PITFALLS AND POTENTIALS OF SOCIAL SOFTWARE IN HIGHER EDUCATION

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Keywords: Blog, discussion forum, knowledge sharing, knowledge transfer, social software, virtual communities, Web 2.0, WIKI.

Abstract: The overwhelming success of all different types of social software, such as WIKIs, Blogs etc. is about to change the way how communities interact with each other. Most of the systems are being used on a voluntary basis run and maintained by individuals who have a deep wish to transfer and share their knowledge with others. This transfer and sharing, however, often takes place outside any educational setting even though the main purpose of educational settings such as universities is to educate students through sharing and transferring knowledge. Up to now social software tools are used very rarely in universities to support teaching and training, and this is the case even though students are keen on using exactly these tools in their spare time. This observation leads to the guiding research question for our work: *How can social software be used most effectively and efficiently in higher education?* In order to find answers we conducted four case studies at Graz University of Technology with more than 350 students involved.

1 INTRODUCTION

We are currently witnessing the overwhelming success of all different types of social software, such as WIKIs, Blogs etc. Most of these systems are being used on a voluntary basis run and maintained by individuals who have a deep wish to communicate, transfer and share their knowledge with others. Particularly among young people it becomes more and more popular to distribute their weblog address instead (or at least in addition) to their phone number.

This new collaborative nature of communication and knowledge transfer methods on the web is often referred to as the Web 2.0 movement. The Web 2.0 is an ambiguous, even polymorph concept which is understood by different people in different ways. One interpretation is that Web2.0 is the web for the people and not for the commerce (as it is the case with "Web 1.0").

To some, Web 2.0 refers to a perceived transition of the internet from a collection of websites to a full-fledged computing platform serving web applications to end users. To others, Web 2.0 is a social phenomenon and dues to an approach to create web content; direct, honest and open communication with respect to the market as a conversation; reliance on community and decentralization of authority; freedom to share and transfer remix and license knowledge.

This transfer and sharing, however, often takes place outside any educational setting even though the main purpose of educational settings such as universities is to educate students through sharing and transferring knowledge. And the scientific communities agrees that up to now there are very few academic publications about the use of social

Puntschart I., Tochtermann K. and Dösinger G. (2006).
PITFALLS AND POTENTIALS OF SOCIAL SOFTWARE IN HIGHER EDUCATION.
In *Proceedings of WEBIST 2006 - Second International Conference on Web Information Systems and Technologies - Society, e-Business and e-Government / e-Learning*, pages 21-28
DOI: 10.5220/0001256100210028

software tools for teaching and training at universities. This observation leads to the guiding research question for our research: *How can social software be used most effectively and efficiently in higher education?*

With the attribute "effectively" we take into consideration that social software provides some added-value to traditional face-to-face sharing and transferring of knowledge. With the attribute "efficiently" we emphasise that the use of such tools should decrease and not increase the workload of the lectures for both, students and lecturers in "higher education".

The purpose of this paper is to suggest answers to the above question. To achieve this, the paper is structured as follows. Section 2 introduces important terms needed throughout this paper. In order to give an exhaustive answer to our research question we need a model for knowledge sharing and transfer helping us to completely understand the problem space. A first extension of such a model and its application in two explorative case studies with more than 140 students involved is described in Section 3. Section 3 also identifies limitations of the model. In order to overcome these limitations, Section 4 introduces indicators based on the well established design-based research approach. These indicators are used to measure how the limitations of the first extension model can be overcome. This feeds directly into a further model extension which is presented in Section 5. The paper closes with a conclusion in Section 6.

2 DEFINITIONS OF TERMS

Higher education comprises communities (e.g., consisting of a group of students, or of a lecturer and students etc.) in which knowledge is shared and transferred. To have a common notion of these terms throughout this paper, we provide some definitions in this section.

The idea of *communities* in the context of knowledge management is not new: Positive and emotional associations as well as high expectations, especially regarding communication and innovation, have resulted in the foundation of communities as informal groups of shared interests in many organizations (Reinmann 2000).

According to a general definition a community is *„a group of people with a common characteristic or interest living together within a larger society"* (MERRIAM-WEBSTER 2005).

Depending on the purpose of coming together, communities of interest or communities of practice (Preece 2000) are built.

The basic definition of *Communities of Practice* was coined by Etienne Wenger (Wenger 1998): "*In a nutshell, a community of practice is a group of people who share an interest in a domain of human endeavour and engage in a process of collective learning that creates bonds between them: a tribe, a garage band, a group of engineers working on similar problems.* " The three essential elements are the domain, the community and the practice.

A *Community of Interest* is a group of people connected to each other by a need to solve common problems, develop skills and share common practices. A community of interest may contain smaller subsets of people sharing information within their respective communities of practice.

According to the way how communication takes place we distinguish further between face-to-face communities and virtual communities.

In *Face-to-Face Communities* the members communicate in person in a common room of perception while in *Virtual Communities* the participants transfer and share knowledge technology-enhanced using a *Community-Platform.*

In higher education all forms of communities mentioned can be found. Students find together in lectures where they engage in a process of collective learning because they share a common interest. While the lecture itself still in the majority of cases is held face-to-face it is also possible and getting more and more common to integrate community-platforms for further exchange of documents, comments etc.

The human communication, interaction and cooperation within communities can be supported by social software. In our notion *social software* enables people to interact with each other using the Internet. This interaction can be uni-directional or bi-directional which leads us to the definition of knowledge transfer and sharing:

In our notion *Knowledge Transfer* is the uni-directional transfer of knowledge (i) from individual A to individual B, (ii) from individual A to a community {B, C, D,…}, (iii) from a community {B, C, D,…} to individual A and (iv) from a community $\{B_A, C_A, D_A,\ldots\}$ to a community $\{B_B, C_B, D_B,\ldots\}$. Note, that an individual A can be the sender of a knowledge transfer and at the same time be a member of the receiving community.

Knowlege Sharing is an extension of knowledge transfer in the sense that knowledge flows in either direction, from the sender to the receiver and vice versa.

Note, that conceptually each individual A can be represented by a community {A} with just one community member. This is why the remainder of the paper often talks about communities and not individuals any more.

3 COMMUNITY-COMMUNICATION-MODEL

The Community-Communication-Model (CCM) (fig. 1) was created to demonstrate all theoretically possible ways of knowledge transfer and sharing within and between communities (Puntschart 2005).

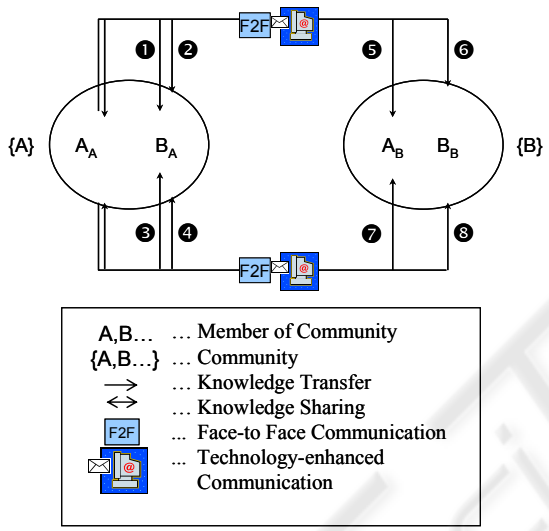

Figure 1: Community-Communication Model.

Arrows 1-8 show all forms of knowledge transfer and sharing within (arrows 1-4) and between (arrows 5-8) communities. These possibilities of transfer according to the variables introduced above within communities are:

1. A_A → B_A ~ transfer between two members within the same community
2. A_A → {A} ~ transfer from one community member to the entire community
3. {A} → A_A ~ transfer from the entire community to one community member
4. {A} → {A} ~ transfer from the entire community to itself

The possible ways of knowledge transfer and sharing between different communities are:

5. A_A → $A_{B,C,...}$ ~ transfer from one community member to member(s) of another community
6. A_A → {B, C,..} ~ transfer from one community member to another community
7. {A} → $A_{B,C,...}$ ~ transfer from one community to member(s) of another community
8. {A} → {B, C,...} ~ transfer from one community to another community

For example, arrow 1 represents the knowledge transfer from one single member of the community to another member of the community, e.g. if a member posts a comment to a statement of another person. Arrow 5 describes the same situation between members of different communities. For example, if a student looks in another forum to which he/she joined in order to participate in the discussion. (The model is described in detail in Puntschart 2006).

3.1 Explorative Studies

In order to answer our guiding research question, we conducted two consecutive case studies at Graz University of Technology (TU Graz) using different types of social software to support two lectures. These studies are summarized to the extent which is necessary to make this paper self-contained. A detailed description of these studies to approve the model can be found in (Puntschart 2005).

The initial point for the enforcement of the studies was the fact that TU Graz offers their students a broad set of different IT systems: TUG Online (https://online.tu-graz.ac.at/) for extensive information about lectures, lecturers, administrative issues etc. Another system is used for newsgroups and yet another to provide course material. There is no space for individual working environments for the students to deposit their own working documents and relevant literature. Also no social software tools are offered to support the knowledge sharing within and between the communities.

To overcome such a heterogeneous working environment which obviously hinders knowledge transfer and sharing a *Knowledge Management System* was implemented for the lecture "Introduction to Knowledge Management" attended by about 140 Students and in the following summer term in the lecture "eCommerce" with about 42 students. With this system an integrated IT environment including a personal working space for each student to store documents, links, etc. was provided. In order to support knowledge sharing several discussion forums linked to the topics of the lecture were integrated. Within the system the students had immediate access to all slides of the lecture, links and literature, and also research tools and references to scientific methods. In addition, a Blog was used in the lecture. This blog, however,

was not a "traditional" personal Blog but a community Blog for collecting specific links classified into categories.

The discussion forums were being moderated by four e-moderators consisting of the lecture team to extend the discussion and guarantee quality of the statements, help the students to keep the topic, and to keep the netiquettes.

3.2 Preliminary Results

The analysis of the use of the CCM in these two studies reveals that the CCM applies to all possible ways of knowledge communication. According to the practical impact the CCM provides helpful guidance for the design of community environments. (Puntschart 2006).

But much more important is that already during these studies further important research questions emerged: An additional insight is that the moderation of the discussion forums and the Blog implemented in the lecture is very time consuming for the lecturer. To fulfil some of the typical tasks of e-moderators, like conformity to the netiquette, or keeping the members focused to the topic, the lecturer has to read all statements. Having a lecture with 180 students who post at least six statements each means that the lecturer has to read more about 850 statements. Thus, the social software environment was perceived more as a burden rather than a relief. Referring to our initial research question, the use of social software is not "efficient". Still, the tool is "effective" in the sense that students had a one-stop-shop for the lecture offering all relevant lecture material.

As a consequence a key question is how to reduce the workload of e-moderators. In order to find a solution for this problem we analyse the differences between Wikis, Blogs and discussions forums to find out why Wikis and Blogs work without
e-moderators and why discussion forums do not:

In *Blogs* the communication is often based on content such as links to further websites or documents integrated in the statements. Something similar was found for Wikis: *Wikis* focus on the production of content in forms of statements that can be commented or discussed. *Discussion forums* in contrary support the communication separately from the content which in our specific case relies in background libraries of the knowledge management system. *Content* in this context (in contrary to communication) is not associated to certain members of the group. Content consists of documents, URLs and statements that are provided to all community members.

As a conclusion, in our notion, one difference between Wikis, Blogs and discussion forums lies in the degree of *integration between communication and content.* Whereas in Wikis and Blogs the degree of integration is very high, in discussion forums the degree of integration is low since these two parts are often completely separated. This also explains the high workload of the e-moderators during our case study: Their main task was to connect communication entries in the discussion forums with the content in the background libraries.

Concerning the CCM and these insights our research reveals that the model only focuses on communication and knowledge transfer aspects but does not take into consideration the role of what we refer to as content (e.g., documents, Internet resources etc.). Thus the CCM has to be extended to cover all aspects which relate to *content*. This extended model, the *Community-Communication-Content Model* will be described in the following Section.

Before doing this, we want to drop some figures indicating how time-consuming the task of e-moderators is to guide discussion forums. For this purpose we differentiate between the tasks of a system administrator and the tasks of an e-moderator: The system administrators' main tasks are the to implement a system with adequate rights and role concepts for the users, keep the system running, maintain any technical problems or help the community members use the system. The main tasks of e-moderators are to motivate members or to keep the discussion on the track (see Section 4).

Results of the studies show that with an increase of members the amount of time e-moderators spent for supporting a community increases much faster than the necessary time needed for administrative purposes. To implement the system including registering the students, uploading the material and granting adequate access rights to the members took about 2 hours during the design phase. During the study, one task of the system administrator lasts about 30 seconds on average. In total four students needed administrative support since they forgot their user identification and further three students were granted with wrong rights. This amounts to a total time spent by the administrator of 3.5 minutes.

To moderate a discussion includes posting initial statements and motivating the members but also keeping the discussion on track, which in turn includes the reading of all statements. The time spent for all e-moderators accumulates to about four

hours if we consider the following parameters of our case study:

- Reading of each statement takes one minute,
- Each student posts six statements with a length of about 5 to 10 lines,
- 141 students participate in the lecture.

In addition, the e-moderator posted initial statements, questions, motivating statements etc. which also takes about one minute per statement. All e-moderators posted a total of 70 statements, which increases their workload by further 70 minutes. Please note, that we do not include the time e-moderators need for login and logout, navigating to the forums, uploading course material and background documents etc.

We found another interesting correlation between the number of statements from students and the number of statements from e-moderators: During the first case study we offered our 141 students eight different discussion forums. One e-moderator was responsible for two forums. In the most active forum the statements posted by the e-moderator amounted to 15.45% of all statements. In contrast to this, in the forum with the lowest activity the e-moderator's contributions were only 1.37% of all contributions.

These investigations indicate that the more active an e-moderator is the more activity is generated in the discussion forum. On the other hand, a high degree of activity of an e-moderator is quite time-consuming. If we look for alternatives which help reduce the workload of the e-moderator, we should take into account that the degree of activity within a community must not be affected in a negative way. We therefore need to find interventions which lead to the same effects as e-moderator statements but at the same time reduce the workload of e-moderators. As mentioned above Social Software tools like WIKIs and Blogs work without the help of e-moderators. One reason for this lies in the tight integration between content and communication which lacks in discussion forums. With this in background we develop the following research hypothesis: *An e-moderator can be substituted or supported, if the social software does not only support the knowledge sharing and transfer through communication but through a tight connection between content and communication.*

In order to prove this hypothesis, we extend the CCM and we prepare the ground for justificative (and not just explorative) case studies. This is why the next section introduces a corresponding methodology.

4 METHODOLOGY

Existing research approaches in educational settings are often not capable of creating sustained innovation. The mostly quantitative approaches turned out to be insufficient in methodology and procedure to effect sustainable changes in higher education and to provide concepts for practical issues. An appropriate approach for the context of innovation in higher education seemed to be Design-Based Research traced back of Ann Brown and her ideas to "design experiments" (Brown 1992).

"Design research is not defined by methodology. All sorts of methods may be employed. What defines design research is its purpose: sustained innovative development" (Bereiter 2002).

The two main aims of Design-Based Research are to understand how people learn, particularly within educational settings and to design ways to better ensure that learning will happen in these settings.

Because this approach is still not very well known, and thus sometimes doubted to be scientifically proven Fischer et al. (Fischer 2003) analysed the Design-Based Research Approach in regard to the principles published by the National Research Council. Some of these principals are (National Research Council 2002):

- Pose significant questions that can be investigated empirically
- Link research to relevant theory
- Replicate and generalize across studies
- Use methods that permit direct investigation on the question

All of these principals are fulfilled in order to be considered as empirical and proved that none of the principles is being breached.

To answer the research questions concerning the degree of integration between content and communication in discussion forums, the necessity of e-moderators and to develop a general concept for knowledge transfer and sharing in communities in higher education, we define systematic setting (or categories) and tag them with indicators. For each indicator a number of interventions was taken and put into practice in two further case studies. Examples of indicators, corresponding interventions and expected results will now be presented.

The basis for defining indicators is a list of the typical roles of e-moderators. Several authors (e.g. Berge, 1992; 1994; 2005, Brochet, 1989; Feenberg, 1989; Morris, 1993; Paulsen, 1995) have attempted to list the many roles or functions of the e-moderator which include: assistant, consultant, contextualizer,

coordinator, editor, entertainer, expert, explainer, facilitator, filter, goal setter, helper, intermediary, leader, lecturer, manager, marketer, mediator, meeting chairperson, mentor, observer, participant, promoter, provocateur, tutor etc. As this list of roles is very long, we select the following tasks of e-moderators.

- keeping members focused to topic
- motivation of participants to communicate
- complying with the netiquette
- acquirement of new members
- elimination of members
- definition of community-aim
- motivation of members to integrate content
- providing and referencing literature
- implementing new communication tools

The main selection criterion is the affinity of the task to our application context. We assign all these tasks to four categories or *systematic settings* – the *community*, the *communication*, the *content* and the *integration of content and community*.

And finally, we define measurable *indicators* for each systematic setting. For example the task "motivation of members to communicate" belongs to the category "communication". The indicator to measure this task is the number of statements made by each member. The systematic settings with respect to WHAT can change are the

1. change of *community* over time
2. change of *communication* over time
3. change of *content* over time
4. change of the *degree of integration between content and communication* over time

The indicators that belong to the systematic settings covering all tasks of e-moderators are.

1.) change of community

Indicators for the change of the community are the size of the community at different points in time and also the constitution of the members of a community. The size is characterized by the number of participants whereas the constitution is reflected by the participants themselves. Within this context, the task of the e-moderators is the acquisition of new and the elimination of existing members.

2.) change of communication

Possible changes of the communication due to the way how members communicate and the content of the communication for example if objective and purpose change. Another indicator is the extent of entries. Within this context, tasks of e-moderators include the integration of new communication tools, the definition of a new community objective, keeping the members focused to the topic and the motivation of participants to communicate.

3.) change of content

Concerning the content the number of documents and the quality of documents can vary. In the beginning of a discussion to a certain topic rather basic literature or links will be used. In an advanced discussion rather specific content will be added. The tasks of e-moderators are to motivate the community members to integrate new content, to provide relevant literature and to continuously leverage the level of knowledge concerning the topic.

4.) integration of content and community

The integration of content and community is the most important setting because characterises the difference between Wikis, Blogs and discussion forums. The only task an e-moderator can do in this case is to recommend literature not knowing if these references are agreed or not.

In a next step each indicator is measured in order to conclude which tasks of e-moderators can be substituted or supported. All these interventions are implemented in two case studies at TU Graz.

5 COMMUNITY-COMMUNICATION-CONTENT MODEL

According to the results of the studies, this section extends the Community-Communication-Model by the dimension "content".

The extended model, the Community-Communication-Content Model (C²CM) (Fig. 2) is based on the CCM.

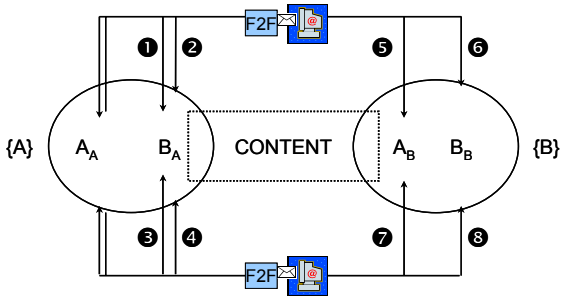

Figure 2: Community-Communication-Content Model.

Up to now the factor content has not been considered in our model. In order to integrate content we consider it to be useful to distinguish between internal and external content: internal content is already integrated in the repository of the

social software tool, external content can be found outside the social software in the Internet (e.g., links or documents), in libraries, magazines or proceedings but can be integrated to the repository (e.g. by referring to the content with a URL).

Additionally, this model supports the different ways of knowledge communication – electronically, supported with artefacts or face-to-face. This shows that the C²CM does not only include virtual communities but also Face-to-Face Communities.

5.1 Justificative Case Studies

Two further case studies were conducted to verify the C²CM and to take measures for the indicators presented in Section 4. The objective was to figure out how the tasks e-moderators can be reduced or e-moderators can even be substituted.

During the design phase of the two case studies all interventions were defined and the resulting rules for communication were reported to the students. During the case studies there were no actions taken by e-moderators. They neither participated by posting any statements nor by uploading documents. This step ensures that we can analyse to which degree an intervention can support e-moderators.

Case Study 2 (CS2) is realized in the lecture "Introduction to knowledge management" (92 students) and Case Study 3 (CS3) in the lecture "Basics of knowledge management", (20 students) using again our knowledge management system. To cover all ways of knowledge transfer and sharing in CS3 the forums are designed in the way that there is one superior discussion forum during the entire semester and specific forums linked to each topic of the lecture. After a certain period of time (six weeks in our case) the discussion of the specific forums continues in the superior forum at a higher level of knowledge among the students. With this design all arrows of the C²CM are covered and confirm the importance of the model as supporting tool for the design and use of discussion forums in lectures.

The importance of communication in this context lies in the support by lecturers to select relevant content. This was another reason for us to integrate communities in lectures and connect content and communication with one another. Often time lacks for discussion in lectures and using social software tools a discussion that has to be finished can be continued later.

One specific intervention to integrate content and communication is for example the duty of students to add literature references which are related to their statements. The students can select from a couple of possibilities: they can either reference documents and links that are already offered to this topic by the lecture team, they can upload files and links themselves and reference these or they can reference content that was found outside the system in the internet, in libraries etc.

To figure out if the students make use of the content and if relevant literature is provided by the lecture team several interventions were taken. We designed different constellations consisting of discussion forums and background libraries containing the content. The purpose was to gain insights about which constellation has which effect on the discussion. For example, one forum is designed as a mix of several documents and links to topics to be discussed in the forum. Another forum provides only basic literature to see, if the discussion ends once the students have reached a certain degree of knowledge about the topic or if the students add more advanced literature to continue the discussion at a higher level. Another forum offers only advanced literature to see if the discussion maybe even does not started because the students are overstrained or if the students integrated basic literature.

What all forums have in common is that there is no literature uploaded by e-moderators during the semester. These interventions are taken to see which forums are likely to stimulate the discussion. We try to offer a broad set of interesting forums, technical and organizational ones, as we had made good experiences in our first case studies. The forums are limited with a number of 20 members – this is about the number of interested students each topic. And additionally each student can discuss in the forum he/she is interested in. As all these forums are obligatory forums additional volunteer forums to free topics are offered to further the discussion without any pressure and duty to communicate.

The measurement of the indicators provides first indications that the requirement to connect discussion entries with content helps the students to stay on a thematic track. Our results also show that through this intervention the number of entries from an e-moderator can easily be reduced by about 50% without risking that the discussions delve into tangential areas (Puntschart 2006). If this trend remains (what we expect), we can conclude that social software can be used efficiently in educational setting. Its effectiveness is guaranteed through the many possibilities which such tools offer (c.f. Section 3).

6 CONCLUSION AND OUTLOOK

In the context of higher education the adequate use of social software tools is of great importance. The use of such tools must fit to the situation of each side, the lecturer and the students. There is a clear evidence that social software tools have the potential to increase the workload of the lectures. This is particularly true if their role as e-moderator requires many interactions in order to keep the community on a given thematic track. However, if content is better integrated into the communication patterns, this integration can substitute or at least support the e-moderator.

We are currently working on a guideline helping lecturers to assess which social software type (e.g, social networking, social bookmarking etc.) can be best used for which type of course in universities. This guideline will also include a catalog of interventions which will trigger the same effects which are triggered by e-moderator statements (Puntschart 2006). The application of such intervention will help to reduce the workload of the e-moderators.

A further aim is to find the way back to traditional universities where discussion was part of studying like the Socratic Dialogues. The new teaching form – the Web 2.0 teaching – combines well tried dialogues integrated with relevant content using new media. The lecturers become reachable for students still keeping distance but communication can be furthered without loosing time.

ACKNOWLEDGEMENTS

The Know-Center is funded by the Austrian Competence Center program Kplus under the auspices of the Austrian Ministry of Transport, Innovation and Technology (http://www.ffg.at) and by the State of Styria.

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