Using wiki to support constructivist learning: a case study in university education settings

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Abstract

According to Tim Berners-Lee, wiki technology represents an instantiation of how the World Wide Web was planned to work: a platform that users can use both to retrieve content (read) and contribute content (write). Wiki technology lends itself to many uses. One of the main features of wiki technology is its support for collaborative editing of content. In this paper, we introduce briefly wiki technology, the pedagogical premises of the use of wiki in education, and present one case of the use of wiki in university education context as support for constructivist collaborative learning. We present empirical data on the participants’ evaluation of the use of wiki, and the analysis by the course instructor. We also discuss possibilities and potential problem situations when utilizing wiki-technology in educational settings, in particular related to the assessment of learning, the monitoring of student participation, and the need for communication support in the learning process.

1. Introduction

In the past few years, we have witnessed a fundamental change in how people get informed. The Internet has come to play a more and more important role and people have become more and more used to using the Internet for all purposes, not least information gathering, but lately also for information creation, using what people usually refer to as Web 2.0 technologies. As San Murugesan [15] puts it, “Web 2.0 is more interactive and dynamic than its predecessor, Web 1.0, letting users both access content from a website and contribute to it”. We have in the last couple of years witnessed a fundamental change in how people utilize the Internet. Many people have ceased to be mere receivers of information and started contributing to the Internet by using e.g. discussion forums, blogs, chats and wikis. Internet users have started to turn from consumers to “prosumers”, that is, from consumers to both pro-ducers and con-sumers.

The common denominators of these tools are that they enable User Generated Content (UGC) in an easy manner and that they often are open to all. Hence, participation is unrestricted and democratic. These Web 2.0 components also generally rely on the users to monitor the content and behaviour of other users. One requirement for this is that there exists a large enough user mass, the so-called critical mass of users, and also that there are power users, or leaders.

As part of this change in Internet technologies, wiki is a tool that has gained acceptance among users. Most Internet users consult the Wikipedia when searching for information on the Internet. The success of Wikipedia as a source of information has been tremendous, despite that some critics have voiced their doubts about the validity of its content, especially in academic circles. Wikipedia is today the largest online encyclopedia – available in 253 languages. The English-language version contains more than 2,300,000 articles (statistics collected on May 23, 2008, http://meta.wikimedia.org/wiki/List_of_Wikipedias).

The success of Wikipedia (and wiki technology) has sprouted a series of similar sites, using wikis to foster participation and leverage the participative power of online users (e.g. Wikibooks, Wikitravel, and so forth). Wiki is also increasingly being taken into use in various learning contexts.

One of the main features of wiki technology is the support it gives for collaborative editing of content, enabling collaborative writing. In a learning context, collaborative writing is a method used by pedagogues within the framework of collaborative pedagogy, where learners are encouraged to engage in collaborative activities (e.g. writing) in order to understand or solve a problem. Some components of collaborative pedagogy are also found in constructivist learning, where peer-to-peer interaction and instructor feedback are key features. In a constructivist learning setting [4], [17], [18], wiki technology will naturally be an interesting alternative to other collaborative writing tools. The purpose of this paper is to examine the
suitability of wiki technology as a collaborative writing tool in the context of constructivist learning. A case of the use of wiki in university education is presented, analysed and reflected upon.

In this paper, we pay particular attention to the use of wiki in university education, especially as a tool for students to collaboratively contribute to a course assignment. The use of wiki as part of a course module raises many questions. First, the technology should work smoothly and not be a hinder to student participation. Second, an appropriate assessment of the learning outcomes is required, with respect to the pedagogical approach used. Third, adequate support to the learners should be provided. The paper will attempt to answer these questions in the following way: (i) empirical data on the participants’ evaluation of the use of wiki will be presented, (ii) an analysis of the learning process and outcomes, made by the course instructors, will be provided. On the basis of the case, we will also discuss possibilities and potential problem situations when utilizing wiki-technology in educational settings, in particular related to the assessment of learning, the monitoring of student participation, and the need for communication support in the learning process.

The structure of the paper is as follows: we will first cover the state-of-the-art of wiki and its use in learning education environments. Then we will present the pedagogical framework within which we have used wikis. The case study will be introduced; and we will present our findings in terms of responses to a questionnaire distributed to students and a qualitative evaluation made by the responsible course leader. Finally, we will discuss the findings and make some concluding remarks.

2. Wiki state-of-the-art

2.1. Wiki: definition, characteristics and features

The word “wiki” is borrowed from Hawaiian. Some of the meanings associated with the word “wiki” in Hawaiian are “quick” and “informal” [13]. Will Richardson (2006, p. 8) defines wiki as “a collaborative Web space where anyone can add content and anyone can edit content that has already been published”. The core properties of a wiki are: the ease of use, simple navigation and linking features, user involvement and democratisation. “Wiki is a lot about a collaboration space, albeit an unusual one because of its total freedom, ease and access of use, simple and uniform navigational conventions, and apparent lack of formal structure (p. 16)” [20]. Wagner and Prasarnphanich [26] find that wiki technology follows a collaborative model of content creation where the individual receives little recognition. However, they also find that “wiki is a set of linked web pages, created through the incremental development by a group of collaborating users”. Hence, the users are, obviously, a central part of the wiki concept. Informality is at the core of the wiki concept: wiki sites invite users to freely and easily contribute to the content of a wiki. Users are on an equal basis and there are practically no barriers to start contributing to a wiki. The fact that wiki is very easy to implement and understand, is probably a key to why wikis have become so popular. Previous attempts at creating technologies for collaboration have not been as successful. At the same time as technology has perhaps become easier to use, people have become more used to computers and the Internet so that virtual collaboration seems more natural than before.

2.2. Wiki selection issues

There are several dozens of wiki programs available on the Internet, but only a few of these can be seen as unique. According to Schwartz et al. [22], common feature categories of wikis are: source code, wiki management, page formatting, access control, communications, support and advanced features.

According to Schwartz et al., there are several issues to consider when selecting a wiki for educational purposes:

- **cost**: acquisition and use costs vary depending on whether the technology is open-source or licensed.
- **complexity**: availability of technical support (through online documentation, user and developer community support, technology hosted or to be downloaded/installed, and sandbox).
- **control**: regarding user rights management, required user registration, password-protection of specific content, restore capabilities (history and version tracking).
- **clarity of wiki structure and functionality**: through availability of index/site maps, interwiki formatting, back-linking, page hierarchy (navigation and structure), archiving, page creation/deletion, new content identification (compare), change notifications by e-mail.
- **common technical framework used**: browser and cross-platform compatibility, internet and intranet installation, support of simultaneous edits, plain ASCII text storage.
- **features**: WYSIWYG editing, HTML support, text editing (bold, italic...), insertion of images, tables, lists, media and hyperlinks, search function, spell-check, emoticons, blogging, polling, RSS feeds,
Many of the features listed above - such as index/site map, page hierarchy, WYSIWYG editing, search - enhance the tool’s usability, which is an important adoption factor.

Wiki is a tool among others, competing with other collaborative tools in the scope of learning. Collaborative tools can be classified according to two dimensions: (1) communication-oriented (e.g. discussion forums, e-mails); (2) document-oriented (e.g. content management systems, learning platforms). Depending on their implementation and features, wikis can be found midways between these two axes: some wikis might impose tight control (in terms of user rights management and document management), whereas some others may look unstructured and promote high interaction between participants.

2.3. Related research - use of wikis in education and learning

There have been several attempts to use wiki in educational settings. An extensive coverage of the state-of-the-art of wikis in learning is beyond the scope of this paper but a good starting point can be found in the wiki page hosted by EduTech Wiki [29]. Parker and Chao [16] provide an extensive review of the use of wikis as a teaching tool. In this section, we will focus on the role of wikis in learning, especially in the context of collaborative and constructivist learning. We will also discuss the importance of assessment in collaborative learning, the issues of participation and control, and the role of communication in the “wiki process”.

2.3.1. Role of wiki in learning. Students regularly use wikis as a source of information, for example to get knowledge about a subject for an assignment. Probably the most commonly used wiki is Wikipedia. However, the use of wikis may cause problems connected to the trustworthiness of the information and the risk for plagiarism [20]. Another problem is that wikis often have anonymous authors, making viable research work difficult. The trustworthiness of on-line sources, and especially wikis, have resulted in that many people regard them as inaccurate. However, it might be argued that they are no less trustworthy than other sources. It seems that contrary to a general belief wikis are quite trustworthy, although there certainly are examples of misrepresented facts, errors and deliberate lies in wikis, as can be the case in any source.

Kim et al. [11] report their use of a wiki to support idea sharing in a problem solving process in computer programming methods. Wiki is also being used as a way to organize, structure and share information and knowledge resources across groups of students in the context of design project work [6], [8]. Schaffert et al. [21] identify several tasks where wikis can be used: cognitive apprenticeship, learning within communities of practice, project-based learning, collaborative story writing, as well as interdisciplinary and intercultural learning.

Wikis have been found to support the collaborative learning paradigm: Parker and Chao [16] identify that wikis can be used to support cooperative learning, computer-supported collaborative learning, and collaborative learning. By cooperative learning is meant that the tasks have been divided between learners whereas collaborative learning means that the tasks are done together. In their literature review, Parker and Chao identify several benefits of the applications of wikis; among these, higher levels of thought and information retention than achieved by students working individually, enhanced peer interaction and group work, sharing of knowledge and expertise among learners, and promotion of cooperation. Forte et al. [5] have studied the use of wikis to engage students in authentic collaborative writing activities. The use of wikis engages students in a learning opportunity, addressing the following features: personal (in terms of students’ commitment to the learning task), real world (connected to reality outside the classroom), disciplinary (related to the subject matter to be dealt with), and assessment (assessment of one’s own learning as well as that of others).

Parker and Chao also review the use of wikis within the framework of constructivist learning. Reflective learning is one of the features of constructivism: wikis can support this feature by enabling students to structure their reflections on their own (and their peers’) learning. For example, Chen et al. [2] found that wikis help students in engineering reflect on what they have learned, meaning that wikis can be used as a tool to support knowledge synthesis or learning outcomes. Also, the collaborative features of wikis are outlined by Parker and Chao as important enablers of shared and distributed knowledge building within communities of practice.

2.3.2. Assessment. In the study conducted by Forte et al. [5], the students edited essays and reviewed each others’ work. The authors found out that a perceived online audience plays a role in helping students monitor the quality of writing. Wheeler et al. [28] underline that an equitable assessment of wiki contributors is a problem that requires further thought: some students contribute more than others. It has also
been shown that contributors learn even when not actively contributing content.

2.3.3. Participation and control. Chong et al. [3] investigated the use of wikis to support collaborative learning. Their results show that wikis, when supported with appropriate communication tools, foster active participation and high-quality debate among students. According to Richardson, wiki projects in schools have worked best when there have been less regulations of the wiki and the students have been able to manage the content on the wiki themselves. Richardson also believes it is a good idea for students to contribute to a widely accessible wiki, if for example the student has done some prior research on the topic in question ([20] pp. 64-65). The issue of control has been discussed by Wang et al. [27] in terms of who can edit what wiki artefact, and when. They identify situations where teachers may need to exert control on the wiki in order to prevent changes from other users. Participation, and especially the issue of free-riding, is discussed by Augar et al. [1]. In an open wiki environment, without many restrictions, participation is often bound to the contributors’ interest, motivation and responsibility for their own learning. Augar et al. report on an experiment in which 42% of the surveyed participants joined the discussion on a weekly basis. Reinhold et al. [19] suggest, based on their experience with wikis, that the participation level is often low and that the quality of articles depends almost exclusively on the students’ motivation.

2.3.4. Role of coordination. Viégas et al. [25] studied the coordination features provided by Wikipedia. Their conclusion is that although Wikipedia seems to be uncoordinated and potentially a place where anarchy would prevail, the coordination features provided by Wikipedia actually promote group coordination, policy and processes and support “strategic planning of edits and enforcement of standard guidelines and conventions”. In their analysis of “Talk” pages, Viégas et al. identified 11 categories of posting to Talk pages. The researchers found out that “requests for coordination” accounted for more than a half of the contributions. Stvilia et al. [23] in turn found that “Talk” pages in Wikipedia play a crucial role in letting users articulate quality issues in Wikipedia articles.

3. Constructivist virtual collaboration

Constructivist pedagogy generally agree on certain characteristics of constructivist learning, the main of which are problem orientation, the importance of individual learning strategies and situated collaboration. The learners are advised and encouraged to set out from a problem they feel to be of personal importance and in which they are genuinely interested. Thus the questions should not come from above, from the teacher, but the learners should ideally come up with their own questions. These questions should target real-life problems or at least be as close to real-life problems as possible. This helps the learners to feel that solving the problem has a real meaning to them personally, and that they find it easy to own the problem. The learner is also supposed to take the chief responsibility over the finding of learning materials and work methods (which usually entails that they are given guidance in finding or rehearsing proper methods), which gives individual learners an opportunity to apply methods and sources they feel confident with and that suit their personal learning style. However, links to a real-life problem and a personally-felt question have to be negotiated with the learner’s peers. In constructivist learning group work and the matching of individual strengths for attaining a common goal (i.e. project work) are conditions for successful collaboration. Collaboration is perhaps the most important single factor in constructivist collaborative learning. Hence, various forms of communicative and collaborative technologies are very valuable to communities of practice as well as to teachers applying constructivist learning principles [4], [10], [17], [18] [24].

In their research on collaborative learning based on 875 case studies, Johnson and Johnson [9] show that collaborative learning is likely to lead to improved outcomes, higher achievement and better productivity. Learning can be enhanced by virtual or real-life collaboration. Koufman-Frederick et al. [12] point out that the problem with virtual collaboration is that it does not seem to be quite as easily accomplished as real-life collaboration. The problems are mainly due to technology, individual work methods and prejudices. Technology is not so important a factor as people generally seem to believe, whereas social matters prove to be the main obstacles for successful virtual collaborative learning. Keys for successful collaborative learning are a shared goal and purposeful channels for dialogue and interaction [14].

Gross Davis [7] claims that best learning outcomes are to be expected when learners are actively involved in the process. Learners working in groups attain better learning outcomes and are more satisfied with the teaching or guidance given by the facilitator. Learning should be applied in a context, so that it could be perceived as having a personally felt meaning. Unfortunately, collaboration in education, as a rule, takes place physically and technology is used for informing alone, that is, to disseminate the course materials to students, and not so much for actual
learning. Accordingly, technology supported collaboration is usually done with the help of e-mail or discussion forums. Wiki clearly goes a step further, as it is a viable means to collaboration that enables easy co-authoring of content. Other new media are the blog and the videoblog, which also can be used to support learning.

The traditional term for collaborative technology enhanced learning is Computer-Supported Collaborative Learning, but as new technologies emerge new possibilities for virtual collaboration also emerge. Collaborative learning should not be restricted to computers alone but should include any means found useful, depending on the situation where learning takes place. The prospects brought about by improved collaboration include the utilization of collective intelligence; enhancing the participants’ ability to focus on their core-capabilities; and better distribution of information [12].

Improved collaboration can enrich learning when people come together to discuss a topic, especially when the participants have different backgrounds and can amend one another’s knowledge. Wiki technology enables reflection through co-author summaries, so that learners can discuss what they have learned, and for instance apply it in the form of stories. Furthermore, learning to collaborate is an important learning outcome sui generis because success in modern everyday working life depends much on collaboration and group work skills. Furthermore, collaboration between teachers will allow teachers to reflect on their teaching, develop the curriculum, share resources, and receive help and advice. This enables the reuse of learning resources, too [12].

4. Learning with wikis – case study

4.1. Method

During spring 2007, we used wikis as a tool for an assignment in an introductory course in Information Systems at the Åbo Akademi University. The wiki was embedded in the learning platform Moodle. The rationale behind choosing Moodle is simply because the course was scheduled to run in Moodle. The students (1st year students) were divided into five groups of 15 participants and were asked to create a knowledge base, each describing a particular technology. Students were asked to complete an evaluation questionnaire after the course ended. The questionnaire asked students about their impressions on using the wiki as a tool to build a knowledge base. 47 questionnaires were returned. A teacher assessment of this case is also done, paying particular attention to the learning outcomes, student participation, and the role of communication support. The assessment and the results presented in this chapter have been gathered by the first author of the paper, who acted as the main lecturer in the course. Quantitative data on student participation has been collected through log-file analysis.

4.2. Case – Using wikis to build a knowledge base

The purpose of the assignment was to build a knowledge base about different business models that the selected companies use, and how they use Information and Communication Technology (ICT) to support their business models in their operations. Each student group chose a company and produced materials on how the company used ICT to support their respective business model. Students were given access to a wiki-tool in the Moodle learning platform. The course participants were organized in 5 groups, with about 15 students per group. Each group was given the task of creating their own wiki about one company assigned to them. Each wiki included a start page created by the course teacher. The page could be changed or filled in by the students with their own materials. Sub-pages could also be freely created by the students.

Before the start of the assignment, the students received a document with a proposed way of organizing their work (the students were free to organize their work in a different way, if they wanted to do so). The assignment was divided into three periods, lasting 10 days each, and the students were not assigned different tasks:

i. gathering materials to the wiki,
ii. structuring the wiki, and
iii. finalizing the wiki.

The students got access to instructions, giving advice on what kind of materials is appropriate to use in the assignment (especially on how to avoid plagiarism) and how to use the wiki. The students were also given access to a “test wiki” where they could experiment how wiki works and behaves upon editing. The course leader demonstrated how to use the wiki during one of the course lectures. A discussion forum was created to support remote communication and interaction between students during the assignment.

The assignment lasted for a period of 30 days. During this time, the students had made between 70 and 190 contributions to each wiki (in other words, one wiki was edited only 70 times, the wiki with the most edits was edited 190 times). The content created by the
students included not only text, but also pictures and links to internal wiki pages and external web pages.

Figure 1 summarizes the assessment made for one group of students. The assignment was graded according to the following criteria: (i) wiki actions – the editing, creation and review of wiki pages; (ii) start of new pages; (iii) links to external web pages and the appropriate use of referencing techniques, (iv) the number of good quality page starts and reviews, and (v) bonus participation points. Both quality and quantity were taken into account. The grade was obtained by calculating a weighted average (see components and weights in figure 1). The students’ individual and collective input was taken into account in the final grade.

<table>
<thead>
<tr>
<th></th>
<th>All actions (w=1)</th>
<th>Start new pages (w=10)</th>
<th>Links &amp; referencing (w=2)</th>
<th>Number of good quality start and reviews (w=5)</th>
<th>Bonus (w=10)</th>
<th>Points</th>
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<td>1</td>
<td>1</td>
<td>100</td>
<td></td>
</tr>
<tr>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>14</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>38</td>
<td></td>
</tr>
<tr>
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<td>1</td>
<td>1</td>
<td>56</td>
<td></td>
</tr>
<tr>
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<td>2</td>
<td>1</td>
<td>26</td>
<td></td>
</tr>
<tr>
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<td>1</td>
<td>2</td>
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<tr>
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<td>1</td>
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<td>1</td>
<td>1</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Assessment of students’ contributions

4.3. Students’ perceptions of the use of wiki

Students’ perceptions of the use of wiki were collected through an on-line questionnaire, which was made available at the end of the course. The questionnaire included 22 questions. Respondents were asked to indicate their gender and if they had previous experience in reading wikis and/or writing in wikis (Yes/No). They were also asked to indicate their approximate frequency and time of usage of the wiki.

Respondents were asked to rate the following statements on a scale of 1 to 5 (1 = do not agree at all, 5 = absolutely agree):
- Using the wiki was easy
- Editing pages was easy
- It was difficult to edit links and create new pages
- It was difficult to get an overall picture of the content of the wiki
- The discussion forum was useful
- I think that the content that we produced is of high quality
- My own input was excellent
- I think that wiki should be used more in education
- Wiki is a good collaboration tool
- The text that we produced was of good quality

- The assignment promotes better learning than traditional assignments
- I think that I have learned a lot
- It was not easy to coordinate editing with other participants

Four open-ended questions were also asked:
- What were the most successful aspects of this assignment?
- What were the worst problems you encountered?
- How could we improve the use of wikis in the course?
- Other comments on the wiki.

The students’ prior experience of wiki usage is an interesting starting point: while a large majority (N=37) has previously read content from a wiki website, most of them (N=43) have never produced content using a wiki tool. This could mean that the wiki-concept is somehow familiar, but few students actually know how to use wikis.

When asked about their frequency and time of usage during the assignment, half of the students responded that they used the wiki several times per week, several students also used the wiki at least once a day (see Figure 2). About a third of the respondents used the wiki only once a week or less. Most students used the wiki less than 10 hours during the 4 week period. About a third used the wiki more than 10 hours.

![Usage frequency](image-url)
It was difficult to edit links and create new pages

![Graph showing difficulty in editing links and creating new pages]

Figure 3. Difficult to edit links and create new pages

It was not easy to coordinate editing with other participants

![Graph showing difficulty in coordinating editing]

Figure 5. Coordinating editing with other participants

It was difficult to get an overall picture of the content of the wiki

![Graph showing difficulty in getting overall picture]

Figure 4. Difficult to get an overall picture of the wiki

There was a large consensus that the content produced was of high quality (N=34), although there were mixed answers about the quality of individual contributions. Students also agreed that the quality of the text was good (N=28). About 40% of the students thought that they had learned a lot with the assignment (N=20), about a third disagreed to the same statement (N=17). Opinions were mixed regarding if this type of assignment promoted better learning than traditional written assignments.

About half of the students agreed that using the discussion forum was useful to complete the task at hand. 19 students (40%) answered “do not know”. One reason explaining this could be that some groups did not use the discussion forum at all as a support for the assignment. At the same time, respondents largely agreed that it was not easy to coordinate editing with other participants (N=22) (Figure 5). Besides, 27 students thought that wiki is a good collaboration tool, and the majority (N=24) answered that wiki should be used more in education (Figure 6).

4.4 Teacher qualitative evaluation

Overall, it can be said that the wiki assignment was a success. The resulting wikis consisted of one main page and several sub-pages (ranging between 7 and 33 sub-pages). While some groups preferred to write long pages, other groups preferred to have many links to shorter pages. The quality of the text was varying: overall, it can be said that the main pages were written carefully (and reviewed many times), while sub-pages’ quality could vary very much.

Student participation was high in several cases (groups made between 70 and 190 contributions to their wiki during a period of 4 weeks - the group that reached only 70 contributions was an exception, other groups reached over 120 contributions).

Figure 7 illustrates the cumulated number of edits on one of the wikis for a period of 30 days. In this figure, we can observe that participation is more intense when the end of each phase is approaching (at Day 10, Day 20 and Day 30).
Communication played a significant role in the process of the assignment. It appeared that the groups that were most active in the wiki process were also communicating actively through the medium given to them (the discussion forum). The students were communicating with their peers when they made changes to the wiki. Wikis are a good tool for collaborative assignment writing. However, it appears that the particular version of the wiki that was used in this assignment lacked functionality and had poor usability, although it worked well technically.

5. Discussion and lessons learned

The case that we report in the previous section indicates that wiki is a suitable tool for use in university education. There are certainly many pitfalls that one should avoid when using a wiki: we will discuss these pitfalls in some detail in this section.

Choosing the right wiki is essential. As mentioned in section 2, there are several dozens of wikis available, all with a different set of available features. From a teacher’s point of view, it might be important to keep in mind that some wikis do not enable a proper follow-up of the contributors’ edits, which in turn can be difficult if one wants to make a quantitative evaluation of the contributors’ individual input. From a learner’s point of view, usability issues might need to be taken into consideration. In our case, the wiki was easy to use, but it was somehow difficult to edit and link pages, and it did not enable the students to get an holistic view of the content of the wiki (a “site map” would have been needed). Several students commented on the poor usability of the wiki. For instance, one student remarked that a better wiki-module would be required to improve the assignment. Another one observed that the Moodle user interface could be more user friendly and practical. A third one found the wiki technology the biggest stumbling block in the assignment. We have also noticed how important it is to produce help material on how to use the wiki’s basic functions (or alternatively to run a tutorial). Quality of learning is an essential issue, since it is the main outcome of the wiki process. As we could notice from the case, students can produce high quality results with wiki. Peer quality control kicked in early on and decisively contributed to the guidance of the wiki process. Although students could not see other groups’ wikis, they expressed their need to see other groups’ contributions in the future; this finding is in line with the principles of constructivist learning [17] [18]. The students’ comments show that they appreciated the chance to search for information independently as well as contribute with a relevant piece of knowledge to the collaborative effort. Discussions during the classroom, outside of classroom, through email, forum and the wiki log files were highly valued as they were regarded as a central element of peer collaboration. Although not all students assumed the role of a quality controller, even students with a more modest overall contribution commented and criticized parts of the ongoing work. According to the students’ feedback, the relative freedom to decide upon what to write, from what angle and how, made the task more interesting. The ability of learners themselves to set standards to their own work and assess the progress of their work can be seen as a valuable learning outcome. It also shows that wikis serve the constructivist pedagogical guidelines in the sense that the students are enabled to set their own goals as well as collectively take responsibility of both the learning process and outcome. For instance, the students were given free hands to retrieve information from any source they considered appropriate, which naturally led to a need to assess the reliability and usefulness of various information sources. Wikis also supported the learning of how to work together, and thus are likely to improve the social skills needed in collaboration in the real world. The students voiced their willingness to evaluate each others’ work and learn from them. Quite clearly the peer collaboration aspect throughout the assignment, including the assessment of the assignment, could be considerably extended as the students en masse and repeatedly expressed their keen interest in this form of work. 

One issue related to the learning outcome is the issue of assessment. The learning outcomes have been examined in quantitative terms in section 4.2, which corroborates earlier findings indicating that quantitative criteria are up to a certain point applicable for evaluation purposes. Especially the number of edits gives a rough measure of a satisfactorily performed wiki assignment. Evaluation of a group’s learning outcome can be done with several qualitative and quantitative criteria; other groups’ output can also be
used as a point of comparison. Evaluation of individual performance is a bit trickier and a sensitive issue. Several wikis do not allow a proper statistical follow-up of edits and contributions, and even when a quantitative evaluation is possible, there is a risk of it being of little value, since statistical data give little information about the quality of the output. Also, contributors can, if they want to, remain anonymous during the wiki process, making it even more difficult to identify the origins of the contributions. In our study, the students voiced their concerns about user participation. They were disheartened by not all fellow students contributing to the extent that they considered appropriate.

We suggest that part of the evaluation should be made as a form of self-assessment or/and peer assessment. The benefits of self-assessment are that students learn to assess themselves the quality of their work, and that the workload of the teacher can be reduced to some extent. Students could be asked to evaluate their own contribution as well as evaluate how their peers performed. This could be done on an individual basis or in groups. Such an assessment would be in line with the nature of collaboration related to the use of wiki: democratic and informal.

- Democratic since each contributor could have his or her say about the quality of the work.
- It would be informal as the procedure would bypass the hierarchical control of most traditional education.

From the students’ point of view, such an assessment would certainly be welcome: in the questionnaire sent to students, many respondents voiced their concerns about how individual contributions will be taken into consideration in the evaluation. This finding confirms similar observations made by [5].

Participation is also an issue at which we looked very closely. Several studies report a low participation level [1], [19]. In our case, we observed that there were two typical groups of users: “leaders” and “free-riders”. Leaders are users who are (pro)active in the wiki process, communicate with the other group members and make decisions or influence how the wiki content should develop. Free-riders are less active, do not take initiatives and act when asked to (or reminded). In each group experiment, “leaders/power users” were about a third of the group and took a much more active role in the wiki process (figure 1 provides support for this claim). It is possible that involving less active students in their own evaluation and their peers’ will encourage them to participate.

The wiki process requires some basic level of communication and coordination. Depending on the increasing complexity of the task at hand, the need for

communication and coordination might increase. Students were satisfied, and, judging from their written comments, surprised to see that the end result of their work was coherent, even though it was a joint effort by people who had not necessarily met physically. Communication problems seemed to be a hinder to the writing of the wiki. According to the students, it was at times difficult to know who was supposed to do what. Some anxiety about the end result was also a concern for many students. In our case, we created an external discussion forum and encouraged students to use it to discuss and coordinate the development of the wiki. We noticed that groups which communicated more actively achieved better results, both in terms of quantity and quality. This result is corroborated by a study made by Stvilia et al. [23].

6. Conclusion

In this paper, we presented evidence of the suitability of wikis to support collaborative writing. We discussed in particular the issues of assessment, of learning, the monitoring of student participation, and communication support. We concluded that assessment should reflect the principles of wikis: democratic and informal, through open peer assessment and course leader assessment. The monitoring of student participation showed that there are distinct groups of contributors. Passive participants are a challenge which can be met by involving these students in the assessment of their own and their peers’ contribution. Communication support is an essential condition for collaborative writing to take place effectively.

As a concluding remark, it could be added that students were pleased with the use of wiki in university education and that this kind of innovation was welcomed. Tools like blogs and wikis, which promote peer-to-peer collaboration throughout all society, are widely available on the Internet. People are not only consumers but also producers of information. In terms of education, this means that all sorts of collaborative technologies are becoming readily available and should be integrated into the mainstream of the educational system.

7. References

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