collaboration between students is facilitated through social software according to the constructivist learning paradigm. With collaboration playing a key part in the learning process, the use of this wiki is based on the social constructivist learning model, which postulates that "[...] in order to learn, students have to create." [26]. This constructivist approach to the acquisition of knowledge emphasizes besides other interaction, reflection and exploration of knowledge, which is reflected in the five principles for the integration of social software in formal educational settings formulated by [27]:

- the process of learning is predominantly social,
- knowledge is generated through practice,
- learning needs active participation (responsibility),
- content is generated in cooperative learning situations,
- above all, communication structures need to be designed instead of content.

Based on these principles, the students are encouraged to interactively deal with problems, reflect their own and others' work processes and link information to a knowledge network.

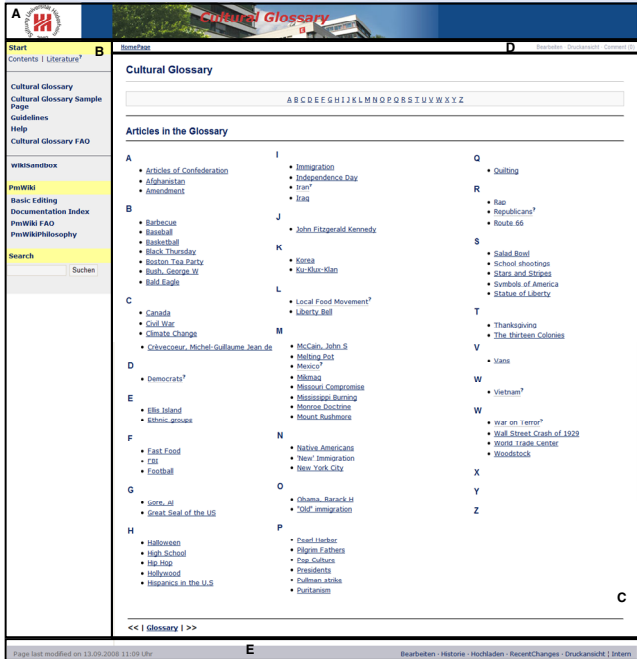


Fig. 1. Screenshot of the wiki-based glossary

Besides these design issues, which mainly describe course design, the design of the wiki interface also needs to be considered in this phase. In order to provide orientation to the users – students and teachers alike – a consistent interface is offered that consists of five central areas (Fig. 1). The header (A) is automatically filled with the title of the glossary that the educator has chosen. The functionality of the navigation bar (B) on the left is static according to the needs of the course whereas the menu items can be edited by the teacher at any time. The students only have editing rights in the main area (C) in the center of the screen although editing restrictions can be set here by the teacher or an administrator. Editing restrictions are employed by setting passwords for those parts of the wiki students should not edit. In addition, conditional markups facilitate adaptive hiding of links for the role of students, so confusion about non-executable functionality is prevented (Fig. 2 and 3). This is for example the case on a wiki field's start page that gives an overview of the field's contents and can only be changed by the administrator or the instructors of the classes a module is applied to. The areas (D, E) surrounding the main area contain this functionality to manipulate the main area like editing, printing, commenting or viewing the page's history.

By implementing a basic structure in the wiki the instructor provides additional orientation. For the wiki-based glossary the content structure is represented in alphabetical order in the first phase, but can be enhanced by categorizing the entries as the wiki becomes bigger through the student activity. Discussion sections regarding the different topics are tied to the created presentation pages in order to provide room for feedback, reviews or for coordinating the collaborative work.



Fig. 2. Wiki-based glossary without edit privileges



Fig. 3. Wiki-based glossary with edit privileges

According to the basic conditions and the design issues just discussed the wiki-based glossary is developed on the basis of the open-source software PmWiki⁴. The following section focuses on the implementation of this wiki into the course and the didactic factors like different roles and motivation as well as the technological infrastructure.

3.3 Implementation of the Wiki

Introducing a wiki as a new technology in educational settings does not necessarily guarantee to be a success by just implementing it. Section 2.1.2 already discussed objections towards the use of wikis in general and concerns referring to their use in academic settings. Therefore, for the successful use of a wiki in education certain prerequisites need to be considered before starting to actually work with it. These will be discussed in the following sections.

The students of the *Cultural Studies I – North America* course are requested to develop a Cultural Glossary throughout the semester, which is to result in an encyclopedic collection of information on different areas of North American cultural studies. The contents of this Cultural Glossary are oriented towards the topics addressed during the semester. Twice during the semester the students' task is to choose an aspect of the current topic (American history and American holidays and traditions) and write a glossary entry about it. The presentation of a certain topic can be a mixture of text, picture, audio or video files.

A detailed definition of the students' and the instructor's role will be given in the following before the issue of their motivation and the technological infrastructure that wiki is integrated into will be addressed.

3.3.1 Definition of Roles and Their Responsibilities

First of all it needs to be acknowledged that the students and the instructors embody different roles within the wiki. Whereas the role of the students will be that of active creators, authors and reviewers, the role of the instructor will be within the range of an observer, mediator, reviewer and coach. Within the wiki the students will create articles, review their peers' contributions and at the same time provide learning resources. [27] points out that in some respects while working with a wiki the students are required to become more autonomous and self-organized and as a result of this educators lose control over the content creation. However, in order to guide this

⁴ <http://www.pmwiki.org>

learning process the educator will provide the students amongst others with specific learning resources and create initial page templates, which present simple guidelines⁵ on working with the wiki referring to the course's content.

Since the target group constitutes of first year students of an introductory course and it is assumed that they are neither familiar with the contents nor have they developed collaborative skills yet, the educator needs to enable guided learning by giving structured instructions. In addition, it is advisable that the instructor points out the technical equipment that is made available to the students. In combination with using a wiki, which is web-based, this means pointing out the availability of computers as well as wireless access to the World Wide Web at the university.

3.3.2 Learner Motivation

A wiki is only successful under the condition that people actively participate. Several studies have dealt with the phenomenon of lurking, which means that most users of wikis don't actively contribute contents but instead only passively consume it [34]. Especially for the use of a wiki in an educational setting the participation of students is important and therefore needs to be motivated. That is why incentives need to be created in order to increase the willingness to work with the wiki and enforce a more active participation. According to [22], the instructor has to encourage the students' work in the wiki by being an active reviewer and leaving feedback so that the students feel the instructor's presence. This is of special importance for this target group since the wiki scenario is supposedly entirely new to them. In the case of assessment-driven students [22], an effective incentive is to make the contributions to the wiki part of the requirements for the course or even to reward the students' active contributions in form of additional credits towards the oncoming exam. Besides incentives that increase extrinsic motivation it is even more important to address the learners' intrinsic motivation by pointing out the usefulness of the wiki as preparation material for the final exam.

However, the difficulty of motivation is not only limited to students. Applying a new technology in a course also results in extra work and effort for educators, because functionality as well as the syntax of a wiki need to be learned. Furthermore, the educator's traditional role is expanded in the way that "[p]lanning lessons, a traditional hallmark of teacher expertise, need to be extended to designs." [28]. This means that the educator needs to design activities specifically for interaction within the wiki. Therefore essential conditions need to be created in order to point out the benefits of adopting a wiki to the educators. It is essential to present a wiki tutorial to the educators in order to motivate them to work with this technology. It needs to be discussed why technology can enhance their teaching and what the specific benefits are for the educators. Therefore it should be highlighted that the application of technology within a course serves "[...] to create opportunities for new objectives that may not be possible without them." [29]. One of these new objectives is possible because of the fact that wikis enable teachers to communicate easily and asynchronously with their students on course topics and thereby facilitate to "[...] quickly dispel misconceptions and correct errors [...]" that occurred in class [30]. Furthermore, collaboration of

⁵ Example for a guideline: "Add your entries in alphabetical order using the reference style specified in *How to work with this wiki*".

students is mostly a black box⁶ process to instructors. In most cases the instructor is not able to review the actual collaboration process but only the output in form of a final product. Wiki technology reveals this collaboration process and makes it visible to the educator. Its version control features enable to track and assess the knowledge development of the students as well as monitor the content development in order to determine problem areas for students. In addition the educator can use the wiki to present course information and have the basics compiled by the students in it. This way, the focus of the traditional classroom sessions can shift to more topical issues. Concluding, it is important that the educator is supporting the concept of wikis because after all, the educators can only motivate the students to work with a wiki if they believe in the benefits of the wiki concept themselves.

An integral part of the implementation of the wiki-based glossary as well as other wiki-based applications in the CELEB project is the training of the instructors in using a wiki in order to get to know this kind of software and become aware of its advantages and limitations. The goal of this introduction is to familiarize the teachers with the technology and to enable them to train, support and encourage their students in using the wiki, because it can be assumed that educators are more encouraged to use a software in their teaching practice and are capable of encouraging their students to also actively use it, if they are familiar with it. In addition to the introduction, further support is supplied by written tutorials about introductory topics, article templates, FAQs and contact persons in case of technical difficulties. These support channels are accessible by instructors and students alike and can be supplemented by forum threads or chats if necessary. Further support through video tutorials by way of screencasts is planned. Because they enable and encourage instructors and students to use the wiki effectively, these support channels constitute further incentives.

3.3.3 Guidelines for Working with Wikis

Guidelines for working with wikis can further enhance the effective usage of wikis. Deriving from the objections towards wikis discussed in section 2.1.2 the following guidelines are addressed particularly.

First of all, an emphasis has to be put on the main characteristic of collaborative work. As discussed in section 2.1.2 the ingrained norm of authorship raises objections towards the work with wikis. It is essential to emphasize from the start that there will not be individual ownership of contributions and that the students need to be aware of that. Each contribution can be edited by every other participant and everyone is welcome to do so. To avoid contributions of lesser quality it is advisable to announce that even though it will not be possible to take individual credit for single contributions, the students' participation will still be monitored in order to give feedback on the development process of the content and in order to assess whether the students are eligible to earn credit points towards their exam [22]. Secondly, students are taught that the wiki concept depends on the constant changes made to its content. Therefore the students should be encouraged to contribute to a wiki page even though the presentation might not be the final version yet. A wiki enables the successive development of content. Thirdly, the participants are requested to review their peers'

⁶ Black Box: "Black box is a technical term for a device or system or object when it is viewed primarily in terms of its input and output characteristics." (cf. Wikipedia: Black Box 2008).

contributions critically in order to improve the content quality. This means that in consideration of spelling mistakes, formal mistakes and mistakes as regards content students are invited to read through and edit their peers' presentations. Especially for the means of a glossary, a neutral style with preferably no bias needs to be established. Guidelines and techniques on objective writing are therefore of special importance. [12] advert to this as a process, in which "[...] striving towards objectivity is a form of self-education." Hence, an important pre-condition for collaborative editing is that guidelines with examples for objective language are given in order for the students to be able to express the "neutral point of view" [22].

The next section will give an overview of the technological infrastructure in which the wiki will be embedded.

3.3.4 Technological Infrastructure

The E-Learning modules created within the CELEB project are embedded in the E-Learning infrastructure of Stud.IP⁷. In the context of the project, the Stud.IP system presents a central access point for the administration of the courses and therefore for the E-Learning modules. As a consequence, access to the wiki-based glossary, which is part of the E-Learning module Cultural Studies, can be obtained via the user interface of Stud.IP. First of all, the students need to sign in to the Stud.IP system. They then are automatically directed to the interface, which lists their courses. By clicking on the link for the *Cultural Studies – North America* course they enter the course's website (Fig. 4).

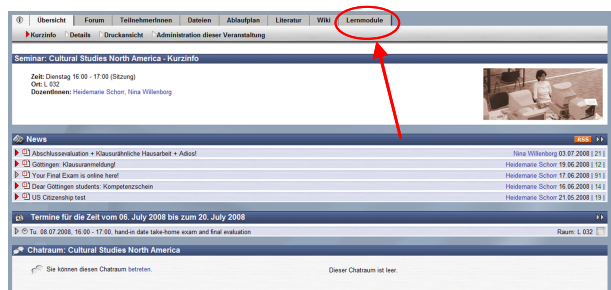


Fig. 4. Stud.IP Cultural Studies North America website

By choosing one of the learning modules listed under the tab *Lernmodule* the user is redirected to the wiki-based learning environment, which uses PmWiki software. PmWiki includes the basic wiki features and is easy to install but at the same time it is quite extensible and customizable. The software facilitates the inclusion of images in the wiki pages, the attachment of documents as well as the creation of links and therefore allow for "[...] efficient collaboration, knowledge-sharing, and resource-tracking." [31]. In addition, it enables the assignment of different levels of permission for different users and wiki pages by establishing passwords. This is especially useful in the context of the wiki-based glossary, since some of the pages, such as the start

⁷ <http://www.studip.de>

page or pages that contain statistics about activity in the wiki, are not intended to be edited by students. Therefore, password protection for certain wiki pages is suitable. The decision for using PmWiki is based on the fact that it can easily be incorporated into the Stud.IP system.

In contrast to public wikis the wiki-based glossary will only be open for editing to students participating in this particular course in the first phase of the project. For a later phase of the project the wiki-based glossary can be involved in additional courses at the same time. This enables comprehensive collaboration over different courses as well as collaboration over more than one semester. When working within the wiki the students' contributions will not be signed with their name but instead with their identification issued by the university's electronic data processing center. This permits to overcome the inhibitions of public writing especially in the case of first year students. It guarantees a high degree of anonymity yet the contributions can still be attributed to the individual students.

3.3.5 Summary

The described design and implementation should help conquer the main objections that arise with a wiki's openness and were mentioned in section 2.1.2. One of these common objections to wikis concerned vandalism. However, the mechanism of version control facilitates monitoring the changing content of the wiki pages and easy restoration of deleted content. Furthermore, in the context of the Cultural Glossary wiki this issue does not fully apply since it is not open to all users. As of now, only students who are registered in the course of *Cultural Studies I - North America* are able to access and edit the wiki. Therefore, the number of users editing the wiki pages is limited. It can be assumed that the students are interested in a positive process while developing wiki pages since they are motivated by the credits they can earn for the final exam when actively taking part in the wiki (cf. section 3.3.2). Additionally, vandalism in the wiki-based glossary is restricted by having the participants sign in before accessing it. In this respect all contributions can be traced to individuals. Last but not least the awareness of the instructor's presence in the form of feedback will limit vandalism.

Another challenge in connection with the wiki philosophy concerns the traditional epistemology of individual ownership that students need to overcome. Research has found that students are hesitant editing each other's pages and that they primarily edit the contents they have created themselves since they feel individual ownership for these contents [19]. Another aspect is that according to the wiki principle users create links to non-existing topics indicating that there is still need for information. These links invite others to fill the articles with content depending on their knowledge. However, [32] points out that it will be difficult for new users to get used to this kind of collaboration as well as to use premature ideas as a suggestion for their peers. It can be assumed that this will also apply to the students using the wiki-based glossary and that it will remain challenging for them to get used to the process of collaborative authoring and open access. Therefore the challenge in respect to the educator's role is to constantly and actively encourage the students and to scaffold productive interactions among students in order to facilitate collaborative authoring. This involves amongst others commenting existing entries, designing activities such as peer editing and referring the students to the guidelines page, which contains principles on working with the wiki.

Another issue often reported is the motivation for using a wiki. Educators as well as students have to deal with a new technology within a small time frame and as a result of this have to put up with extra work. As a consequence this might cause reluctance to work with a new system. Although the technical hurdles of a wiki are few its use still needs to be learned. Especially first time users such as the students of the wiki-based glossary not only have to get acquainted with the wiki philosophy but also with the PmWiki syntax. [12] underline that “[t]he acceptance of wikis depends on the degree to which [...] [the user] can truly benefit personally from using them.” As a consequence, it is not only necessary to point out the wiki syntax, technical background and philosophy of the wiki in an early tutorial but also the beneficial areas, for which the wiki can be valuable. Therefore, training is provided to the educators who use the PmWiki software in their courses regarding technical and didactic aspects for the use of the software. In addition, technical assistance to support the wiki implementation serves as an incentive. Motivated educators who introduce new technologies in their courses then need to take over the role of a guide. In the context of the wiki-based glossary the educator gives an introduction to the wiki and its advantages such as the fact that the contents of the wiki pages can serve as a repository of learning materials and help the students prepare for the final exam and other incentives for contributing to the wiki (cf. section 3.3.2).

High relevance in regards to the issue of quality assurance exists for the context of the wiki-based glossary. Therefore it is necessary to introduce mechanisms such as peer reviews and feedback from the educator. This way closer attention is paid to the formal aspect of the wiki articles and its contents. The prospective that the wiki will be used, extended and promoted in different contexts in successive semesters and that it will be used by the students’ peers as a starting point for their learning might also have influence on the quality of form and content. Under these circumstances it can be assumed that the students will work more thoroughly since the wiki will be made available to future students. However, making the wiki accessible to other users in a later stage of the project increases the exigency of adherence relating to copyright. A neutral style of the articles as well as academic research and writing needs to be postulated.

4 Evaluation Arrangements

Deriving from the objectives discussed in section 3.1.3 the focus of evaluation in the context of the wiki-based glossary is based on the question whether and in what way a wiki has an influence on collaborative learning and the active development of knowledge and competencies.

For this type of process evaluation online surveys and logging data are analyzed during and at the end of the semester. The online survey encompasses the overall opinion towards E-Learning in general and the wiki usage in particular, the quality of the technical design and technical problems as well as the motivation towards interacting with the E-Learning platform and with peers while working on the wiki-based

glossary. The results of the survey that has been filled out by 22 out of 29 participating students, are compared with the logging data which show the actual overall participation. Participation data is distinguished between activity in the wiki itself and in discussions about wiki entries that take place in the discussion section of the wiki. Above that, the number of active students is examined. Other sources of information are the different support channels offered to the students in case of technical problems. Critical design issues as well as the willingness of the students to work with the wiki can be inferred from the number and kinds of problems that occurred while using the software. While students fill out surveys, instructors are interviewed in an unstructured fashion on similar aspects. These arrangements constitute a combination of formative and summative evaluation, since logging data and the usage of the support channels is analyzed during the semester while the survey is conducted at the end of it.

First results have shown that students are eager to try out this new concept and after some time they produce good results. After initial reluctance the activity as well as the number of authors has increased noticeably in creating wiki entries as well as commenting on peers' entries in the discussion section (Fig. 5).

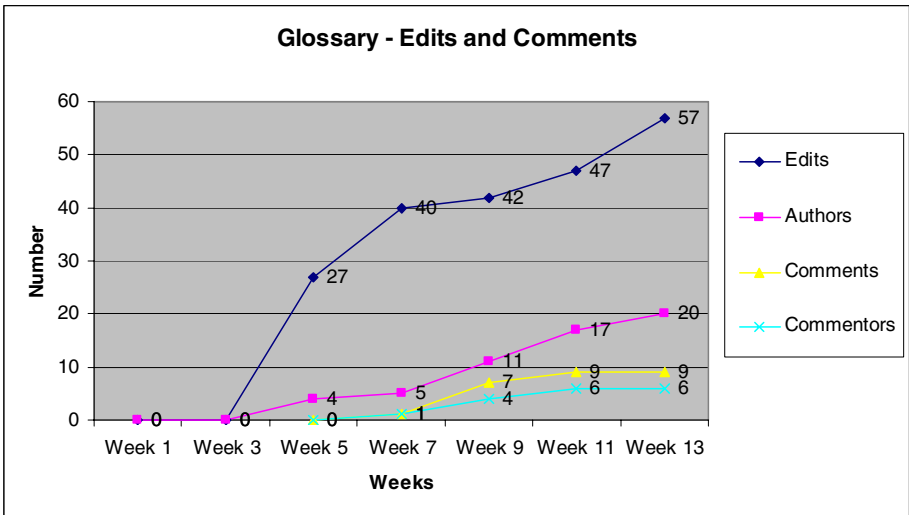


Fig. 5. Number of edits and comments in the wiki-based glossary

These numbers have to be put in relation with the minimum course requirements of two wiki entries per student which is accumulated to 58 required entries, because of 29 participating students. Comparing these figures with the actual number of 74 entries produced, about 28% extra work has been done. Therefore, it can be inferred that by creating a rather informal scenario in addition to the formal classroom phases, it is possible to enhance intrinsic motivation, which is necessary in order to be able to learn and develop skills [33]. From the survey results we know that students wished to work on the wiki more, but didn't have time to do so, because they were also required

to prepare weekly tasks and meeting minutes for the course. This statement confirms the inference that intrinsic motivation has been addressed successfully.

Despite these positive results the logging data also revealed that students mostly worked on an entry by themselves and didn't collaborate with their peers. In another scenario where a wiki was incorporated into the same course in order to collaboratively write meeting minutes groups were build in advance. As a result the average number of authors in these group scenarios was 3.5 whereas in the glossary only 1.6 authors averagely worked together on an entry.

The usability of the wiki undergoes an iterative process that is accompanied by user tests. The first iteration occurred in parallel to the productive use of the glossary and has been supplemented by an expert review. Whereas the logging data and the survey results reveal the user acceptance of the wiki-based glossary the expert review pointed out a range of possible improvements to the interface and functionality of the wiki, which are attended to in the current second iteration. The main improvements concern the structuring of the wiki by setting passwords and separating open areas from those that are closed for students. Other aspects concern navigational support, a more visible offering of help documents as well as the handling of multimedia contents.

5 Conclusion and Outlook

In order to successfully integrate a wiki in an academic setting long-term an implementation strategy is required. This necessitates that all parties hitherto are included in this process. Not only the students need to be convinced of the new technology's benefits but especially educators are challenged. Also the educators have to deal with a new technology and therefore have to adapt their didactic concepts to the new circumstances in order to achieve added value. In this respect, this paper describes a concept and its realization for the integration of a wiki in an E-Learning module starting with an analysis of the target group as well as the basic conditions. Based on this, advantages for the use of a wiki were highlighted and an appropriate process framework for using a wiki was presented. This framework comprises of the instructional design phases applied to the integration of social software components exemplified by the integration of a wiki-based glossary at the University of Hildesheim as part of the CELEB project. Special attention is paid to the design and implementation phase where usability and HCI aspects need to be considered as well as didactical considerations such as the roles of the teacher and the learner and their motivation.

This paper presents a framework that aims at maintaining essential Web 2.0 attributes, such as trust, openness, voluntariness and self-organization, when applying Web 2.0 tools in institutional contexts [8]. The focus is put on usability engineering and the interface design of the wiki as well as on the necessary prerequisites concerning the implementation of the designed wiki. In order to further improve collaboration in scenarios without pre-defined groups advanced mechanisms will be investigated that can support the collaboration process. For the role of the teacher research is done for the implementation of support structures for constructing wiki scenarios and reusing them.

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