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Patterns of Knowledge Sharing and Knowledge Creation in New Information Environments

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Abstract: Do the knowledge sharing and creation processes in collaborating groups benefit from the use of new information environments or are the environments rather inhibitive to the development of these processes?
A number of different studies have shown quite varied results when it comes to appraising the importance and value of using new information technology in knowledge sharing and creation processes.
In this paper we will try to unveil the patterns appearing in the use of new information environment and the users' understanding of the significance of using information technology in knowledge sharing and creation processes. The aim is to obtain a deeper comprehension of which factors determine whether the use of information technology becomes a success or a failure in relation to knowledge sharing and creation.
The paper is based on three previous studies investigating the use of information technology in group work in learning processes: "Scenarios in computer-mediated and net-based education"[1], "CLIENT – Collaborative Learning in an International Environment"[2] and "RUC-online"[3]. Data in the studies is gathered through questionnaires, semi-structured interviews, focus-group interviews and observations.

Introduction

Following the development of information technology and the increased popularity of the PC and the Internet, the idea developed to broaden the usage of information technology at Danish universities to aid in the teaching and learning process. Several universities have started experimental projects where computers and Internet are used, and have targets regarding IT-development written into development contracts with the Ministry of Science, Technology and Innovation and the Ministry of Education.

The idea to promote the use of information technology was also popular in political circles, particularly because it is a common political vision to make Denmark a leader

[1] "Scenarios in computer-mediated and net-based education" was an attempt to identify suitable computer-mediated and net-based forms of interaction among students, between students and teachers, and between students and computers. A central aspect taken in consideration was the pedagogical principles at Roskilde University and the valuable social processes that are the outcome of these principles. The research project took place at Roskilde University 2001-02.

[2] The CLIENT project was a two-year project, 2001-2003, funded by the European Commission under the Socrates-Minerva program. In the CLIENT project students from different universities of four countries worked collaboratively on a problem-based assignment in an international, virtual setting where all contact between the students, tutors and the company involved, took place through ICT technologies. The project addressed collaborative learning on the basis of a problem-based approach and specifically focused on the impact of the international context of the learning process. The project consisted of two experiments, a pilot project from February 2002 until May 2002 and the main project from September 2002 until December 2002, where 27 students of four different countries (Denmark (Roskilde), England (Salford), Norway (Tromsø) and the Netherlands (Maastricht)) collaborated in three groups on an assignment developed by the company Océ. The focus was on how the participating students in the groups managed to work together with participants from different countries, representing diverse educational cultures and different disciplines.

[3] "RUC-online" is a research project established in September 2003 in connection with new ICT facilities implemented at Roskilde University. The research team has been evaluating the results of these enhancements and investigating how the pedagogic, the didactic and the study life are influenced by the use of ICT.

in technological development, but also because of an assumption that IT could make the teaching-learning processes increasingly efficient.

In 1999 an ambitious IT project for higher education in Denmark was launched: The Virtual University. The purpose of the project was to create a framework for co-operation between Danish universities and other institutions of higher education in the fields of Internet based programs and adult education courses, and to support the development of flexible Internet based educational options. The project has since been cancelled and replaced by a more limited co-operation among the universities with a joint web portal, www.unev.dk, which allows the user to use the Internet to gain knowledge of the universities' offers of programs and courses.

The many ideas about how to use information technology in the university setting have to a large extent been based on traditional ideas concerning learning and experiences from the business world, where the information technology has most definitely helped rationalize and streamline work processes and where e-learning has showed to be a helpful tool in educating the employees.

However this approach has turned out to be flawed, particularly at Roskilde University (RUC) where studies are organized as participant-directed, collaborative, problem-based project work in groups, with an interdisciplinary approach. This means that the students are spending half of their study time working in project groups. The pedagogical principles at RUC imply that the learning process is more similar to the process of learning through socio-culturally organized cognition as it is seen, for example in research than to a traditional teaching process with lectures.

This also implies that the type of IT system feasible for supporting this kind of learning processes will be *systems supporting collaboration* and *knowledge sharing and creation* in groups like CSCW systems (Computer Supported Cooperative Work), which is the most evident type of system to support students collaborating in problem based, project oriented group work rather than traditional LMS/VLE (Learning Management Systems/Virtual Learning Environment) solutions.

Use of New Information Environment in Project Work

On the basis of a number of different student initiated experiments with ICT, the experiences stemming from long-distance learning programs, as well as the requirement that Danish universities develop and utilize ICT possibilities and, in the case of RUC, the university's own desire to take the lead in developing new usages for the technology, RUC decided in September 2003 to invest in a large-scale ICT project. A central element of this project was to give all students access to the CSCW system, BSCW, which supports group based project work.

Scenarios in computer-mediated and net-based education

Before implementing this decision, RUC carried out a research project, "Scenarios in computer-mediated and net-based education," which attempted to identify suitable computer-mediated and net-based forms of interaction among students, between students and teachers, and between students and computers. A central aspect taken into consideration was the pedagogical principles at Roskilde University and the valuable social processes that are the outcome of these principles. The research project took place at Roskilde University 2001-02. The report from this project can be found at: http://www.cncl.ruc.dk/publications.html

This research project identified a number of experiences of students and advisors in different projects, which indicated a number of advantages in connection with the implementation of a student focused system that supported collaborative processes and knowledge sharing.

Client

A second research project to precede the ICT project at RUC was the CLIENT project, a two-year project that ran from 2001-2003, which was funded by the European Commission under the Socrates-Minerva program. In the CLIENT project students from different universities of four countries worked collaboratively on a problem-based assignment in an international, virtual setting where all contact between the involved students, tutors and the company, took place through ICT technologies. The project addressed collaborative learning on the basis of a problem-based approach and specifically focused on the impact of the international context of the learning process. The project consisted of two experiments, a pilot project from February 2002 until May 2002 and the main project from September 2002 until December 2002, where 27 students of four different countries (Denmark (Roskilde), England (Salford), Norway (Tromsø) and the Netherlands (Maastricht)) collaborated in three groups on an assignment developed by the company Océ. The focus was on how the participating students in the groups managed to work together with participants from different countries, representing diverse educational cultures and different disciplines.

The CLIENT research showed that the access to virtual cooperation and collaboration tools, even less sufficient ones such as the LMS ClassFronter, resulted in a number of advantages of virtual collaboration, which would also be gainful in situations where the geography does not necessitate the use of ICT in collaborative processes.

These conclusions are supported by evidence from a number of long-distance education programs, where different ICT solutions have been employed to support the students' communication within groups and with their supervisors. These programs seem to indicate that the use of ICT can produce new possibilities to improve the collaboration and learning processes in the groups. Based on these experiences, it seemed evident for RUC to include access to a tool to support group work, such as the BSCW, in the ICT project

RUC online

As part of the ICT endeavor, RUC decided to attach a side-project, RUC-online. This is a research project established in September 2003 in connection with new ICT facilities implemented at Roskilde University. The research team has been evaluating the results of these enhancements and investigating how the pedagogic, the didactic and the study life are influenced by the use of ICT.

What characterizes the successful cases

In the above-mentioned research projects, which preceded the ICT improvements at RUC – The Scenario Project and the Client Project – students and teachers identified a number of advantages for the learning and knowledge sharing processes. These advantages as further described below are related to the communication and writing processes, the reflective and socio-cultural cognitive learning processes, collaboration and to new, multidimensional qualifications and competences.

Text Based Communication

In group work, as it traditionally has been performed at Roskilde University, most discussions and decisions take place at group meetings. When using a CSCW system to support the group work, a lot of the discussions move to take place within the virtual learning environment instead. This means that traditionally oral, face-to-face communication becomes text based and mediated.

It appears that the project work becomes more transparent when words are written instead of spoken and disappearing with the sound. It is always possible to go back and reread the written words, whereas it can be difficult to recall what was said half an hour ago, even for the person speaking.

During the different phases of a project there are periods where the written mediated dialogue serves very well, while it is at other phases necessary to meet and have the face-to-face dialogue. Particularly at the point of decisions the group usually needs the face-to-face meetings or at least to engage in a synchronous dialogue – like a chat, instant messaging and/or a VoIP system, that enables people to make telephone meetings via the Internet.

On the other hand the students emphasize that the group meetings get much more effective and efficient when using a CSCW system:

> I believe for sure that our group meetings are shorter than if we had worked the other way. You always know what you are going to discuss at the group meeting. You always know what has been going on. It is never totally unknown to you what the rest of the group has been doing. (Lerche et al, 2002 (our translation))

BSCW is a sufficient tool when working with texts that have to be commented, revised, versioned, etc. It offers members of the group access to each other's papers and enables insight into one another's writing and work processes. The system is especially efficient when it comes to sharing and distribution, and it moves the focus from the spoken to the written construction and presentation. This change in perspective creates new opportunities for communication.

Writing Culture

Also the writing process of the individual students and in the group changes significantly when a CSCW system is used during the work process.

One of the students describes how her writing process has changed through her use of BSCW. Earlier her working habit was to work on her drafts longer time and rewrite them before sending them to her group members. Through the use of BSCW she now has the possibility of experiencing different kinds of writing processes, and she can focus on how to do it in an optimal way. Another student explains that they are meta-communicating very much about the texts:

> We are writing a lot about what we are dealing with, why we are doing it ... if it is coming straight from the heart or if it is a result of heavy reflection. Then we are writing small parenthesis also within the text: (I don't know if this is exactly relevant for us;), (I think it is a good idea to take a discussion just on that). (Lerche et al, 2002 (our translation))

BSCW can on the one hand motivate or inspire the participants, though also lead to anxiety about not being able to perform well enough, since they are constantly feeling the pressure to perform and to show their work, in its early stages, in a public sphere.

On the other hand the BSCW system offers the possibility for quick presentation and a softening of the borders regarding how completed a text should be before making it public. One student describes that she is experiencing that there is a drive or incentive in the system: "That there is something to be uploaded or placed in the system for another person to see, it is crucial to start constructing the text, and then you just should get on board and start writing."

The application opportunities with a tool as BSCW should also be seen in relation to existing cultures of writing. As an example, a student tells that she earlier needed to read much and then had the habit of composing the whole text in one go after her phase of reading. Her way of working has changed in the way that her writing processes now "clearly has become much, much better."

Reflective Learning and cognition

It has become evident that the use of the CSCW system can open up the conscious awareness of, and increased reflexivity about, what is going on in the study and work processes. If the students continually gather and structure their documents throughout the process, they can develop competencies to organize differentiated parts, to see the wholes as well as the component parts in their mutual relationships. During the flow of work, the process results in a range of material, and the participants build upon these in the structuring of the final report. Thus letters, proposals, draft versions of documents, etc. become stored in the system. The availability of this material gives rise to the unique possibility to trace, reflectively evaluate, and critically redirect one's involvement in the ongoing course of events in group and study processes.

Of special value for a group in its working process is the possibility of automating the versioning of documents being uploaded to the CSCW system. When a number of people continually and progressively work on the same document, this makes it much easier for the group members to keep track of the changes being implemented.

The following reflections on the use of the system can be seen as an indication of this:

> The primary aim for using the CSCW system was our wish to have the many different working papers from throughout the project assembled: the BSCW system is quite well suited for storing documents, links and the like. In addition there are facilities for version control of documents, which is an important resource when there are several persons working in tandem with the same documents. (Lerche et al, 2002 (our translation))

When a user looks through a file and folder structure, follows the threads of the intricate web of discussion and orients oneself to the changes made in the documents, a clear possibility for improved reflection and ongoing evaluation becomes available. This can be seen in contrast to group work where you merely draw on the verbal discussions in face-to-face meetings and where group members individually save different versions of their work on their personal computer.

A quote from one of the students illustrates how the fact that she has been forced to work explicitly with her working habits has developed her reflection and cognition process:

> … has pushed me into a position to compose over and over again as a process of reflection and cognition instead of attaining that situation by reading intensively and writing the whole paper in one process. In the new way of doing it I get much more layers of the stuff along ... I feel that in this way, you get more

> nuances in the picture because you are constantly reflecting on the aspects you are writing and when you are reading it all over again you manage to obtain new, deeper understandings. (Lerche et al, 2002 (our translation))

Through the writing process, where the students continuously attempt to formulate and mediate something that they have not yet cognitively recognized, they are forced to make some considerations that are difficult but highly self-educational.

Such experiences can also be found in the research regarding the process oriented pedagogy of writing. Findings here indicate that the production of identity, knowledge and culture is enabled through such interactive processes.

The Norwegian researcher Olga Dysthe draws our attention to the relationship between dialogue, interaction, and learning and hence knowledge production is made possible through the writer's desire for expressing opinions and experiences in a more spontaneous way. And through a CSCW system it is easy to have such direct expressions confronted with peer students' feedback. A process of writing, dialogical confrontation can lead to a deeper analytical competence and a mutual interpretation (Dysthe, 2004).

Usually the mediation contains knowledge, holds a message, which the author wishes to share with others. In this case, however, the process of mediation of knowledge *in itself* functions as a valuable and challenging tool for achieving further cognition. With Schön (1983) it can be argued that the study- and learning process contained learning as well as mediation praxis and the continuous reflection connected with it.

Collaboration vs. cooperation

In the CLIENT project, the participating students from the UK, The Netherlands, Norway and Denmark were organized in groups and asked to work together during a period of nine weeks write a report regarding construction of a product and furthermore produce a process report with their reflective evaluation of the process. For almost all involved this was a new and challenging experience. At the same time the students found it difficult to work with people representing different educational backgrounds but also very challenging and enriching.

> … the project that has been undertaken, although difficult and challenging, has enabled the participants to gain an insight into the nature of working collaboratively in an international environment with different cultures. Valid knowledge has been gained on the dedication required to complete a project in such an environment. (Lerche and Meyer, 2003)

The Norwegian students write in their process report:

> At the University of Tromsø, project working as an educational method is not commonly used. We know that the other universities involved have a more project-related way of working. We thought that the other students would understand the task easier, and this could have led to us not being an active part of the group. Lucky for us, this did not happen. We saw ourselves as equals with them with respect to work amount and participation. (Lerche and Meyer, 2003)

It was not an easy task for students from different countries brought up with varying educational cultures and having different views regarding authority structures, to work together. Students from RUC are accustomed to self-directed project work in groups. It was very interesting to observe how guest students at RUC from Germany

and France took an active role in the process. The French student writes: "First of all because being myself a foreign student in Denmark, I came here mainly to discover other ways of working." The two German students visiting RUC were enthusiastic, active and talented in making use of the new opportunities. They were outgoing, pro-active, and came with many proposals and suggestions concerning how to deal with the structure and organization of the group's work.

It did happen that students from the universities representing more traditional educational cultures were hesitant to the proposals from the German RUC students. Some of the British students showed anxiety about whether their professors would approve of the suggestions. Students representing such educational culture and personal authority structure had the attitude of waiting for approval from their local professors.

In the long term these students might eventually learn something regarding independence from the more daring RUC students. However during the cooperative study process some of those more cautious students got irritated, thinking that other students were controlling the groups output.

The main conclusion however is that the students in this experiment were not only receivers of the information presented by the professors. On the contrary they had to play an active and pro-active role, to make plans for their work, to organize and to structure the information they were gathering. Thus they themselves had to construct their own knowledge through negotiation of meaning and to foster mutual accountability and engagement. In their process report one of the groups explain:

> There was no one hanging over our shoulders to make sure we did what we were supposed to do during this project. We could choose to do nothing at all if we wanted to, just let the others do everything. Thus we had to have some self-discipline in order to get things done. We feel that we managed this part just fine, and we feel that all members of the group have shown interest and contributed to the final result. (Lerche and Meyer, 2003)

At the four universities it could sometime be difficult to arrange meetings locally for the students situated there. Similar complications occurred when chat meetings among the distributed group members across the four universities were to be organized:

> Sometimes individuals would not turn up to group discussions consequently, issues piled up and things were being repeated, wasting time. In addition, tasks which were intended to be done by an individual, could not be completed in time, so therefore the responsibility of some the tasks was passed on to another, who did not have efficient knowledge and skills to complete the task. However the way the team developed this strategy, I feel this was strength in itself. (Lerche and Meyer, 2003)

This student continues his reflection by stating: “For many of our group members, team working alone had been a whole new experience, let alone the fact we had team members from universities abroad.” The French RUC student sums her experience up:

> The Internet is a fast way of communicating and it also breaks bounds of space, i.e. the European students involved in the project gathered in one unique place. Secondly, that communication is never easy above all between people with different backgrounds (study, personal, environment). We all have to do efforts to be understood while using simple words or to explain in an easy way so that it can be accessible for everyone. Thirdly, that working together means: to agree

> altogether, to take decisions, to share the work, to be involved from the beginning until the end, to participate as actively as possible, but also to be patient and diplomat. In brief, it is a good experience and also a kind of responsibility that each student has to be aware of because we work for a team; the constraints are omnipresent and tough. But at the end there is a satisfaction of doing well your part and by the way to success into collaborating. After all, we shared the work, each writing about its own field of study, so we did not really learn about each other's specialty. Due to a lack of time, we could not share our knowledge, as we did not really try to know each other privately. (Lerche and Meyer, 2003)

The way of organizing the work together among the Client students must mainly be called cooperative. They agreed on organizing a kind of division of labour, where each person took responsibility for his/her portion of the work.

A more engaging way of doing work together is to act collaboratively. This involves a process of transformation, one filled with challenges and unknown problems. It is also a dynamic, stimulating and socially challenging process where the students, working collaboratively, have to organize work, make decisions and evaluate their results. The setting is that of participant control and collaboration, and the approach is often inter-disciplinary. Their work will involve negotiations, dialogues and inquiries relevant to the field they have engaged in.

In the words of Etienne Wenger (1998) this type of learning may be characterized as joint enterprise, mutual engagement and shared repertoire. Students have a mutual obligation for designing and carrying out the project, and normally considerable mutual engagement will be fostered.

The examples from the Scenario project have showed us that even this kind of collaboration can be supported through the BSCW system.

Multidimensional qualification

Many of the students in the Scenario and the Client Projects have pointed out that, during the working processes, they had achieved not only professional qualifications, but also had to use their time to develop abilities in using the new ICT tools.

> The way I used ICT before entering RUC was more like a typewriter. I wrote the draft by hand and only made the final typing on the computer. I have always felt that computers and technique was a big mystery ... Then I started at Communication Studies with all the workshops: Photoshop, PageMaker and different editing tools. We were making a sound/slide show and as representative from our group I followed the introduction to the tools. I don't understand why I was chosen as the representative but I felt an enormous responsibility. I had to understand it to explain it to the rest of the group. I believe this was the first time I actually played with the computer. And then – out of a sudden – it was really cool to edit the sound track ... Then I entered the ICT cluster where we were forced to use BSCW. And in my group we ended up using it as a tool to collect our empirical material ... Anyway I got so keen on using BSCW ... that I ended up as a kind of "webmaster" in my next project organizing and sorting the folders. (Lerche et al, 2002 (our translation))

This development of qualifications different, from the traditional academic qualifications students achieve during their studies, is a sign of *multidimensional qualification or competence*. In a way one can argue that such development of

competencies is equivalent to Lave and Wenger's understanding of learning, which focuses on the changing participation of the subjects in their movement through many different contexts in their daily lives (Lave and Wenger, 1991). According to this view of the learning process, learning occurs in any social setting within the frames of a community of practice. It is exactly through the active participation in concrete practice, and by the experience of ownership of the situation, that the work becomes meaningful and learning takes place (Wenger, 1998).

Self Directed Work in the CSCW System

As can be seen, an appropriate use of the virtual learning environment can clearly contribute to an improvement of the project work processes normally located on campus. But the system also has some drawbacks from the viewpoint of students.

The more documents there are, the more difficult it is to maintain an overview of the folder and file structure, especially when quite different types of documents are placed in the archives. Transparency diminishes and navigation becomes difficult if not impossible. This can be seen from this student statement:

There is great variation in how much or how little use individual students make of the virtual learning environment. Some log in every day, others only seldom and reluctantly. For a project group it is vital that an agreement is reached on rules about this and to develop a common communication and work culture. It can be quite demoralizing if some of the students do not log in, make rare use of the system and only rarely contribute with information, references or links.

Another consequence - to which there are mixed reactions - is a gradual removal of the difference between work and free time. Parallel to the general condition in society today our work and study conditions become extensively flexible:

> Well you could go in and look at the folders in the CSCW system several times during the day. Sometimes there wasn't anything new and at other times there was a whole pile of messages and new files. We were six people in the group. If each one had sent two pages requiring comments the next day or the day after, well then there were twelve pages. And if you should also manage to write something, then suddenly it was just – you were kind of keeping your nose to the grindstone … but it seemed to me that we worked and read and wrote a lot all the time. (Lerche et al, 2002 (our translation))

Generally the idea of "project and group work" presupposes that students invest a great deal of time and energy in the process. Such engagement arises from students themselves choosing the problems with which they will work. Our experience is twofold, manifesting central aspects of Piaget's notion of accommodation. The ongoing flow of the project has its ups and downs, swinging between periods of confusion, defeat and frustration and periods marked by feelings of breakthrough, relief, joy. Underlying this ambivalence is an ongoing feeling of deep engagement throughout the whole process. The intensity of work even increases throughout the whole sequence, culminating in an energetic final spurt during the last two to three weeks where the project report must be finished. All in all these processes are similar to those found in many modern work settings.

As becomes evident in the reflections above, this modern technology – characterized by its provision of possibilities for ongoing corrections, rewriting, collation of materials, development of layout, negation of time and space, removing the borders

between university and home – provides facilities for furthering the processes whereby students not only write and read a great deal and put an unbelievable amount of work into their projects but where they can also develop reflexive and critical competencies.

Experiences from the first years after the big ICT improvements at RUC

In September 2003 RUC introduced a major ICT initiative including a portal "Portalino" giving access to administrative and information systems at the university, wireless network on campus, attractive offers to buy computers and access for all students to the CSCW tool BSCW. The aim for RUC was to be the leading Danish university in the use of ICT technology and thus make the university more attractive for new students. The ICT improvements were accompanied by information material, introductory lectures, workshops and helpdesk for support. As this was a remarkable investment in modernizing the information technology at RUC and it was expected to widely influence and change everyday life and studies, a research project, RUC-online was established to follow and document these changes. After the above described sparse but successful experiences the expectations were that especially the BSCW system would be an important factor in the changes so the research has especially been focusing on this part of the improvements.

The empirical material is based on questionnaires to all students starting at RUC in September 2003, observations of the students' use of BSCW in their project work, interviews with teachers and coordinators after the first year and statistics from the ICT systems.

The questionnaires showed that the students' prerequisites for using the technology were good. Nearly all students were familiar with e-mail, word processing and internet and 93% had access to computer and 77% to the internet from home. 90% had knowledge about the ICT offers at RUC and after the first semester 66% of the students had tried the BSCW system and 59% had used it in their project work. Scattered examples showed that BSCW was sometimes were used very actively and innovatively in ways where the students really benefited from the use of the technology. An example of this innovative and benefiting use origins from the Basic Science Studies where BSCW were used as a tool to support the organization and structuring of big quantities of literature:

> Our projects are based on a broad range of input primarily articles both scientific and reports and here I have experienced BSCW as a necessary tool. With access to ICT and internet the students today are using many more primary sources and because of the increasing number it is important for the group to have a tool to organize and get a common view. This tool is enhancing the students' possibility to get this overview over the complexity. (Meyer, 2004 (our translation))

Also in connection to the lectures there are examples of good and advantaging usages. At the Basic Science Studies, BSCW has been used since 2002 as a tool that offered the teachers the possibility make different material accessible to the students without interfering with copyright questions.

> If we made a webpage we couldn't publish everything, as we wanted because some of the materials are protected by copyright but BSCW gave us the possibility to publish the stuff to a closed forum. (Meyer, 2004 (our translation))

Now BSCW is used very systematically to publish lectures, PowerPoint presentations, assignments, complementary course material, links and course calendars.

Another example took place at the Basic Studies in Humanities where two teachers responsible for an introductory course in philosophy chose to use BSCW as a common forum for discussions among the students:

> We used it to discuss some of the problematics related to the lectures we gave. The lectures only served as introduction, which should give the student a framework or an overview over the philosophic ways of thinking. Through BSCW the students got the possibility to get deeper into the discussions than a 2-hour lecture with 90 students offers. (Meyer, 2004 (our translation))

As this was an untested experiment for the teachers, they approached it very openly establishing a folder structure but still open to changes and enhancements:

> We saw this as an experiment, so to a start we had simply made one folder for each lecture and one for each project group in the house. Then we told the students that they could enter the lecture folders and comment on anything we had said during the lecture or they could enter their group folders and make philosophical or theory of science based contributions related to their project work or they could set up new folders for discussing any philosophical issue they were inspired to during the lectures or the discussions in their group work. (Meyer, 2004 (our translation))

The experiment turned out to become an overwhelming success with 70 diverse discussions on different topics beside the discussions related to the lectures or the project groups.

Finally the house for International Cultural Studies chose to use BSCW as a kind of intranet for all the students, teachers and administrative staff in the house. It was made as a common folder for the house, with subfolders for courses, seminars, project groups, calendars, evaluations etc. where everybody had the possibility to add input the relevant places. The house secretary saw the use of BSCW as a major advantage compared to the previously used solutions:

> It has been an obvious advantage that the students have had access to any relevant documents ... that there have been constant access and also access to material from previous semesters. (Meyer, 2004 (our translation))

A consequence of the two experiments at the Basic Studies for Humanities is that the frequency for use of BSCW is much higher in the three involved houses than anywhere else at the Humanities. In the involved houses nearly 95% of the students used BSCW while only 59% used it in the remaining houses.

When studying the use of BSCW in the project work it is apparent that the use is not as significant as could have been expected. Almost half of the groups did not use the system at all and many of the groups only used BSCW as a joint, rather disorganized archive. Further it showed that the use of the system was declining as time passed by.

Evidence of use of the system as a tool for genuine collaborative work is quite rare, and only few groups at RUC are engaging in alternative work patterns discovering the possibilities of a system as BSCW and of using the net medium as instant and complete documentation, transparency in decision-making and planning, the possibility of grasping at a glance the present state, structure and history of a discussion theme – not to mention the degrees of freedom offered by the fluctuating

time/place interrelations (Heilesen and Nielsen, J.L. 2004).

The reasons for this are many. Among the teachers and the administrative staff BSCW is primarily considered as a tool for the students to support their project work among the teachers.

> We talked about that BSCW at the start of the semester but it was primarily about help and support to using the system. But as it is the students' tool they have to find out for themselves. (Meyer, 2004 (our translation))

Some supervisors consider the tool as an offer for the project groups but they do not reflect on if or how the students use it. Solely e-mail is used in the communication between the students and the supervisor. The position is reflected in this quote:

> What you need as supervisor is something on print from the students you can read and comment on. You don't need a virtual forum for that and as a supervisor you have no need to participate in the students' forum because you don't have time to participate or follow their working process. (Meyer, 2004 (our translation))

Others have used BSCW in the supervision because the students have invited them or because they have actively tried encouraging the students to use it. Most of those are using BSCW as a joint archive, which is not significantly different from using e-mail. The supervisor engagement in the process varies from fetching papers on demand to actually participating in the students' discussions and work processes.

The importance of the teachers encouragement of the use of BSCW in the project work is formulated by one of the secretaries:

> I believe the use of BSCW in the project groups is very much influenced by the supervisors approach to using the system. A few of them don't feel like using BSCW and I don't think their groups are using it either. (Meyer, 2004 (our translation))

Barriers and problems

In the study based on observations among students using BSCW in their project work (Pors, 2004) several barriers against using the system were identified:

1. The barrier for getting accustomed to BSCW is rather high. Instruction is necessary to use even the most basic functions as upload or the more advanced as version control and other techniques for common writing of documents.
2. The integration to other infrastructures is poor: Mobile devices or e-mail could be used to inform group members about changes.
3. The categorizing of big quantities of literature and other input is difficult. The groups tend to lose the broad view during the project work.
4. Knowledge about BSCW among teachers and supervisor is very limited.
5. Access to a broadband or similar fast connection is necessary to get BSCW to work satisfying. The many refreshments of the window and the exchange of big documents require a capacity larger than the one a modem connection can provide. A slow connection to BSCW can be a threat against the dissemination of the system, as the navigation will be demanding a lot of patience.
6. In general the interface of the system is complicated with cryptic symbols and

> a time-consuming procedure for uploading documents. Further the facilities discussions are too complex to use. The students never adapt them because the implementation in BSCW is too obscure and the text-based communication doesn't support all aspects of the discussion in the group.

The interviews with administrative staff, teachers and supervisors also unveil problems and barriers for using BSCW. The problems and barriers experienced in the use of the new ICT facilities can be divided into technical problems and more psychological blockades or barriers rooted in personal opinions.

Technical problems

The technical problems have been few and mostly temporary. Still, these problems did in some cases have consequences for the way the new technology was adapted.

> We had the problem in our house, that the network was not ready when the students started... And these problems had as consequence that we were not quite aware of the possibilities BSCW offers. (Meyer, 2004 (our translation))

The interviews showed a significant insecurity about who is entitled to get support and extended help. Many assumed that only first semester students had the right to get support and workshops:

> Last semester we had all the introductions. Are we allowed to ask for another workshop because we have forgotten how to use the system? (Meyer, 2004 (our translation))

Many had the expectation that the students should ask the secretary in the house if they needed help, a task the interviewed secretaries definitely do not feel they can handle.

Barriers

If the technical problems have been only few, the problems rooted in personal attitudes or psychological factors have influenced the use of the new facilities considerably. It seems though there are significant differences here, depending on the department.

Not surprisingly the staff at Science Studies considers ICT as a tool that is naturally used by both teachers and students, and there is no experience of difficulties in getting the students to use the technology:

> I don’t know anyone among the new students who don’t just go straight to the computer. Everyone is familiar with Word, PowerPoint and Excel. (Meyer, 2004 (our translation))

In Social Science the general opinion is that the students ought to learn to use the fundamental ICT tools during their basic studies. Also it is accepted that the students need help to become skilled at this the same way as they are supported in learning other methodological competencies.

> I don’t think they should leave this place without being familiar with for instance Excel and PowerPoint and when they are entering the Graduate Studies they are expected to know how to use these tools. So we have to secure that they can. (Meyer, 2004 (our translation))

Contrary to this, the general opinion at humanities is that ICT is an *offer* to the

students, which they can decide to use if they wish and this is definitely not something the teachers need to care about.

These differences in attitudes to the role of the ICT facilities are reflected in the teachers' willingness to use the facilities themselves. While the teachers at the Science Studies jump into using it without hesitation, the teachers at Social Science and especially the Humanities are remarkably more reluctant.

The reservation against using the new ICT facilities is primarily rooted in three factors:

1. A general satisfaction with the existing solutions:

> It would have been more interesting if we felt there was a lack in the way communication is taking place through e-mail today. And we actually don't experience any shortcomings. (Meyer, 2004 (our translation))

2. The general barrier against starting to utilize new systems. Especially a system like BSCW, which in no way is self explaining and where even the most fundamental functions demand an introduction as the comments below indicates:

> I don't know for what and how to use it, as I haven't got any introduction
>
> The few times I have looked into BSCW I have had difficulties finding the things I was looking for.
>
> That's what I mean it's not self-motivating. I can't imagine even a student from the UK who perhaps had more access than some students just coming in, logging in and doing BSCW, (Meyer, 2004 (our translation))

The research does not indicate anything about age in relation to the barriers against using the system, age is mentioned as a factor by some of the interviewees so maybe this aspect should be taken into consideration when planning introductions and courses as suggested by this teacher:

> Most of the administrative staff at Social Science is above 55, which means they need an introduction. They are very familiar with the tools they are using today, but a new tool requires an introduction. (Meyer, 2004 (our translation))

3. The third type of barrier, which was presented in different variants is the one based on some form of cost-benefit calculation: Will I get more work without gaining similar benefits?

> It is simply a matter of cost-benefit. How much time am I going to spend on this and what do I believe to get back ... I must admit that I am considering carefully because my experience with ICT is that it takes a lot of time. I need a clear belief that I will save time or get other advantages in the long run before considering this. How will my daily life get easier or my supervising become better? Where will I save time or get a better pedagogical practice?
>
> If you are going to use (BSCW) in the supervision it will actually result in much more workload on the supervisor as it will be assumed you follow the group much more actively than usual. It is more unstructured, you have to log on yourself and you will easily end up supervising in the use of the system instead of the project work.
>
> BSCW gives the student the possibility to load big amounts of drafts on the

> supervisor instead of considering where the group really needs supervising. (Meyer, 2004 (our translation))

Even among the teachers who have actually used BSCW there are reservations. The teachers have to consider very carefully which tasks they wish to take so they do not end up doing work, which is actually the students own responsibility. As a novice in BSCW, the teacher very easily ends up doing much more work than usually. The system offers the teacher the possibility to follow the process of the group work but the price will be that he has to do a lot more reading.

Furthermore there are barriers based on pedagogical principles. They are most clearly formulated in relation to the lectures:

> I use the blackboard and that is a pedagogical choice ... the students are less aware and active if they think they can get the presentation afterwards. They don't listen properly ... When I use the blackboard I can develop things. You can tell if the students don't understand and make another round. (Meyer, 2004 (our translation))

Also in relation to giving the groups feedback through for instance BSCW there are reservations:

> Here at the Basic Studies you can't just send a written comment. You have to talk with the students. (Meyer, 2004 (our translation))

Finally; some of the teachers hold an ambiguity against computers in the lecture rooms. On one hand it looks like many of the students benefit from downloading the PowerPoint presentations and other material and making annotations on the computer; on the other hand the teachers feel that the use of computers during the lectures pacify the students.

> You can tell that they are less active. I have followed the lectures in sociology during the autumn and it is very rarely the students with the laptops ask questions. (Meyer, 2004 (our translation))

Conclusion

Even though, as can be seen above, there have been success stories, our general conclusion after the first years' implementation of BSCW is that the use of the system, following the general introduction to the students, has been superficial and sporadic compared to the examples we witnessed in the previous research projects.

The fact that most groups using BSCW in their project work mainly choose to use the system as a joint archive has meant that the students do not benefit from the system the same way as the Client students and the students from the Scenario project. Here we experienced how CSCW can be a valuable tool in the learning process.

When using CSCW, several parts of the work process are altered. The most basic part is that when such a relatively large part of the communication is written, rather than oral, no part of the discussion is 'lost' in the transmission. Everything has a written record.

CSCW also means that the participants' writing culture is affected. Without it, the individual participant would go home and create a more finished product before showing it to the other participants. However, with CSCW, the participants share unfinished work and create more drafts. Everything is put in writing along the way,

rather than at the end of the research process.

Because the work is put into writing throughout the process, the user will inevitably achieve a more reflective stance towards his/her own work, as well as that of the other group members. As such, CSCW creates more awareness of the work on part of each individual in the group.

Finally, the process creates a new dynamic between the mediation of knowledge and the cognitive process. They become intertwined, occur simultaneously.

Naturally, due to the nature of the CSCW work process, the individuals using these tools must show more self-discipline than the 'normal' work process requires. When nearly all communication occurs over the internet, each participant must take it upon him/herself to play an active part in the process. However, we observed that the experiment carried out in the CLIENT project turned out to be successful even in groups that initially seemed to have difficulties of this kind.

CSCW can, when the participants truly want it, be a valuable tool in the learning process and a means of developing skills, both personal and professional, which would otherwise not be part of the general learning process.

However, when the system is sporadically employed for limited tasks, as for example the joint archive function, the learning trajectory becomes too steep. The benefit from using the system seems too limited compared to the workload/effort necessary to deal with the system. It is our impression that the students, as we observed with many teachers, make some kind of cost-benefit calculation.

The problem in relation to the big ICT-effort has been that quite a lot of resources have been used to disseminate information about the system and make introductions to it, primarily for the students. A predominantly technical support function has been established without being sufficiently aware of the importance of communication the findings regarding the benefits affiliated by using BSCW as documented in the Scenario and Client projects. Such a dissemination and communication should have been undertaken both in relation to teachers, supervisors, and staff in order to make it possible for these groups to get a grasp of the opportunities from using such a system supplemented with a dedicated pedagogical support function.

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