

# How to Get Around with Wikis in Teaching

Zuzana Kubincová and Martin Homola

Comenius University, Faculty of Mathematics, Physics and Informatics,  
Mlynská dolina, 84248 Bratislava, Slovakia  
{kubincova, homola}@fmph.uniba.sk

**Abstract.** Wikis were showed to be an interesting and powerful tool in education, supporting tasks starting from project management, collaborative data management, etc., up to more elaborate tasks such as collaborative production of lecture notes, reports, and essays. On the other hand, most wiki softwares were not created as educational tools in the first place, hence their application in curricula with groups of students faces some obstacles which need to be dealt with. These include motivating the students to engage with the tool, boosting collaboration between students, supervising and tracking student's activity, and evaluation. A number of tools were developed to enable or ease these tasks for the teacher. This paper takes a look on selected tools developed with this aim with two main goals: to produce a concise list of functionalities that are needed, and to compare and evaluate the tools that are available.

**Keywords:** wiki, teaching, collaboration, tools.

## 1 Introduction

The advent of Web 2.0, with its various tools for content creation and sharing, has generated an increased interest in employing these tools in education [4]. Among these tools are wikis, a sort of collaborative websites whose content is not created by some webmaster but instead it can be directly contributed by the users. Wikis have great potential especially for any collaborative activity and they have been successfully applied in teaching and learning in various ways from maintaining project pages, and obtaining feedback on course materials, to collaborative lecture notes construction and co-writing exercises [3,14,9,4].

On the other hand, wikis were not originally conceived as educational tools, to be used by a group of students for specific tasks with educational goals whose work is supervised and evaluated by the teacher. Most wikis offer only basic features that can support the tasks the students and especially the teachers have to carry out in fostering and keeping track of the students' activity and their educational progress which is to be evaluated and assessed. This fact makes more sophisticated uses of wikis difficult for the educators, if not impossible with larger groups of students. This problem was noted by researchers [14] and multiple tools that can support the educational process with wikis were proposed and developed either as plugins or extensions of existing wikis

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(e.g., Co-Writing Wiki [1,2], EdDokuWiki [9,10], and Tracking Bundle for MediaWiki [7]) or as self-standing wiki-based educational systems (e.g., ClassroomWiki [5,6]).

These tools can be useful in organization and evaluation of student's work, but some of their features can also have significant impact on the learning outcome. On the other hand, they were often designed to support specific needs faced by a specific group of teachers tackling a specific application of a wiki in the educational process. In this paper, we build on the experience with these tools, and we look at the problem from a broader perspective. We first concentrate on the process in which a wiki is typically applied in education, and we study the tasks faced by students and teachers as well. Our attention is then shifted towards features and functions that can be useful in supporting these tasks. We produce a list of possible features, that were either described in the literature but also based on our own experience. Finally, we get back to the existing tools and evaluate them in order to find out which of these functionalities they currently offer. This study maybe useful for the potential user of these tools, who is trying to select the best tool for her needs (albeit not all of the tools are freely available). More importantly, the list can help the developers to extend their tools or to build new tools with improved versatility and more universal applicability. Our survey of these tools is based on the published research reports and partly on direct communication with the authors.

## 2 Use of Wikis in the Educational Process

In this section we take a look on the goals and especially tasks placed on students and teachers engaged with a wiki in an educational process. We start from student's point of view passing the phases of work carried out by the students. Then we look on the tasks required from the teacher.

### 2.1 Student's Tasks

Wiki-based assignments are typically collaborative content development tasks, inherent to the nature of wikis. As such, the work has to be split somehow at the beginning, then content is built which includes some interaction between students. Additionally, students may be involved in self assessment and/or peer review to strengthen reflection and social learning.

**Material study:** the assignment may often involve study of materials that are to be processed or in which useful information is found. This is usually placed as the very first step in the process [14,10] however the materials will likely be referred to also later in the process.

**Work planning:** typically the assignment is placed on a group of students who first have to split up the work among themselves and possibly plan the content structure thus exercising important competencies such as group management and collaborative tasks planning [14,10,2].

**Writing/content development:** the principal task in which text is written, other content developed and put in place. Each student may work on her own part as assigned

during the planning phase, incorporating feedback from others, however deeper collaboration patterns in which students exchange their parts, or take turns in passes are also possible. It is important to note that while content-wise this phase is principal, and is often perceived as such by the students, it need not necessarily carry the majority of pedagogical goals, especially if emphasis is placed on the latter phases.

**Social interaction:** an important part of the process is interaction during which students communicate, comment on the work of others, ask questions and share ideas. Comparing one's point of view on the subject with others enhances social learning and enables consensus to be formed, thus this phase is very important [3,14,8]. Wiki tools are well equipped for this task, however, engagement in interaction may not be granted for many students who may see it as unnecessary work.

**Peer review and peer assessment:** one of the most effective strategies to reinforce interaction and social learning is to ask students to review and comment on the work done by others [14]. Students benefit from understanding the others view point on the topic and from getting feedback on their own work. To further reinforce and simplify this process, students may be asked to rate the work of their colleagues on some scale [10,2].

**Self assessment:** to foster critical perception of one's own work students may be asked to rate as well the work done by themselves [2,1]. As explained later on, this may also ease the evaluation process for the teacher.

## 2.2 Teacher's tasks

A number of tasks has to be coped by the teacher as well. The assignment needs to be communicated to the students and typically students have to be broken into smaller teams. During the content development students have to be coordinated in order to maintain desired levels of collaboration and interaction, and to avoid free riding, student apathy, and other common problems associated with online group learning [11]. In addition the collaborative work has to be evaluated which is a non-trivial task.

**Instruction:** the assignment can easily be delivered as a wiki page. In these instructions, the teacher not only describes the scope of the work to be done, but also has to carefully guide the students to act collaboratively and to interact. Wiki tools allow to comment on any page, hence it is good if the students may ask additional questions and get answers from the teacher so the assignment may become interactive. In addition, the teacher may add further instructions during the supervision of students placed directly into the students work-in-progress pages as special wiki templates [7]. Students then react to these contextual, or just-in-time instructions by carrying out the indicated changes and removing the template.

**Group formation and interaction policy:** in large groups, some students may feel that there is too little space for them to contribute [7], hence it is strongly desired to split them into smaller groups [14,5,11]. While theoretically, groups can be self-organized by students, a number of reports stress on well balanced groups carefully selected by the teacher which may improve the collaboration outcome [5,11].

**Supervision:** collaborative writing and content creation takes time, and the whole process has to be supervised by the teacher in order to avoid leaving the work to the last

moment which many students tend to do and which would marginalize the collaborative goals. Tracking of students contributions and interactions allows the teacher to understand better the dynamics of student's learning and to provide a proactive and timely scaffolding to the students or groups [6]. Student's motivation has to be built via feedback and other means and collaboration with other students has to be encouraged. Formative intermediate feedback can improve student's performance and learning outcome: hence it is useful to split also the evaluation in multiple (e.g., weekly or biweekly) phases [7].

**Assessment:** assessment of a collaborative assignment is a difficult task [14,10,7], an increased number of edits has to be inspected and multiple aspects have to be evaluated and then combined. These include content quality, collaboration, communication, cross-referencing, and possibly more. As already noted, intermediate evaluation may improve motivation, and it also reduces the momentary workload placed on the teacher.

### 3 Functionality to Support Wiki-based Learning

As wikis were not originally conceived as educational tools, they do not provide many functions needed for comfortable integration into the educational process. As pointed out by previous research, many useful functionalities are lacking [14]. In this section we list the most interesting functions that would be useful to integrate into a typical wiki implementation in order to support the educational process and its goals, and ease the tasks placed on teachers and students.

**Instruction delivery support:** instructions and assignments may be easily delivered as wiki pages, however, additional support of contextual just-in-time instruction may be beneficial. To certain extent this can be achieved by dedicated editor templates created by the teacher [7], but clearly there is space for further research.

**Group management:** breaking students into smaller groups is highly desired [14,1,10] but most wikis do not support this function. Apart from users, also the wiki pages they are supposed to work on should be part of the group [7] and even a dedicated group homepage gathering the groups recent activity was proven useful [6,1]. Automated group formation tools can be used to balance group members [5]. Access control and group roles can also be useful in some learning scenarios.

**Writing aids:** there is open space for equipping wikis with various writing aids such as spell checkers, thesauri, literature tracking and sharing tools, etc. Currently we only found mentions of incorporating a WYSIWYG editor [6]. This can ease writing, on the other hand, wikitext languages are quite simple and learning them can be considered a useful skill in the digital age. Tools for resolving conflicts and other aids for collaborative writing [12] may also be useful.

**Content archiving:** in certain cases archiving previous runs of the course, cleaning the wiki for new cohort of students while enabling the teacher to browse older runs of the course would be useful.

**Motivation and collaboration boosting:** to motivate student's engagement, the assignment is usually made part of overall assessment including interaction processes

such as cross-linking, peer review, etc. Additional tools useful for motivating students and fostering collaboration include monitors showing online presence of their colleagues [1] and automatic reminders of planned activities [6]. Another option that can be useful is to introduce student's profile pages with visualization of their progress and achievements.

**Social interaction:** communication between users is typically supported in wikis via discussion pages (e.g., in MediaWiki), which are edited as any other page (i.e., messages are directly written into the page). While this is an effective form of communication, automated tracking and evaluation of student's interaction calls for structured discussion in form of messages or comments [1,10] which can be more easily processed. Typical implementation would include comments under each page and peer to peer messages between students. More elaborate one would allow to create fora on any topic and comment on them [6].

**Activity tracking:** the tools provided by a typical wiki for user's activity tracking include revision history and revision diffs. Typically it is possible to browse history of each page, and as well overall recent changes in the wiki. Once students groups are added to a wiki, filtering revisions by the group should be added to ease tracking of group activity. As the number of revisions can be high, additional filters, such as arbitrary time window can be very useful [7]. Basic revision difference visualization can be enhanced by highlighting the contribution of each user by unique colors, which facilitates the teacher in the process of examining the revisions [1].

Besides for changes in the pages (active usage), other activities should be tracked, such as frequency of user's access of a page and time spent there (passive usage), hyperlinks between the pages and also with outside sources, social interaction and communication [6,14]. To support data analysis, this information should be visualized in form of charts and diagrams [14,1,7].

**Teacher assessment:** assessment capabilities are not part of wikis but for teachers they can be very useful. Basic option would be to add evaluation (points, grades, comments) to each student once or multiple times per course [10]. Another option is to add evaluation to every revision and to compute the overall result by some formula [7]. This evaluation can also be structured (i.e., multiple aspects evaluated for each revision separately) [7] or possibly data recorded from tracking passive usage and social activities, can be part of the formula [14,1]. As the number of revisions can be high, some form of grouping partial revisions before assigning the points may also be useful.

Other useful features that could facilitate assessment include integration with some anti-plagiarism tools, or analyzers that can detect excessive similarities between different students' output. Also assessment questionnaires may be useful, especially with distance courses.

**Self assessment:** basic self assessment can be readily implemented via revision comments which are common in wikis. Enhancements may include adding numerical self evaluation of each revision's relevance to overall group task and incorporating this into revision filters and grading formulae [1].

**Peer assessment:** peer review and peer assessment in form of commentary can be easily implemented via the social layer. This can be further enhanced by adding user,

page, revision and comment rating facilities [1,10]. Again, the recorded data can be incorporated into the final grading formula [1].

## 4 Existing Tools

As most wikis were not originally aimed at educational uses, a number of lacking functionalities that would be useful in the teaching scenarios were identified, as we summarize in previous section. Given the usefulness of wikis, this problem was already addressed by some implementations. In this section we review and compare ClassroomWiki, Co-Writing Wiki, EdDokuWiki, and Tracking Bundle for MediaWiki.

### 4.1 ClassroomWiki

ClassroomWiki [5,6] was developed at the University of Nebraska-Lincoln. It was developed as an research prototype and it is not being used at the parent university any longer. Unlike its preceding prototype I-MINDS [13] in which most of the students' activities was based on synchronous collaboration, this wiki-like collaborative environment was designed as an asynchronous tool mainly used for collaborative writing. In contrast to the following tools, ClassroomWiki was developed from scratch, i.e., it is not based on any existing wiki implementation. Together with wiki it offers other functionalities such as fora and announcements which are composed into an unified collaborative learning environment.

Students and teachers are assigned different roles with distinct rights. Student's view is similar to a regular wiki with versioning and revision tracking, comparison and visualization. A distinctive feature is a WYSIWYG editor for wiki pages which is not a standard for regular wikis which normally prefer wikitext (a simple markup language) editors. In the topic-based forum students can discuss their plans and contributions with other group members as well as communicate with the teacher.

ClassroomWiki adds significant functionalities for the teacher: students activity tracking and visualization which includes active usage (number of words added, changed or deleted), passive usage (number of page and revision history views) and interaction (number of topics created in fora and number of messages posted). An assessment tool is provided by which the student's contribution to the group task can be evaluated. The evaluation is based on combination of data from student's activity tracking with the peer rating results. The teacher is also able to create survey forms which are then filled in by the students.

A distinctive feature offered by ClassroomWiki is the automated group formation tool. Based on collaborative learning theories [11,3], the tool enables to optimize the distribution of students into groups in the way that improves the collaborative learning outcome.

### 4.2 Co-Writing Wiki

Co-Writing Wiki [1,2], developed at the Graz University of Technology, is aimed as tool to support collaborative writing with self assessment, peer reviewing, social awareness and other enhancements. It is based on the open source ScrewTurn Wiki.

Students arrive on a dedicated assignment homepage, where they can see revisions done by other students (of the same group), these revisions can be browsed, difference visualized, and each revision can be commented upon and rated, which is used for the peer assessment process. The assignment homepage also includes contribution charts where they can track their contribution to the collaborative task and compare it with other group members as well as with progress of other groups. To boost social awareness, information about group members currently online is also showed.

The teacher is able to explore the activity of each group on their assignment. Each group member is assigned a unique color by which her part of contribution to the assignment pages is marked up. A unique feature is the history player which allows the teacher to go over a selected wiki-page as a slide show and keep track of particular student's contributions by following her color. Useful statistics is also showed which goes beyond usual wiki statistics: number of revisions made, characters changed, but also links created by each student. Visualization charts are also provided to the teacher including contribution chart, navigation graph, and social network graph. The teacher is also able to send feedback to the students and to evaluate their contribution.

The Co-Writing Wiki dedicates special attention to self assessment and peer assessment. When editing a wiki page, the student is asked to indicate her intention (add text, delete text, change style) and also to rate the significance of the edit towards the group's final goal. After the new revision of the assignment Wiki-page is posted, other group members are allowed to review it (using comments) and rate it. This internal peer review process can be configured to be mandatory. Moreover, there is a special tool by which students assess the final product of other groups. This assessment is structured into so called assessment rubrics. The teacher then can take the peer review and peer assessment into account during the final grading.

### 4.3 EdDokuWiki

EdDokuWiki [9,10], developed at the University of Craiova, is an extension of the popular open-source system DokuWiki with additional features related to collaborative learning and evaluation of student's work which were triggered by the experience with DokuWiki in teaching. This tool is not yet released, but it is already being used in courses at its parent university.

Students are enabled to peer review the others' contributions, rate wiki-pages, add comments, as well as to rate comments they receive. The comments rating is particularly interesting. It is supposed to indicate the utility of the feedback received from peers, and the teacher can take it into account during grading.

For the teacher, this tool enables to track and summarize students' interactions with the wiki, including time and frequency of accesses, pages created and edited by each student, internal and external links added, comments added, comment and page ratings, and number of characters changed. This summary allows the teacher to grasp the level of students engagement with the wiki and the evaluation of the students by her peers. The teacher is then allowed to give grading and also individual textual feedback to the student using a dedicated interface which is also a part of this tool.

#### 4.4 Tracking Bundle for MediaWiki

Tracking Bundle [7] is an extension for MediaWiki that offers tools for students activity tracking and assessment. This open-source tool was developed at the Comenius University of Bratislava and it was released via the MediaWiki extension matrix service.

This tool is especially visible for the teacher and it allows to create student groups and to track and evaluate the student's activity within the group. The groups are built on top of MediaWiki users and the same user can independently participate in multiple groups (e.g., respective to two distinct courses). Users but as well wiki pages of interest are assigned to the group.

Using the tracking tool, the teacher is able to view the activity for each group as a chronological listing of revisions of pages related to the group. Additional filters (e.g., time intervals, selected users or pages only, etc.) can be applied to break down the number of revisions showed. The teacher is also able to assess each revision by points. A distinctive feature of this tool is that the assessment is structured into multiple categories which are configurable (the three predefined categories are new content, modified content, and grammar/editing). Final grading of each revision is then computed by a dedicated formula, which is also fully configurable by the user.

In addition the tool provides summarization of the results in tables and useful visualization in form of charts, including chronological activity in time, shares of points earned by different students (i.e., how many points each of the students earned), but as well shares of student's points by different categories (i.e., how many points of each type the student earned). Same filters can be applied on the visualizations as well, so for instance the score earned during any selected time period or only the score respective to selected wiki-pages can be visualized.

#### 4.5 Comparison

In Section 3 we have gone through a number of features which may facilitate the applications of wikis in teaching. Many of these are already supported by some of the tools described above. In Table 1 we present a comparative summary of the four tools. The columns are respective to ClassroomWiki (CRW), Co-Writing Wiki (CWW), EdDokuWiki (EDW), and Tracking Bundle (TB). By “Y” we indicate if the tool provides dedicated functionality which supports the feature and “(Y)” indicates that the feature is already supported by the underlying wiki software on top of which the tool was built.

### 5 Conclusions

Employing wikis in educational practice is a rewarding experience, it contributes to development of important skills and competencies including team work and collaboration and it boosts social learning and thus improves the learning outcome. In this paper we have inspected the process associated with educational applications of wikis, focusing on the tasks placed on students and teachers and especially on the useful supportive features which the wiki-based learning environment should provide.

Out of these features, many have been already implemented in the existing supportive tools such as ClassroomWiki, Co-Writing Wiki, EdDokuWiki, or Tracking Bundle



|                                 | CRW  | CWW            | EDW      | TB        |
|---------------------------------|------|----------------|----------|-----------|
| <b>Groups</b>                   |      |                |          |           |
| Creation and Management         | Y    | Y              | (Y)      | Y         |
| Group Homepage                  | Y    | Y              |          |           |
| Automatic formation             | Y    |                |          |           |
| Access control                  |      | Y              | (Y)      |           |
| <b>Motivation</b>               |      |                |          |           |
| Online presence monitor         |      | Y              |          |           |
| Activity reminders              | Y    |                |          |           |
| <b>Writing aids</b>             |      |                |          |           |
| WYSIWYG editor                  | Y    |                |          |           |
| <b>Social layer</b>             |      |                |          |           |
| Discussion pages                |      |                |          | (Y)       |
| Comments                        |      | Y              | Y        |           |
| Per revision comments           |      | Y              |          |           |
| Fora                            | Y    |                |          |           |
| <b>Tracking</b>                 |      |                |          |           |
| Active interaction              | Y    | Y              | Y        | Y         |
| Passive interaction             | Y    |                |          |           |
| Links                           |      | Y              | Y        |           |
| Graphical visualization         |      | Y              |          | Y         |
| Revision diff. visualization    |      | Y              | (Y)      | (Y)       |
| <b>Self and peer assessment</b> |      |                |          |           |
| Self assessment                 |      | Y              |          |           |
| Peer review                     | Y    | Y              | Y        | (Y)       |
| Page rating                     |      |                | Y        |           |
| Other groups rating             |      | Y              |          |           |
| Comment rating                  |      |                | Y        |           |
| <b>Teacher assessment</b>       |      |                |          |           |
| Overall                         | Y    | Y              | Y        | Y         |
| Per revision/action             |      | Y              |          | Y         |
| Structured                      | Y    | Y              |          | Y         |
| Configurable                    |      |                |          | Y         |
| <b>Distribution</b>             |      |                |          |           |
| Open source                     |      |                |          | Y         |
| Based on wiki                   | own  | ScrewTurn Wiki | DokuWiki | MediaWiki |
| Platform                        | Java | ASP.NET        | PHP      | PHP       |

**Table 1.** Concise comparison of the existing tools functionalities

for MediaWiki. This includes group management, activity tracking, teacher assessment but also self assessment, peer review, and other features.

But there is also a number of features that we have identified, to our best knowledge, not yet implemented in any wiki-based learning environment. This includes profile pages for users which would visualize students' overall progress and their achievements, more writing aids, content management and archiving, plagiarism detection tools. In addition, we see significant space for improvement of existing tools for activity

tracking and assessment with more advanced functions such as grouping of multiple revisions before evaluation, and better visualization options. Providing for such features would surely be useful for the students and for the teachers who are dealing with wiki assignments in their courses.

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