Recommendation letter on *Collaborative Learning with Wikis*, 17.11.2017
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Dear Professor Keijo Hämäläinen, Rector of the University of Jyväskylä,

In this letter, we are going to present the results of our investigation of whether, and how, wiki technology could be used in higher education to better meet the requirements of the working life in the 21st century. In the following, we will discuss the state of the art in how wikis can be used in higher education, as well as the benefits and critical issues of their use. At the end of this letter, we will sum up our main conclusions and present our recommendations.

State of the Art

As we move forwards in the 21st century, some of the major changes in working life concern the way in which work is done. Today, we are no more confined to the boundaries of local workplaces in individual organizations, but the work is done increasingly in wider networks and communities locally and globally. Collaboration has always had an important role in our lives and it is needed in everyday tasks, work and education. However, in the 21st century, collaboration takes place in geographically distributed settings and on the international level. This requires utilizing new technology for interaction and online collaboration. Various tools and platforms based on advanced web technology enable group work without the barriers of traditional group work, among others the geographical location and time zones. They allow real-time collaboration at a distance as well as working apart at times most suitable for the participants. Wikis are one such technology.

A wiki is a collection of web pages created in an online platform designed for collaborative writing of documents. The platform is implemented using advanced web technology and hypertext functionality, and it can support various genres and styles of structured text. Wikis are widely seen as effective tools for collaborating on shared documents, because they allow people to create and publish documents and debate issues collaboratively, and they also help to keep track of the evolution and growth of documents. Wikis form a vast source of shared information created and edited collaboratively by their users, which allows them to serve as a useful distance facilitator for many kinds of group work (Campbell & Ellingson, 2010; Davidson, 2012). As the quality of content varies in such sources, they also give a basis for developing students' critical evaluation skills (Kiili, Laurinen, & Marttunen, 2008).

In education, wikis have been most often used merely as a source of information for various tasks, but today educators worldwide are most interested in their usefulness for active learning: they are used as websites for collaborative projects or simply as workspaces for collaborative tasks and exercises. Educators realise that wikis can serve as a platform for creating various kinds of literary

and multimedia products as well as reporting and documenting the learning process or work that is done elsewhere, among others. As a shared medium that is easily accessible and editable, a wiki allows students to participate collaboratively in creating and modifying shared documents. Apart from mere writing, it allows students to create complex documents with pages enriched by many kinds of non-textual elements as well as links to external resources, such as web pages, videos, pictures, and documents. Many wiki platforms allow embedding external resources through widgets directly on the pages.

In recent years, the educational potential of wikis has attracted increasing interest among researchers (De Wever, Hämäläinen, Voet, & Gielen, 2015). While wikis are generally seen as helpful tools for collaborative learning and having positive influence on learning processes and outcomes, the experiences of wiki use among students vary immensely (De Wever et al., 2015). Many students find it difficult to disengage themselves from the mindset that years of schooling has forged around the traditional cooperative practices of group work, unless such a change is also reflected in their teacher's expectations, instructions and principles of evaluation. While cooperation is accomplished by division of labour among participants, collaboration is based on mutual engagement in solving a problem together and joint construction of shared meaning, understanding and knowledge (Hämäläinen & Vähäsantanen, 2011). From the viewpoint of sense-making, collaboration unfolds as a continuous dialogue between participants in constructing knowledge, whereas cooperation makes it fundamentally a solitary activity of thinking, writing and reading (Arvaja, 2015; Hämäläinen & Vähäsantanen, 2011). In cooperation, each participant is responsible for some part of the task and coordination is viewed separately from the actual work. In collaboration, instead, the participants are mutually responsible for the whole task and coordination is largely interwoven within the actual work itself. To succeed, collaboration requires connectedness, creativity and flexibility of the participants (Hämäläinen & Vähäsantanen, 2011).

Because the key to collaboration is the right mindset of the participants, the use of collaborative tools and platforms, such as wikis, does not automatically ensure collaboration. The pedagogy underlying the task and its instructions needs to be carefully considered to promote collaborative learning (Hadjerrouit, 2012). Some researchers propose that collaboration among students can be enhanced by scripted collaboration during wiki-based writing (De Wever et al., 2015; Fischer, Kollar, Stegmann, & Wecker, 2013). In scripted collaboration, scripts are intended to shape the way participants build knowledge based on each other's ideas and thoughts. They sequence activities and assign roles to promote effective collaborative processes, so that the available resources and division of tasks are carefully considered to enhance collaboration and feelings of shared responsibility for the full task. (De Wever et al., 2015) However, the results from different experiments do not agree on whether there is a significant overall difference between scripted and non-scripted collaboration (De Wever et al., 2015). We believe this may be due to differences in the design of the scripts and the wiki environment used.

Benefits

The benefits of wikis in collaborative learning concern learning and knowledge building, social interaction, and technical advantages and the quality of documents.

Learning and Knowledge Building

The benefits of wikis for learning and knowledge building seem to be manifold. Firstly, wikis are often regarded to have a positive influence on learning (De Wever et al., 2015). As they provide a huge amount of easily accessible digital information, they inspire students' learning (Kiili et al., 2008). The shared use of the wiki environments in performing multiple tasks might improve individual knowledge acquisition (Laru, Näykki, & Järvelä, 2012). Wikis have also the potential to support students in developing new skills with their peers (Lai & Ng, 2011). A wiki can promote effective collaborative learning and confidence in formative self and peer assessment by facilitating rapid feedback, vicarious learning through observing others' contributions and easy navigation and tracking facilities (Su & Beaumont, 2010). Collaborative writing on wikis creates opportunities for constructivist learning and co-creation of knowledge (Zheng, Niiya, & Warschauer, 2015). Provided that initial difficulties in using the wiki and participating in collaborative scenarios are overcome, the learning results can be very impressive as far as the quality of work, initiative and motivation are concerned (Forment et al., 2012).

Secondly, wikis are found to support collaboration among participants. They are seen as effective tools for collaborating on shared documents, and participating in the collaborative activities is very useful for learning (Kear, Woodthorpe, Robertson, & Hutchison, 2010). A wiki allows participants, in the simplest possible way, to create, publish, debate and keep track of the evolution and growth of dynamic hypertext documents collaboratively (Forment et al., 2012). The academic discourse that is related to collaborative writing and guided by instructors enables students to engage in cognitive apprenticeship (Zheng et al., 2015). The shared social space may also support the formation of learning communities (Zheng et al., 2015). Easy online accessibility makes wikis especially useful in international collaboration (Ertmer et al., 2011).

Thirdly, wikis appear to be useful for developing advanced skills needed in future work environments. Wiki environments facilitate information sharing, knowledge management and collaboration between and within organisations and thereby learning and acquiring various skills needed in collaboration (Minocha & Thomas, 2007). Such skills include, for example, teamwork, effective communication of ideas through networked knowledge environments, learning through discussion, disagreement, and consensus building, articulation, analysis and synthesis of ideas and knowledge sharing, as well as transforming tacit understandings into explicit concepts (Minocha & Thomas, 2007). Working with wikis also enhances students' skills to analyse information and solve complex problems in inter-professional groups (Noroozi, Biemans, Weinberger, Mulder, & Chizari, 2013).

Social Interaction

The degree and depth of social interaction enabled and supported by a wiki environment depends on the design of the wiki. Some wikis support social interaction only minimally, but there are also wiki environments that have been designed to foster the sense of connectedness between participants (Beldarrain, 2006). A wiki can function as a "collaborative icebreaker" that gives the students a chance to socialize and get acquainted virtually. In this way, wiki technology can be used to enhance students' social interaction online (Augar, Raitman, & Zhou, 2004).

Technical Advantages and the Quality of Documents

From a technical viewpoint, the major benefit of wikis is that they can be rather easily adopted by new users (Zheng et al., 2015). A wiki is easy to edit as users are not required to know HTML or scripting languages. Wikis have also many other technical advantages. For example, links can be used to create active references from wiki contents to external web sites or other online resources to help visitors better understand the context. Wikis also tend to have more updated material than ordinary web sites, and they maintain extremely high levels of confidence concerning file management, version and access control and format maintenance (Abreu, Castro Silva, Mendes, & Vinhas, 2012).

Wiki technology may provide structured knowledge schemes, which sustain a type of expert thinking. The information is organized in interrelated blocks of data which do not allow the emergence of parallel issues. This form of knowledge organization resides also in the hyperlink functionality of wikis: relating wiki content to additional information by allowing links to other themes. This kind of easy retrieval of necessary information for sense making enhances considerably the learning experience. (Deaconescu & Matei, May 2013.) A built-in search function helps finding relevant content (Grace, 2009). A wiki environment also tracks changes made in the contents, often at the precision of an individual line, word, or even character, creating a very detailed audit trail of who changed what (Grace, 2009). Authentication enables all wiki edits to be traced back to the author, thus enabling the assessment process, and tracking helps secure wiki content against possible misuse and intentional deletions (Augar et al., 2004).

Critical Issues

Critical issues in using wikis for collaborative learning concern the collaboration process, technical issues, willingness to modify others' work, and inadequate participation.

Collaboration Process

Collaboration is a complex process which cannot be achieved only by bringing students together, and that applies even more in the case of wikis. Such a platform as wiki requires many additional elements to ensure that the collaboration process has a chance to be successful. One of the biggest requirements for collaboration whilst using the wiki is guidance, which as an essential part of collaboration requires the instructor to have some experience with wikis. While guided,

students tend to use higher-level processes of collaboration than students without any support. Students need to achieve higher-order academic skills and be able to critically evaluate the performance of other participants in order to achieve real collaboration (De Wever et al., 2015; Hadjerrouit, 2012).

A further critical issue is the scripted collaboration process, which might be experienced as an attempt to force people to work in a certain way without having a chance to agree or disagree on the task freely. This might deplete the collaboration between students. Even though wikis seem to be the way to learn more about collaboration in the group, students still often prefer individual work over collaborative use of a wiki (De Wever et al., 2015). Students often feel that they could have achieved better results by working independently (Hadjerrouit, 2012). Students may also feel that it is easier to talk to a person face to face than to write messages using some "faceless" technology (Hadjerrouit, 2012). Furthermore, the assignment needs to be chosen well to reinsure that the free form of writing on wikis will be beneficial and that the students are able take advantage of the tool (Zheng et al., 2015).

Technical issues

A wiki is a web-based tool and its use necessarily requires at least some level of digital literacy and technical skills to achieve the goal (Grace, 2009; Zheng et al., 2015). The teacher must ensure that every participant meets these criteria before the task is assigned to students. Difficulties and shortcomings in human-computer interaction might cause confusion, feelings of being lost or frustration and influence the learning process negatively (Raitman, Augar, & Zhou, 2005). The wiki environment also must include functionality for monitoring its use to make sure that it is secure and that the content does not cause any legal or other problems.

Many critical issues are related to the use of a wiki platform. Faulty design together with errors in the functionality, as well as inadequate or lacking features, such as colours and icons, make users feel frustrated and distract them from the task at hand (De Wever et al., 2015; Hadjerrouit, 2012; Trentin, 2009). Lack of specific functionalities, such as a communication panel or notes, might bring frustration to the group work and strongly affect the process of collaboration that can easily change into cooperation. As a web-based tool, a wiki also requires a functioning network connection. Having to edit the contents online, students may feel continuously nervous about losing their progress due to disrupted connections or find themselves unable to simultaneously work on the same wiki page (Hadjerrouit, 2012; Raitman et al., 2005)

Social interaction is one of the most important parts of human personal development. Collaboration cannot exist without social interaction, and even though it might seem that computers have nearly replaced the face-to-face interaction and communication in our daily lives, many students still miss the social contact whilst using a wiki (Trentin, 2009). Sometimes just five minutes of conversation face-to-face can be more effective than one hour of conversation online. Because of this, the teacher should provide at least a few face-to-face meetings for social interaction. Many students experience that wiki-based exercises do not help them communicate

with their group members, and they prefer to work face-to-face rather than with a wiki (Raitman et al., 2005).

Willingness to modify others' work

Academic writing can be complicated and difficult especially in the case of first-year students. They must learn how to collaborate, and become more critical towards their and others' ideas and contributions (De Wever et al., 2015). People who have been brought up working in the safety of an individualistic work environment and then become transferred to a collaborative one tend not to like their work to be edited and criticised by other people. Students put a lot of effort in the texts they write and not many of them are ready to face critics or changes. They tend to care for their ideas and refuse to accept changes made by other students (Hadjerrouit, 2012). Respectively, some people are not comfortable with modifying others' texts or interacting with materials written by other cohorts. They tend more to comment upon them or simply add new ideas without changing anything in the existing content (De Wever et al., 2015; Hadjerrouit, 2012).

If the level of scripting is too low or too specific for a learner, it can constitute a problem for acquiring subject matter knowledge and also for internalizing the collaboration script (Fischer et al., 2013). In addition, the reluctance of students to participate in the editing of others' texts causes that students become less involved in the process of collaboration (Hadjerrouit, 2012). A wiki may fail to support confidence among participants because they can edit others' work without any real consequences and because a wiki allows one to delete someone else's work (Raitman et al., 2005).

Inadequate participation

All group work with wikis, at least at the university level, is focused on adequate participation in the whole writing process. Teachers require that students participate equally and share the responsibility in creating the final document. However, not all students are able to participate as much and as well as their peers (De Wever et al., 2015). There are many reasons leading to inadequate participation, including insufficient knowledge of the subject, academic reading and writing obstacles, bad atmosphere in the group, lack of experience in group work, or that the project is not considered as a priority. There will always be students who take more responsibility of the common task than others, and nevertheless, support must be provided for those who are struggling (Hadjerrouit, 2012). One reason for inadequate participation might be that students do not enjoy participating in work done in an online wiki environment (Raitman et al., 2005).

Conclusion and Recommendations

In the 21st century, the world is becoming ever more globally interconnected, and a major part of this change is due to the introduction of new kinds of information and communication technology and interconnected technological infrastructures. This alters how work is done: within networks and communities instead of the boundaries of local workplaces in individual organizations. This kind of work requires collaboration and utilizing new technology for interaction.

One of the technologies that promises a new way of working are wikis. Wikis are widely seen as effective tools for collaborating on shared documents: they allow people to create and publish documents and debate issues collaboratively, and they also help keeping track of the evolution and growth of documents. Wikis can be perceived as distance facilitators for group work, and since they allow people with different levels of competence to work together, they can be adapted to each group's level of performance.

As a conclusion of our investigation, wiki technology has clearly a high educational potential with several advantages. A wiki is a useful platform for collaborative writing and a source for learning. The main advantages of using wikis in education concern learning and knowledge building, collaboration and social interaction, and the quality of learning and teaching processes. A wiki improves learning and knowledge building by offering everybody an equal possibility to get information and new ideas, to add more content, and to contribute to its evolution, as well as to evaluate each other's works. Wiki technology has a positive influence on the quality of learning processes, and it can be used to facilitate many types of group work together with other learning and teaching platforms. The use of a wiki is also easy to learn in comparison to many other technologies.

In regard to social interaction, a wiki can serve as a medium for distance group work and palliate its usual inconveniences. Yet it cannot replace face-to-face interaction completely. Much of the interaction potential is lost since the participants do not usually work on the document at the exact same time. In addition, the annotations on a wiki page cannot fully meet their purpose due to different levels of competence among the participants. Misinterpretations of each other's work cannot easily be solved since the annotations are open for interpretation rather than for the group to discuss. Many problems remain usually untouched, which can easily be highlighted as a lack of communication intrinsic to this method. In the long run, it is very difficult to think of work with wikis as a complete substitute for face-to-face collaboration.

Wikis have been proved to have a positive impact when they are used in conjunction with other methods of collaborative work, and as a reinforcement for day to day interaction. This requires that the participants are trained up to a minimum level of competence in working with wikis and that they are open to self-regulation processes. Groups show a wide enrichment gained from other people's different specialties and collaboration expertise, which is an interesting viewpoint in regard to education.

However, there are also several critical issues to consider, because the use of a wiki does not automatically ensure collaboration. The shift from cooperation to collaboration is not easy, because it involves a fundamental pedagogical change that needs to be carefully considered. Students who have no prior experience in collaborative learning tend to apply the cooperative scripts they have learnt in earlier studies. For example, a common caveat in collaborative writing is that it is much easier just to add more content to a wiki than to change or modify others' work. If students lack shared responsibility for all parts of the wiki, the "bigger picture" may be lost and participation becomes unequal.

The use of scripts is a promising way to support learning, but a potential shortcoming is that they often address only one particular aspect of the learning process. The chosen scripts should take into account the collaborative writing process as a whole: the various aspects of collaboration, the writing process per se, and the literary genre of the resulting text. It is also necessary to consider whether a wiki is suitable for the task, in the first place, or would some other platform, such as Google Drive, be more appropriate.

A wiki alone is not enough for collaborative learning, because it cannot support the communicative and social aspects of collaborative processes. Effective communication requires a possibility for real-time interaction, preferably via video and audio, or, if those are not available, via chat. An online discussion forum is not enough for creative collaborative communication. However, it should be noted that there are individual differences among students' experiences of using wikis for learning.

In conclusion, we must realise that wikis cannot be used simply without any modifications. It obliges an essential change in the fundamental pedagogy and learning paradigm, support for the students' collaborative process, prior technical knowledge and a clear idea about wikis and their pros and cons. Whenever some issues occur in wiki-based collaboration, teachers are the ones who need to support their students and find ways how to make their project successful. As with all technologies the use of wikis alone doesn't guarantee successful collaborative learning activities.

Our recommendation is, therefore, that many different methods for collaborative work are considered. While wikis have proved useful and enriching in certain context, for some they have become an unwelcome challenge or even a nuisance. A careful study of the objectives of group work is needed and to which degree the resource must be relied upon. As there are many alternatives, it becomes more difficult to recommend one over the other, and even more so when the method does not imply real time interaction.

We believe that wikis could be used in all university faculties and subjects, but only when the literary genres and suitable modes of collaboration in the field of study are taken into careful consideration.

To improve the potential of wikis in education, we suggest that such collaborative methods are used in which wikis are used as an additional resource. Most of the research on wikis we found was based on groups that functioned solely on this format, without face-to-face interaction or

additional resources to supplement it. The lack of face-to-face interaction might lead to misconceptions of how useful wikis actually would be if used in authentic education, with the proper methodologies and guidance from teachers and a considered study plan plus the convenient IT training for it.

Although research has been conducted with positive findings on the use of wikis for learning (Chang, Morales-Arroyo, Than, Tun, & Wang, 2011), we find that further studies are needed to investigate the learning process and outcomes with wiki as a learning tool.

Yours sincerely,

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