

Implementing the “Wiki Way” in a course in higher education

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Abstract: Self-organised collaborative wiki work is reality in today’s businesses and students have to be prepared for the resulting requirements. Therefore, the aim of our paper is to demonstrate and to evaluate a way to practice self-organised and loosely coordinated wiki work in higher education. We simulate a common enterprise 2.0 collaboration situation to convey competences in a graduate-level classroom and identify challenges in this context following action research principles. We conclude with a series of insights that help higher education teachers to overcome organisational barriers and provide technical requirements for wiki software engineering.

1 Introduction

The aim of this paper is to present a new way how to practice self-organised and loosely coordinated wiki work in a course in higher education and to identify the challenges related to this. Instead of adapting the work with wiki technology to fit traditional teaching methods, we focus on a constructivist approach to engage students in form an opinion and knowledge-construction activities [Kar10a]. By this, we allow the students to experience self-coordinated wiki work – the so called *Wiki Way* [LC01].

Next to other social software like social networking services (e.g. Facebook) or blogs, the popularity of wikis has increased in the last decade. The online encyclopaedia Wikipedia is a well-known wiki example [YL10]. Furthermore, a number of case studies have been published about the use of wikis to facilitate communication processes in companies [ST10]. In comparison, the use of wikis in research and teaching is not sufficiently analysed and needs more attention especially in the discipline of Information Systems [KF09], the authors’ discipline.

Companies that use web 2.0 tools or social software to increase transparency about the work and output of their knowledge workers are subsumed under the term of Enterprise 2.0 [McA06]. Through enhanced transparency, social software should facilitate collaboration and knowledge exchange, because the outcome of knowledge work is seen as a common result of a collaborative effort instead of a result of individual tasks coordinated by a prescribed workflow. Therefore, a lot of companies invest in pilot projects and push the rollout of such technologies [Bug08]. In fact, it is not just the technology that matters. Even more organisational processes, culture as well as individual skills and preferences determine the success of collaboration in an Enterprise 2.0 [GEJ+09, GLES10, Bug08].

Hence, the question for institutions in higher education is how to prepare their students adequately for the challenges of self-organised collaboration mediated by social software.

The increased diffusion of Web 2.0 and social software in the society was accompanied by a discussion about a generational change of technology skills and behaviour. This new generation got names like *digital natives* [Pre01] or *net generation* [Tap98]. It is said to use emerging internet technologies intuitively because being familiar to technology-mediated communication since childhood. Furthermore, new learning arrangements were demanded for them [Pre01]. However, empirical evidence for such a generation wide phenomena is still missing [Sch10, Sch09, BMK08] and the proclaimed assumptions are rather seen as an “academic form of ‘moral panic’” [BMK08]. Hence, the use of wikis in higher education should not be driven by adaptation to new learners’ behaviour. Instead it should rather prepare students for changing challenges in professional life. Therefore, we focused on the conveyance of lacking competences [Hei11, pp. 14-17] to our students and how to push our curriculum further to addressing the demand of the labour market. We analysed a current collaboration situation in an Enterprise 2.0 [BK10] and tried to generate a similar situation in a students’ project in one of our courses.

Our overall objectives are the development of artefacts that allows the preparation, realisation, monitoring, and assessment of wiki projects in higher education. Artefacts in this context are e.g. guidelines for lecturers and further development of wiki technology and learning platforms. Methodically, we take an action research approach (see chapter 3). Our research is twofold because we aim at (1) improving our curriculum using an explorative approach to rapidly identify first success factors, challenges, barriers, and problems of our setting and (2) developing artefacts that will help to foster wiki engineering for higher education.

The remainder of the paper is organised as follows. After a review of related literature on wikis and their use in higher education, we present the study design including our research methodology and descriptive data of our setting, before we describe and discuss our findings and conclude with need for further research.

2 Related Work

We started with a thorough literature review which serves as the foundation for the described research as it specifies the existing wiki uses and identifies research gaps.¹

There are several possible types of using wiki in higher education [DB06, GLR+02, Lam04] and we suggest that these can be divided into three broad categories (cf. [Ton05]):

1. *Single-user*. Wikis as a journal for writing down thoughts and reflections.
2. *Collaborative writing*. Wikis as a platform for joint research e.g. group project, presentation.
3. *Knowledge Base*. Wikis can be used as a knowledge base for a students' cohort (e.g. participating in a certain course module), enabling them to share reflections or to collaboratively create course supplements.

Connected to these educational uses is the prospect to gain several pedagogical benefits including: evolutionary knowledge building, progressive problem solving, critical questioning, and reflection and the ability to engage in complex and nuanced analysis of others' work [Fou05, Lam04]. The corresponding research on wikis can be segmented into two main research topics, which include research about learners outcome and wiki usage profiles [HC09].

Research on learners' outcomes can be subdivided into performance outcome and affective outcome. Research in the field of performance outcome wants to answer the question whether wikis can help to improve or enhance students' learning or writing ability [HC09]. Forte and Bruckman [FB06] for instance examine the use of wiki by political-science undergraduates. Drawing on interviews, survey, and wiki log data, the study found that sharing resources and reviewing and critiquing others' work improves students' quality of writing [FB06]. In contrast, studies investigating the affective outcome try to analyse students' or instructors' attitudes and perceptions towards using wikis. De Pedro et al. [dPRL+06] collected survey and interview data to study students' and instructors' satisfaction using wikis. They point out that instructors like using wikis because of the possibility to evaluate each students' participation in teamwork individually, to retrieve historical or deleted parts of the work and to get notifications when changes are made. Students like using wikis because it allows them to easily collaborate together without meeting face-to-face [dPRL+ 06].

¹ We assume that the term and the basic hypertext principle of a wiki is known to the audience (for details see e.g. [LC01]).

Research on wiki usage profiles can be separated into two branches: the frequency of wiki use, i. e. number of user edits, and factors contributing or impeding the use of wikis [HC09]. Hew and Cheung [HC09] distinguish the influencing factors into four categories: wiki usability [MV06], pedagogical issues [GLR+02, MV06, Mos07], social environment [GLR+02], and technical knowledge/skills [DPV05]. Mindel and Verma define wiki usability as the “ease with which students were able to use the wiki technology to undertake the stated assignment” [MV06, p. 24]. Wikis are new to most students, so well-designed software interfaces and a high system stability reduce the need of prior training and minimize drop-outs of frustrated users [MV06]. Whereas the functionality of wikis has been discussed in literature [FKK02], little attention has been paid to the usability of wikis for teachers: Are wikis ready for student assessments? Do they allow a continuous monitoring of student collaboration activities?

The studies we found show a knowledge gap regarding the use of wikis in teaching and learning in higher education [Kar10b], which we address by choosing an exploratory action research approach.

3 Method

In the following, action research is presented as the underlying methodology of our research effort. We have used action research because it is a cyclical process of reflective practice which is well suited for educational settings [Kem00, pp. 20-5]. Carr and Kemmis define action research as “a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which the practices are carried out” [CK02, p. 162]. Hence, it is a research methodology for improving direct practice. Accordingly, we use action research to give a reasoned justification of our educational work to others [KM92]. We take an action research approach because (1) as lecturers we are a part of the environment in question, (2) the inquired situation is a real world setting, and (3) the concrete teaching situation makes it necessary to intervene in case of problems [HL80]. A basic action research cycle involves five steps: observe, reflect, act, modify, and move in new directions [MW05, p. 9]. Fig. 1 and the following discussion illustrates how the cycle is applied to our research.

Observe is about taking stock of what is going on and identifying a concern which belongs to the action researcher [MW05, p. 8]. In our case, we observed a demand while talking with former students and companies. They call for graduates, which are already comfortable with new technologies, show dedicated commitment, are able to communicate in virtually dispersed teams, and can work completely autonomous.

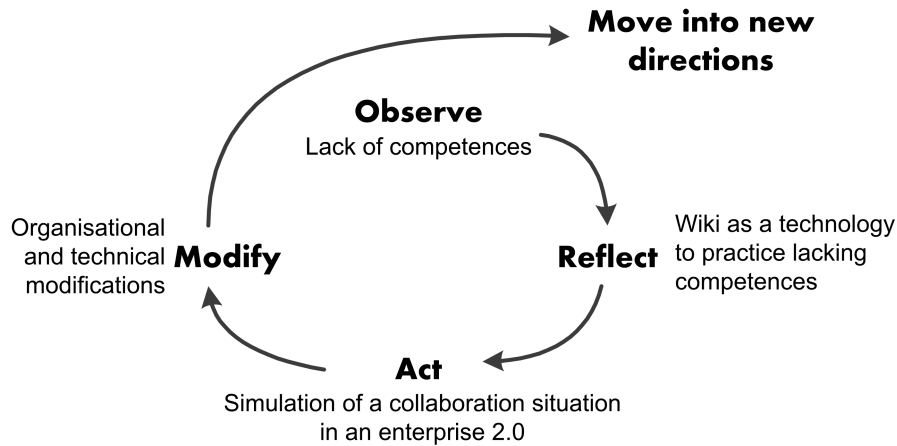


Figure 1: Action research cycle applied to our research [MW05, p. 9]

Reflect After observing an issue, the action researcher thinks of a possible approach [MW05, p. 8]. We therefore aimed to enhance our curriculum, reflected on how to integrate the lacking competences and decided to emulate a real, almost unguided collaboration which could have taken place in an Enterprise 2.0. This refocusing of our curriculum to more self-coordinated work should foster students to form opinions and develop knowledge.

Act Acting is about implementing the idea [MW05, p. 8]. In our case we wanted the students to proceed in the *Wiki Way*, which means that they should engage in self-coordinated work, forming virtually dispersed teams. In doing so they should be free to choose a topic of their choice and how they want to engage in teamwork.

Modify While acting, the action researcher continuously monitors his or her actions by gathering data and evaluating the progress. Depending on the judgement of the progress, the action researcher modifies his or her practice [MW05, pp. 8/9]. Due to insufficient progress we formulate organisational and technical requirements to achieve our goals (see chapter 6 for the discussion of the step *modify*).

Move into new directions After finishing the first cycle the researcher may change the direction to align his or her research and try another action to succeed (see chapter 7 for a potential new direction of our research) [MW05, p. 9].

The methodology of action research structures the research process. Thereby, required steps become manifest and a reflected documentation is facilitated. Normally an action research approach comprises of several cycle-iterations. In this paper, we describe only the first cycle, because we were bound to just one semester. Nevertheless, we have taken smaller modifications during the courses to achieve our goals. The next action research cycle is planned for the summer term of 2011.

4 The Wiki Way

In the following, we present in detail the action part of our research cycle which is the performance of a student project to practice self-organised and loosely coordinated wiki work. An evaluation of the project is presented in the next chapter.

The student's wiki project lasted three months, continued a lecture on knowledge management and completed the course module. 17 students took part, 13 male and 4 female. All participants studied at the faculty of business and economics. The project's objective was to exercise a collaborative work situation in an Enterprise 2.0. The students were expected to (1) reflect about the contents of the lectures, (2) deepen one or more topics of their individual choice and (3) exercise a self-organised collaboration supported by social software.

The project's task was to create and collaboratively extend a knowledge base about knowledge management. The students' had to contribute to a wiki being part of the learning management system² of the university. As the students were already familiar with the environment of the learning management system and could benefit from a single sign-on. The wiki was not made public, only the participants had access to it. To promote a quick start, the wiki was already filled with some contents about knowledge management which had been created by students in former courses. This initial wiki needed improvements with respect to the quality and the addressed topics. Additionally, a first structure of the wiki home page was provided based on six knowledge building blocks [PRR00].

People interested in knowledge management (students, practitioners, laymen) were defined as the target group of the knowledge base. Therefore, the contents of the wiki should have been informative, easy to navigate, and motivating. The students of the project were free to add any information to the wiki. Suggestions to extend the wiki were made by the lecturers to motivate the participants. We suggested (1) to illustrate problems that could be solved by knowledge management, (2) to connect real occurrences and cases with the theoretical explanations, (3) to explain theoretical concepts and models of knowledge management, (4) to illustrate the application of knowledge management methods, and (5) to explain and to link to detailed information from specific topics.

Furthermore, the students were informed that they had free choice of what and how much each of them wanted to contribute. Thus, the organisation of the content creation was fully self-organised by the participants. As intended by the lecturers, the high number of participants made it hardly possible for the students to arrange real meetings with all participants or to implement a coordinating structure (like a hierarchy) within their group.

² The learning management system OPAL (Online Plattform für akademisches Lehren und Lernen) is a central platform for several universities in Saxony. It is available at <https://bildungsportal.sachsen.de/opal/dmz/>.

At the beginning of the project, the participants were informed how the individual contributions would be assessed. The assessment followed a two-step approach. Firstly, the knowledge base was assessed and got an overall mark based on the quality with respect to the already existing content. Secondly, an individual mark for each participant was calculated by weighting the overall mark with the proportion of the amount of individual contributions to the average amount of contributions:

$$mark_{individual} = \frac{mark_{overall} * contributions_{average}}{contributions_{individual}}.$$

Almost everything could be a contribution. Examples for contributions are ideas, findings from literature research, revisions, new content, links between different concepts, etc. Contributions could be made in the wiki itself or in the related forum. To take a contribution into account for the assessment of an individual, the contribution had to be part of the overall result. This means that an idea that was posted in the forum by one participant was only taken into consideration if it was picked up and integrated into the wiki by another or the same participant. The lecturers could as well assess a contribution differently depending on the type and the extent of the contribution. Thereby, students could not benefit from splitting one contribution into several smaller parts.

Within this chapter, the initial settings of the project to practice self-organised and loosely coordinated wiki work in higher education were shown. Results and experiences of this project are presented in the next chapter.

5 Evaluation

The project we presented should improve self-organised and loosely coordinated wiki communication. Its evaluation includes a description of the results as well as the collection of the experiences. These allow further discussion and deduction of requirements.

At the beginning of the project the initial wiki consisted of 126 articles. During the students' work 74 of these articles were changed and 104 new articles were created. The changes of the provided articles were different. In 36 cases the students made just minor adaptations regarding a common format or including a link. The other 38 articles were restructured, extended, and rewritten.

The quality of the wiki articles differed significantly. There were a lot of well-written and revised articles. But unfortunately there were also 10 contributions, which included plagiarisms at least partly.

Each student created a document similar to the protocol in figure 2. The students had to document in this protocol *when* they made a contribution, *what* they had contributed, and *where* they made the contribution.

These protocols were necessary because the wiki's and the forum's capabilities for reviewing are very limited. There exists no functionality enabling the lecturer to individually aggregate the activities of a single user. Hence, each entry in a protocol had to be checked whether the contribution could be found in the wiki or forum and what extent and quality the contribution had. Each proven contribution received points depending on the extent and the quality of the contribution. The granularity of the protocols differed. From case to case, it was necessary to assess two contributions with just one point, e.g. when the creation of a short article and the link to this article were indicated as two separate contributions.

Timestamp	What is the contribution?	Where is it documented?
16.06.2009	Appointment for working together in Case Study	Forum
24.06.2009	Discussion on content regarding the subject "Informatik"	Forum
25.06.09/26.06.09 (multiple entries)	Fallbeispiel Nokia Care (new content)	Wiki-Wissensmanagement
26.06.09/01:43	Index(readability/structure improvement)	Wiki-Wissensmanagement
26.06.2009	Verification and preparation of report with all pages to be deleted (incorrectly created)	e-mail/pdf file
27.06.09/00:04	Calling attention for problems in page "wissensnutzung" regarding a missing graphic	Forum
27.06.09/11:56	Wissensmanagement und BI (minor readability improvement)	Wiki-Wissensmanagement
27.06.09/ca.14:50	Index (new content: Weitere Wissensmanagement Modelle- Wissensspirale Modell)	Wiki-Wissensmanagement
27.06.09/(multiple entries)	SECI-Modell(new content)*	Wiki-Wissensmanagement

Figure 2: Example of a protocol about the contributions of a student

Only editing activities could be analysed because the wiki chosen did not offer further monitoring instruments. The protocols and logs in the wiki indicated that half of the students (9) started editing in the first half of the project but just two in the first quarter. This can be explained by the students' lack of familiarity with the new course design. They had difficulties to understand what they should do and how their contributions would be assessed, because normally, they would have to write a single or small team assignment as linear document. They could hardly accept that there were no criteria how many contributions they would "have to make". Therefore, it needed an additional presentation and discussion a week after the kick-off to clarify the project's objective and answer questions risen.

The students started early with coordination of their work. They declared a reference layout for the articles and a rough time table. One participant analysed the initial wiki regarding the quality of the articles and made a list of necessary changes. Other students processed the concerning pages. Because the project was part of a course module with weekly lectures and exercises, the students used those events for meetings afterwards. Therefore, the coordination between the participants increased significantly during the project. Finally, even a small hierarchical organisation turned out. Although a loose coordination had been intended there had not been any chance to intervene at this point.

During the project, the lecturers could hardly keep track of the changes in the wiki. An email trigger on wiki activity could be generated each day but it included only information that someone had changed something. More details required to login and search manually for the latest changes.

For the assessment we prepared an excel sheet that computed individual marks based on the formula described above. When checking the calculation for plausibility, we detected that the average mark based on the calculated individual marks was different from the overall mark given for the wiki. But the intention of the calculation had been to derive from the common result individual marks depending on the individual contributions. Therefore, the resulting average mark should have represented the common result. So we finally adapted the overall mark for the wiki to the calculated average mark.

Performing and evaluating the wiki project has led to the above collection of useful experiences. These are discussed in the next chapter to deduce further requirements.

6 Discussion

In the following, we reflect the results of our evaluation and deduce requirements for the improvement of wikis use in higher education. We distinguish between organisational and technical requirements: the former describe changes in organising such projects and the latter focus on improved wiki functionalities.

Organisational requirements. As shown in the evaluation, the students had problems to understand the project's objective and their tasks (cf. [Kar10a]). A careful scaffolding (cf. [Col09, GLR+02]) could be helpful, because a lot of explanation and demonstration is needed at the beginning of the project. Additionally, the curriculum designer should think of integrating collaboration projects already early in a study programme and increase continuously the complexity of the challenges regarding collaboration (cf. [Col09]).

A central or hierarchical coordination of the whole group of participants was not intended in the project but similar structures evolved over the time. The relatively small number of participants, geographical distribution and project duration can be possible indicators having inhibited a stronger coordination peer to peer coordination. With an increasing number of students the coordination of timetables and decisions becomes more difficult and the development of a hierarchical structure is less likely to evolve. If the participants are dispersed across different locations (e.g. different countries), their communication is restricted exclusively to electronic media. This limits the opportunities for comprehensive discussions. Additionally, different time zones can further affect the chances for synchronous communication. Because team building or rather building a hierarchical structure demands time especially in the beginning of a project, a short project cycle time increases the advantages of loose coordination. In the described wiki project the number of participants was sufficiently high but members were located at the same university and cycle time of three months appears to have been too long.

Additional experiences with different project settings are needed to adjust these three parameters for more advantageous combinations.

Most students select their courses based on the expected assessment results. In their opinion, marks are the reward they get for their effort in the course (cf. [Col09]). Even if such view is questionable it must be taken into consideration. Therefore, an evaluation system has to be transparent from the very beginning to provide incentives. On the other hand, it has to be flexible enough to avoid abuses. The experiences of the presented project show that a refined evaluation system is necessary (cf. [Cub07]). Therefore, the types of possible contributions have to be categorized and valued by according scores (e.g. one point for a link, ten points for a self-formulated paragraph). The challenge is to develop a grading system that flexibly represents both effort and quality of the contributions. Here additional research is necessary.

Next to the individual assessment, support for the overall assessment of the wiki is needed (cf. [Cub07]). It is very difficult for a lecturer to assess the work of a group of 17 or more students with a single mark (cf. [Cub07]). This problem grows if it is necessary to assess just the change of the provided wiki. Due to these difficulties, indicators are needed that take into consideration the overall workload and the expected improvement of the wiki.

As described above, the calculation of the individual mark needs an improvement. We propose as new calculation:

$$mark_{individual} = 5 - (5 - mark_{overall}) * \frac{contributions_{individual}}{contributions_{average}}.$$

This calculation avoids the deviation between overall mark and average mark. The number five depends on the used scale of marks. In the presented project a scale from one to six was used where one is the highest grade. Calculated marks that exceed the range of the scale (e.g. lower than 1 by a very assiduous student) have to be rounded.

Technical requirements. The wiki used has very limited functionalities especially for monitoring and analysing, thus not only limiting the lecturer's capability to intervene timely during the project but also increasing the effort of the assessment. An automatic monitoring of at least the amount and the types of activities (e.g. creation of new pages, adaptation of pages, creation of links, etc.) could alert the lecturer in time or could direct attention to topics in the wiki that are missed by the students. Additionally, functionalities to annotate and to rate single pages would enhance the capability of the lecturer for motivating feedback and guidance. This applies not only to the wiki software underlying our project, but also to other wiki engines e.g. the popular MediaWiki [Cub07].

Next to the editing activities, reading activities also need to be monitored to support the understanding of the behaviour of the students in the wiki as well as their focus of interest on different topics. Even though reading is hardly discoverable by log files, information about page visits per page and per individual participants should be gathered by the wiki. The wiki used in the project allowed just the aggregated view of the activities on a single page. An additional aggregated view of a single participant's activities on all pages is necessary to reduce the effort of the lecturer.

The choice for the wiki in the project was driven by the advantage of single sign-on and familiarity to the students. Hence, the barriers for the students to use the wiki were very low and they came up with their first editing activities very soon. Nevertheless, for better achievement of the research objectives the separate installation of a more powerful wiki will have to be reconsidered in future.

Within this chapter, a set of organisational and technological requirements were presented. Thereby, planning a new wiki project with improved settings is possible. The new project allows an adaptation of the entire arrangement whereas only small modifications could be made during the project.

7 Conclusion

This paper presented a project with 17 master students practising self-organized wiki work in higher education. The innovative approach is based on research gaps for the wiki use in higher education, which were identified in the existing literature. The educational project was accompanied by scientific research following an action research cycle. In the first iteration, we have gained valuable insights and deduced organisational and technical requirements, especially to support the lecturer in mastering the project. Fulfilling these requirements, the next project in the summer term of 2011 can be performed more convenient and will deliver new findings in the next iteration of our action research cycle. Then, we shall test the adequateness of our proposed solutions and analyse the strengths and weaknesses of an adapted setting. Additionally, this explorative action research should be supplemented by theoretical work about wikis and self-organised collaboration.

Acknowledgements. The authors would like to thank Helena Bukvova and Paul Kruse for their constructive and helpful comments.

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