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The Process of Digital Formalization in Sociotechnical Learning Communities – Needed or Overloaded?

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Abstract: The Web 2.0 is often characterized by an informal participation, which means a free cooperation of as many as possible without any restraints from organizations, processes, or technical platforms. In contrast to public communities, an official organization like a company consists of rather formal structures which define what a member should do and how to fulfill a task by assigning a role. If such a formal organization supports a community, does the balance between informal and formal structures will change? This short paper presents the results of a field study about a socio-technical community called 'InPUD' which is part of a faculty. The main conclusion is that a specific degree of digital formalization in online groups is needed for successful online structures and sustainability. By using new media like Web 2.0, the balance between informal and formal structures in institutions will be changed.

Introduction

In the past decade, new forms of socio-technical phenomena emerged, e.g. online communities and virtual networks. New IT applications like Web 2.0 transform social systems (e.g., social groups, universities) into socio-technical systems, where socially and technically supported relationships are highly interwoven. The Web 2.0 is often characterized by an informal participation, which means a free cooperation of as many as possible without any restraints from organizations, processes, or technical platforms.

Recent studies of internet-based communication show trends that social structures in online communities evolve. For example, Viegas, Wattenberg, Jesse & van Ham (2007) studied the Wikipedia community and found an increase of coordination activities from 2003 to 2007. Despite the potential for anarchy in Wikipedia, "the Wikipedia community places a strong emphasis on group coordination, policy, and process" (Viegas et al., 2007, p. 1530). Viegas, Wattenberg & Kushel (2004) also show the behavior of Wikipedians in conflict situations: the most activity in Wikipedia is not writing new articles but controlling the quality of written articles, to rid new articles of vandalism and to act as mediator for two or more authors (e.g., discussions on spelling). To summarize, the studies reveal that the social structure of an online group changes over time.

Is this observation of a community's change also valid for socio-technical communities, does the structure change over time? In contrast to general web based, online or virtual communities in the public such as Wikipedia or Facebook, a socio-technical community (STC) is part of an official organization consisting of formal structures which define what a member should do and how to fulfil a task by assigning a role.

First, the theoretical framework, second the case of the 'InPUD-community' and third the qualitative research method will be described. Finally, the results on the changes evoked by InPUD's dynamic will be illustrated.

A sociotechnical community and its relation to the official organization

In this short paper a socio-technical community (STC) is defined as follows: A STC – depending on content, lifespan and group size (Preece, 2000), and part of an official organization (e.g., company or university) – consists of a structure of informal ties, social relationships of people sharing same topics or problems (Wenger, McDermott & Snyder, 2002) fostered mainly by computer-mediated human interactions (e.g., a knowledge community about study information at a university or faculty). A STC is different from public online communities since a STC delivers a kind of interaction space for enabling informal communication between members and others within an official formal organization, for instance, a university, or a faculty. According to Jahnke (2009), such a community has the potential to reduce social complexity and information overload from the official organization, and makes it easier to get only such information what a member need at a given time.

Wenger et al. describe in their book about "cultivating communities of practice" how to manage knowledge within a company. The authors analyzed four in-depth cases of large firms mainly through observation and qualitative interviews. Their research has leaded them to conclude a description of seven principles for cultivating communities including different degrees of community participation (p. 57). These degrees include: the core group, active members, peripheral people, outsiders and the role of a coordinator. Is this general model also valid for a STC in a university, or will the structure change over time?

Formal and informal structures

A social structure (formal, informal) is a combination of social relations as well as human (inter-)actions. Formal structures are characterized by conventional forms of behavior, and established conventions, for example, behavior which is formally bound by a work contract and a job/task description. By assigning a role, the formal organization defines what a member should do and how to fulfil a task.

In contrast to work groups in companies, where the group members are formally bound, a STC consists of informal connections between members (Lesser & Prusak 1999). Informal structures are rather casual, unofficial, loose and not triggered by any rules (e.g., informal get-together).

According to Jahnke, Ritterskamp & Herrmann (2005), four categories can be used for the analysis of computer-supported structures: assigned position held by individuals, assigned tasks/activities, assigned expectations, and role-playing (defined as a human interaction process). This article concentrates the description of the analysis on two aspects: position and interaction patterns.

- *Position*. The position means the member's position in the online community in relation to others, also known as network position and social relations. Social relations in online networks exist particularly through different patterns of online communication (e.g., who communicates with whom).
- *Interaction*. Computer-supported human interactions are built and changed by individuals by way of their action and communication. The perceivable repetition of interaction patterns can indicate the structure.

A change from informal to a formalized structure is defined as the process of *digital formalization* including changes of social and technical formalizations. When the study show changes in the social dimension like more formal roles, more coordination activities, one can say it is on its way to a social formalization. When the study shows technical changes (e.g., increased complexity of technical features; technical regulation), one can say it is the way of a technical formalization. The research question is: What forms of structures within a STC emerge?

Case study

With regard to the learning paradigm (e.g., shift from teaching to learning; Barr & Tagg, 1995), information and participation are important key factors for designing technology-enhanced learning communities. Different tools supporting the (co-)creation, communication and annotation of information can be used. The support can takes place in different ways and for different scenarios in teaching and learning environments. Either one could focuses on the teaching scenario itself, for example, the communication opportunities within a tutorial, a lecture, or a course, or one could support communication which takes place after leaving the lecture hall and in the time 'between' several courses. A third scenario combines both cases. In any case, such scenarios include for example Web 2.0 communication tools, a discussion board or other applications (e.g., blogs, or tagging tools).

An example that combines both is the InPUD-community at the Faculty of Computer Science at the Dortmund University of Technology (in more detail Jahnke, 2009). The InPUD-community (http://inpud.cs.uni-dortmund.de) launched in 2002 includes an overview of all classes and offered courses. The community provides information about the lectures, including any tutorials that are being held (and when they are being held), course materials, notices for examinations, lecturer contact information and - that is important - several free discussion boards about courses as well as study services (e.g., 'how to study successfully') are also part of it. The communication tool is used *within* lectures and *about* lectures. It range from discussions about course content, definitions or solutions for exercises to organizational issues, e.g. where and when is the next learning group, what could be the content of the examination, or discussions about the teacher's quality. The InPUD-community differs from public communities which are built in people's spare time and which are not a part of a company. InPUD is an extended part of an official organization supplemented to the formal structure. The InPUD-community is characterized by a large size. The primary content of the InPUD-community is knowledge sharing about computer science courses as well as study management issues.

Research design

From 2001 to 2008, we conducted a long-term study based on the design-based research DBR (e.g., Reeves, Herrington & Oliver, 2005), which consisted of several phases of analysis (reflection) and action (interventions) which were alternated and interwoven (cycle of activities). The aim of such a qualitative research design is to understand the social or socio-technical situation as well as to improve its quality. In our case, the study wanted to create a living community system (practical aim) and analyzed if/what new social structures emerge. The major goal of DBR is to generate theory to solve practical problems. Researchers fulfil several roles like researchers, designers, or practitioners.

The specific research phases included eight phases of data collection (in-depth interviews with students, teachers, study managers; quantitative questionnaire, ethnographic online observations, statistics, formative evaluation methods) as well as interventions (including design, development and implementation).

We are using this qualitative paradigm to refer to our field study in which interviews and other forms (e.g., participant observations; written communication in online boards, interviews, talks with stakeholder) from a rather small number of cases are closely read, analyzed, and interpreted. One essential goal was to find new coherences to understand (the possible emergence of) computer-supported social structures and (possibly new forms of) computer-mediated human interaction. We did not have measurable variables before we started our research, since we did not have a clear picture of what was going on in socio-technical communities at universities. In our prior assumptions we expected to observe a change of the structure. However, we had no ideas in which degree or forms it could change. We had the assumption that socio-technical communities are rather informal and would stay at this level over time. Surprisingly, what we learned is: a socio-technical community changes its structure from an informal to a rather formal structure at least in some forms. The results presenting in this paper produces both practical educational interventions and theory generation including measureable variables that can be checked in a follow-up research.

Results

The analysis asked about the change of informal and formal structures in online communities that depend on technically mediated communication. This article describes the results on two aspects: changing positions and interaction patterns.

Ad a) We observed that the members of the InPUD-community develop social relations online. Some people, the core of the community, even built strong ties, e.g. the same community members met habitually at the same discussion board at the same time. Some months later, the relational structure has changed over time.

Since InPUD's launch in September 2002, the number of users has increased steadily. Today, in September 2008, more than 1,470 individuals had an account. This is 73 percent out of 2,000 enrolled students at the faculty. A quantitative survey in December 2008 confirmed the trend: more than 70 percent of the students labeled themselves as a community member ("I am a part of the community").

The number of contributions per individual in six posting categories over the entire period from 2002 to 2008 (September) was increasing. Some members posted more often than others A core of about 270 individuals provided contributions regularly, ranging from 26 to 483 postings per individual. The core members are especially the 'early adopters' and in this sense (from our today viewpoint) the 'elders'. These people have been active since InPUD's early years. The other active members made postings in the range from 1 to 9 and 10 to 25. These members can be described as regulars, but also include novices and visitors (e.g., high schools students, students from other universities).

A split of the numbers of contributions in relation to 2003, 2004, 2005 and 2006 (we excluded 2007 as this year is very similar to 2006 and for 2008 we only have data for September) show a differentiated picture. It has to be stressed, that an average member posted more in 2003 and 2004 than in 2005 and 2006. For example, in 2003 sixteen individuals posted 101 to 200 contributions (each of them!) and in 2004, 21 users posted a similar amount. In comparison, just 11 users in 2005 and 6 members in 2006 contributed so often. In summary, the large number of registered users indicates that the relational structure has changed over time to *more contributors* but the *quantity of contributions per individual has decreased*.

According to the quantitative change, we also observed changes in the forms of communication. We observed the time between questions and answers, and it looks like that the positions (who communicate with whom and in which time span) are changing over time. One finding from the questionnaire distributed in 2003 was following: just in its beginning, 93 percent of the students were familiar with InPUD. Particularly in the first stages of InPUD's development, students were often the only ones who answered an open question. At that period, the community was an informal large group. The active students helped other members and told them "how to ask questions" or informed them that "that question has already been answered on board 6". In the phase of growth, teachers became part of the communication process and affect the STC. A typical example is a question posted in a discussion board of a lecture with 80 students in 2007. The question of student A was posted at 4.27 pm and concerned the question of-what a 'socio-technical system` is. The first answer was given by student B at 4.34 pm – only 5 minutes later. Student A replied and posted a comprehension question at 4.53 pm. Student C posted a comment at 5.30 and student A replied at 5.55 pm, writing "Now, it is clear to me. Thank you!". Just 1 hour and 28 minutes elapsed between the posted question and the acknowledgement of understanding. The following day at 11.48 am, the teacher confirmed the ideas posted by student C and added new ideas and information. Thirty minutes later, student A thanked the teacher as well as the other users again. In contrast to the earlier phases of InPUD, the STC enables its members in the growing phase to get in contact with people in different positions – when needed. But it also indicates that the teachers want to have a kind of control about the communication process. With the teacher's presence, the process of formalization has begun.

A next example describes the change of the typical communication phrases in InPUD. Members who interacted and helped others, also said "thank you" or wish "good luck with exams". The more the community grew, the more communication phrases were observable. We observed a thread without any factual information just with the topic 'acknowledgements'. A student wrote "I only want to say 'good luck' for all of you for the

written examination, and thanks again!" And some members answered with similar expressions and showed their appreciation. Some discussions also drifted from the content to personal interests (e.g., "where do you live?"). Although InPUD is large anonymous group, the STC gives the students the chance to keep in touch with people who share the same problems. We call this phenomenon 'computer-mediated social proximity' since it was triggered 'through' the medium of the technical system (especially through discussion boards for lectures and study management issues). The comparison of three surveys in the beginning (2002), in the middle (2003) and six years later, in 2008, showed a significant difference. The online proximity has increased.

Ad b) The data shows that the community members were primarily students from the Faculty of Computer Science at Dortmund University of Technology, at least in the early years, between 2002 and 2004. From 2005 to 2008, individuals in formal positions participated more often than in the earlier phases.

In the initial growth phase (2003 to 2004), new online interaction patterns (beginning of new roles) emerged, for example active people took the role of promoters, conclusion-makers, decision-initiators and conflict mediators (Jahnke, 2009). More and more, the informal online group has been formalized by its own social structures. The communicative style – also known as 'netiquette', a set of rules governing the behavior of members – affected the structure of the community. One such case in InPUD was as follows: a student was annoyed about a lecture and asked in an agitated tone: "What the hell does the professor do? I don't understand anything!" In response, some students generated a "true vote for the mood in our lecture". Some members commented on the 'unexpected' remark as "not okay" ("You are not striking the proper tone!"), others ignored that behavior, did not answer, and opened a new thread.

In 2002, there were only 5 formal moderators online. The formal moderators, a task that academic personnel are obliged to perform, usually did not moderate often. For example, it ranged from only 2 to 50 contributions per year. In the interview phase in 2003, students told us that a Yahoo group for Computer Science students in Dortmund existed. They described that participation had decreased since InPUD was launched. "There is also a Yahoo group for computer science students in Dortmund. But it's just an independent separate group. Open, no structure – it's just a student self-organised group. Not really helpful. This online group [Yahoo] hasn't a moderator who is from outside; a moderator who isn't from the same group. InPUD has always at least one moderator from the faculty staff. Well, they could actively do moderation more often. But they are there, that's better than nothing" (quote of a student, 2003).

During the stage of sustainable development in 2005 to 2006, more and more formal roles became part of InPUD. Formal roles are, for instance, study managers, professors, lectures, academic staff, and people from the faculty office. This increased to 16 from 2003 to 2004, in 2005 to 2006 this further increased to 45 moderators. It can be named as a specific degree of social formalization. One student said: "InPUD has got more and more professors, lecturers, and tutors than two years ago, and they are more active than in 2003. That's good." [answer of a student in summer 2007].

In the growing phase, the role names of the academic staff were labeled automatically (when they were logged in). This 'online role presence' can be named as a specific degree of technical formalization. For example: "Mr. Miller, Advisor of Study Management" or "Mrs. Smith, Lecturer for Human-Computer-Interaction". The names of the formal roles were visible when members communicate online. One student said: "When I can see who gives me the answer, a person from my faculty or a study manager, I guess this information is often a more valuable contribution than a student's answer". The visible presence of role names affected the help-yourself behavior of the informal student's group. It regulated the social structure and might have improved the frequency of webpage requests, contributions of students and ultimately encouraged the development and evolution of the community.

An interesting result is that experts in particular study counselors, researchers, teachers and academic staff told us a totally different expectation in 2002: "Software tools again and again – that's not the right way", "We have enough information on our websites", "A community is not helpful", "It doesn't work". Even one professor said "It's more important to initiate face-to-face communication – before we cultivate a web based thing". Apparently the views of experts changed as the student moderation in the informal community proved its added value. This shift from merely informal activities to more formal roles and more activities can be explained by the increased adoption of InPUD from 2004-2008. Obviously, the balance between informal activities and formal roles were changing.

Discussion

The results indicate that the balance between informal and formal activities has changed. The STC called InPUD evolves from a less defined structure to a special form of a digital formalized structure.

With regard to the sustainable development of a community, it seems to be important that the first batch of early adopters were making sure that it would outlast the early stages and early adopters. The increase of formal roles (e.g., formal moderators, professors), and their activities, is one aspect for such a development.

So, a certain degree of formalization is a prerequisite for the future sustainability of an online community. The process of formalization in online groups is needed for successful online structures over time. To conclude, a specific degree of digital formalization might be helpful for successful communities.

However, if 'too many' formal roles emerge – more formal than informal – it might impede the continuing sustainability. Therefore, open issues are for example 'How much formalization is too much?' and 'Does *every* informal community need to go through some process of formalization if it is to sustain itself?' Further research is needed to establish if this development to more formal members is a typical one for social networking applications and 'regular' communities.

Besides these new insights, it has to be mentioned that the study reflects a special type of a community: the STC emerged 'into' or as part of an existing institution. So, the results are limited to such social institutions (e.g., universities), non-profit-organizations or companies. Communities on the Internet are often 'pure' communities without a connection to institutions ('leisure communities'). Future work should be research if our results are valid for public communities, too.

Conclusion

The analysis of the InPUD-case showed a change of social structures. We have observed that computer-supported human interactions and communication processes can lead to new rules: primarily informal structures can initiate the process of formalization. In the stages of growth, the online community formed new formal structures. For example, the InPUD-Community created new social conventions (e.g., more activities of formal moderators). Such social mechanisms affected the process of formalization. The study pointed out that the balance between formal roles at a faculty and informal activities has changed. The results indicate that the InPUD community has been formalized to a specific degree of digital formalization (please find a more detailed analysis in Jahnke, 2009).

Additionally, the study showed that more and more formal roles have been integrated into the online community. The formal structure of the mentioned faculty is on its way to a more informal structure. It seems to be that the faculty structure has been run through a process of a *de-formalization*. We need more studies to research this.

To conclude, the usage of new media with Web 2.0 characteristics can affect the balance between formal and informal social structures in organizations. Online communities – as new forms of computer-supported social interaction – establish a new combination of formal and informal structures within institutions.

However, the results presented in this paper are based on a qualitative research method called DBR. Thus, the results – about the new theory of the changing balance between informal and formal structures by new media like a STC or Web 2.0 – provide measurable variables that should be checked in a follow-up research.

Further research should focus on the question of 'Do formal structures impede socio-technical learning communities at universities, and if yes, how much? Does *every* (or just specific types of) online communities need to go through some process of formalization if it is to sustain itself?' We have to find answers to these research questions to further our understanding of such phenomena as we move from a social to a socio-technical educational system.

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