


Norsk konferanse for organisasjoners bruk
av informasjonsteknologi

NOKOBIT 2012



Universitetet i Nordland 19.–21. november 2012

NOKOBIT styre og redaksjonskomité

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Universitetet i Agder

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FORORD

Velkommen til NOKOBIT 2012!

NOKOBIT 2012 arrangeres av Universitetet i Nordland.

Dette er det 19. NOKOBIT siden starten i 1993, og det er 13. gang at NOKOBIT arrangeres sammen med NIK – og fra 2008 også sammen med NISK. Det var også her i Bodø i år 2000 at NIK og NOKOBIT ble arrangert sammen for første gang. Det ble dermed starten på en tradisjon som har utviklet seg til en viktig arena for det samlede fagmiljøet for informatikk og informasjonssystemer ved universiteter og høyskoler i Norge.

I år har vi mottatt 26 bidrag, og det er 21 bidrag som skal presenteres. Alle bidrag har vært gjennom en grundig fagfellelvurdering (blind review) av tre uavhengige reviewere. Denne proceedings publiseres både på papir og elektronisk som serie på Tapir Akademisk Forlag (www.tapironline.no) Hvert bidrag gir dermed forfatterne ett publikasjonspoeng.

I god NOKOBIT-tradisjon vil hver presentasjon ha en diskutant som er grundig forberedt, og bidragsyttere må også fortelle hvordan de har forholdt seg til kommentarene fra reviewerne.

Jeg vil gjerne takke alle reviewerne for konstruktive tilbakemeldinger. Uten deres innsats hadde det ikke blitt noen konferanse. Jeg vil også takke styret i NOKOBIT for et utmerket samarbeid.

Til slutt vil jeg takke lederne for NIK og NISK for samarbeidet. Det har gått veldig fint å samarbeide over distanse.

Vi gleder oss til en god konferanse!

Terje Fallmyr

Handelshøgskolen i Bodø, Universitetet i Nordland

Redaktør og styreleder for NOKOBIT 2012, samt leder av den lokale arrangementskomiteen

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Innholdsfortegnelse

“Arkitektur handler om praktisk arbeid i organisasjonen, ikke en tegning”. En forskningsagenda om IT-arkitekters utfordringer <i>Bendik Bygstad and Nils Pedersen</i>	1
Information Systems Success and Tourism Employees’ Use of a Payment System: The Influence of User Motivation, Management Attitude and Ease of Use <i>Øystein Sørebo and Anna Mette Fuglseth</i>	15
Factors for Assessing the Alignment of IS Development and IT Operations in System Development Projects <i>Jon Iden</i>	25
The Muddy Waters of E-services – The Use and Misuse of the Concept and How to Get Out of the Maze <i>Arild Jansen and Svein Ølnes</i>	39
Interoperability, Maturity and Benefits in E-government Projects <i>Hans Solli-Sæther and Leif Skiftenes Flak</i>	51
Dressed for Success? Perception of Website Quality Among Webmasters in Government Bodies <i>Hanne Sørsum</i>	63
Combining Think Aloud and Comic Strip Illustration in the Study of Augmented Reality Games <i>Tor Gjøsæter and Kristine Jørgensen</i>	77
Catch Me If You Can! How Technology is Running Away from Ethics in Business Intelligence <i>Wanda Presthus</i>	91
Information Security in Hierarchical and ad-hoc Emergency Organizations: Differences in Communication Challenges and Training Needs <i>Heidi Hartikainen</i>	105
Om møtet mellom fag og IKT i videregående skole; elevers erfaringer med digitale verktøy i norsk og realfag <i>Celia Berg, Anne Karin Wallace and Turid Aarseth</i>	119

Towards Personalized System of Instruction for Educational Online Information Security Lab Exercises: Research-in-progress <i>Sarfraz Iqbal, Todd Booth and Tero Päävärinta</i>	133
Assessing the Accessibility of E-learning <i>Morten Goodwin, Iain Sutherland, Frode Roarson and Tom Drange</i>	145
Virtual PhD Courses – A New Mode of PhD Education? <i>Bjørn Erik Munkvold, Ilze Zigurs and Deepak Khazanchi</i>	159
Boilerplates for Application Interoperability Requirements <i>Guttorm Sindre</i>	171
Requirements Specifications for Data Warehouses <i>Anna Mette Fuglseth, Kjell Grønhaug and Trond Vegard Johannessen</i>	185
Enterprise Modeling Practice in a Turnaround Project <i>Anniken Karlsen and Andreas L. Opdahl</i>	199
Modeling Organizational Behavior in Emergencies <i>Murray Turoff, Jose J. Gonzalez, Starr Roxanne Hiltz and Bartel Van de Walle</i>	213
A Step Towards a Theory of Modeling and Decision Making – Design of an Inductive Empirical Investigation <i>Kjell Ellingsen and Eystein Mathisen</i>	225
Ny type pasientmelding for håndtering av forstyrrelser: tilbakemeldinger fra sykepleiere <i>Maja Selseth, Tor Erik Evjemo and Lill Kristiansen</i>	239
Examining the Use of Social Media Tool “Flickr” for Impact on Loneliness for People with Intellectual Disability <i>Fredrik Kydland, Judith Molka-Danielsen and Susan Balandin</i>	253
Independent Living for the Elderly: Development of an Assessment Framework for Comparison of Assistive ICT Initiatives <i>Carl Erik Moe and Judith Molka-Danielsen</i>	265

VIRTUAL PHD COURSES – A NEW MODE OF PHD EDUCATION?

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Abstract

This paper presents experiences from a joint virtual PhD course for doctoral students at a Norwegian and a US university. Based on an experiential learning approach, the course focused on practices for virtual research collaboration. Through six synchronous online sessions, interspersed with interaction in sub-teams, the participants worked on developing a joint conference publication. This gave the PhD students first-hand experience with working in a virtual research team. Based on our analysis of the experiences from the course, we discuss challenges of the virtual course setting and present guidelines for the design and conduct of similar virtual courses. Our results indicate that the virtual mode of learning could well be included in PhD education, thus enabling interaction between students and instructors in different programs and institutions that otherwise would be difficult. As for any form of virtual work, this requires careful coordination, clarification of leadership roles, and technology and process support for effective interaction and co-production.

1. INTRODUCTION

Various forms of online learning are becoming a standard component in university curricula, involving both asynchronous and synchronous learning activities. An increasingly widespread format is virtual student projects, with ad hoc virtual teams of students from two or more academic institutions being formed to work on an assigned project (Davis and Zigurs 2008; Rutkowski et al. 2008). The reported results of such projects are positive: while the virtual mode of working is perceived as challenging, the students rate the learning outcome from these projects as highly relevant for future work practice (Chen et al. 2008; Munkvold et al. 2011). So far, the virtual student projects being reported have been part of bachelor or master programs, and we do not yet have a clear sense of whether this mode of virtual learning could also be applied in doctoral programs. Doctoral courses are traditionally conducted as co-located seminars, with the format and agenda emphasizing discussion on research topics based on a set of prepared readings as well as the doctoral students' dissertation projects, and with instructors taking the role as facilitators rather than lecturers. On the one hand, one might argue that this form of discussion intensive seminar is best run co-located, and that a virtual format implies a risk of reducing the possible engagement of the participants. On the other hand, given that much of the research conducted today in academia (e.g. co-authoring of papers) and industry takes place in global settings, it could be argued that a virtual mode of working would be highly relevant for doctoral students as the next generation of researchers. Therefore, the question we examine in this paper is: How can a virtual learning experience be used for enhancing doctoral education?

To investigate this issue, we present the experiences from a joint PhD course run in Fall 2011 between University of Agder and University of Nebraska at Omaha. The seminar was titled "Collaborative Research Processes Across Boundaries", with three PhD students from each institution and three professors as participants. The course comprised six bi-weekly synchronous sessions, including three guest lectures from industry R&D managers. The course was based on experiential learning (Kolb, 1984), through collaborative authoring of a conference paper on virtual research collaboration, presented at a regional US conference (Arora et al. 2012). Thus, in addition to discussion on relevant literature, the course gave the doctoral students first-hand experience with working in a virtual research team.

The remainder of this article is structured as follows. Section two provides a brief overview of related research, and section three introduces the format and media used for the online course. Section four presents key experiences from the online course activities, and section five discusses the findings and presents lessons learned. Section six concludes the paper.

2. RELATED RESEARCH

While experiences with online learning in different formats are well-documented, we have not found much literature explicitly focusing on the use of online learning in PhD education. The format of joint national and international PhD schools typically involves sending students to co-located PhD courses and seminars hosted by the different partner institutions (e.g. Maci et al. 2005), without distributed, online interaction. Terzevia et al. (2004) report on the implementation of a web-based learning environment for PhD students, based on Microsoft Class Server. Through this they aim at providing a flexible and personalized learning environment that will meet the needs of this group of students. Yet, the functionality presented is similar to that of common learning management systems (LMS), with focus on on-line access to learning material and assessment tools, and less on synchronous interaction among course participants. Indeed, the literature on challenges for doctoral education focuses primarily on aspects of mentoring and dissertation work, rather than classroom experiences (see, for example, Golde and Dore 2001; Van Slyke et al. 2003). One survey of over 4,000 students found that a third of students believed that coursework failed to give them either knowledge in their field or preparation for doing independent research (Golde and Dore 2001). There seems to be ample opportunity for enhancing doctoral education, both in terms of content and pedagogy. The course design that we used followed directly from this motivation, namely to provide both a unique environment and a topic area that was directly related to developing students' understanding of the research process.

In our PhD course we defined the participants to constitute a virtual research team, working on a joint authoring project. As a basis for this project, the participants reviewed literature on collaborative research and virtual research teams (see Arora et al. [2012] for a summary of this literature). Overall, we found increasing interest in this subject, including several journal special issues (Jirotko et al. 2006; Spencer et al. 2011). Also, we found many different terms in use for denoting this type of work, including collaboratories (Bos et al. 2007), e-research (Jirotko et al. 2006) and e-science (Spencer et al. 2011). Bos et al. (2007) even refine this further by introducing a taxonomy of seven categories of collaboratories.

Virtual research teams can be seen to inherit the needs and challenges reported in the extensive research on virtual teams 'in general', in terms of virtual team leadership, coordination, task support, relationship building, establishing trust and developing an effective communication rhythm (e.g. Dubé and Robey 2008; Malhotra et al. 2007; Munkvold and Zigers 2007; Powell et al. 2004). In addition, virtual research teams face specific challenges related to the nature of the collaborative work undertaken. Collaborative research processes can be characterized as complex and dynamic, requiring collective conceptualization and coordinated knowledge creation (Spencer et al. 2011; Söldner et al. 2009). Projects involving multiple disciplines and/or institutions imply additional challenges of coordination and integration of epistemologies (Cummings and Kiesler 2005; Newell and Galliers 2000), requiring carefully planned team interventions for developing shared vision and plans for the research (Pennington 2011).

The findings provide implications for the skills that a collaborative, virtual researcher might need. As noted above, the common team needs of communication, information processing, and process structure must be provided in the roles and skills that team members have (Munkvold and Zigers 2007). The skills essential in the doctoral context are for developing both a collective understanding and artifacts, i.e., for transforming individual knowledge and expression to a shared artifact.

Complementary to the skills component is the technology support that is needed for virtual research teams. Several studies focus on developing ICT platforms for supporting different phases of virtual research projects (Farooq et al. 2009; Söldner et al. 2009), also referred to as virtual research environments (Keraminiyage et al. 2009). But experiences reported so far show that even with such a collaborative platform in place, establishing effective inter-personal collaboration across institutions may be challenging (Riemer et al. 2008).

3. COURSE FORMAT AND MEDIA USE

The PhD course titled Collaborative Research Processes Across Boundaries was conducted over 12 weeks during fall 2011, as a joint course between University of Agder (UiA) in Norway and University of Nebraska at Omaha (UNO) in the US. Three PhD students from each institution participated in the course; they were enrolled in the PhD program in Information Technology at UNO and the PhD program in Information Systems at UiA. The UiA students were in the second year of the three year program, while two of the UNO students were in the final year of their studies and one was two thirds into the program. The UiA students were all full-time students, although one took the PhD as part of her position in industry. Two of the UNO students were part-time students. The course was facilitated by two professors from UNO and one professor from UiA, who are the authors of this article.

The students were pre-assigned in two-person teams, with one student from each institution. These teams are hereafter referred to as 'sub-teams', to distinguish these from the course concept of viewing all the course participants and instructors as a virtual research team. The sub-team composition was partly based on the students' background and research interests, and also some on their personal characteristics as experienced by the instructors. Prior to the start of the course, the students were asked to post their bio and picture to the course repository (Huddle™) and to initiate contact with their sub-team partner.

All scheduled course activities were based on virtual interaction, and thus independent of geographical location. The core technologies used in the course included:

- Adobe Connect™ for class sessions and instructor meetings.
- Shared workspace in Huddle™ for course repository.
- Discussion board in Huddle™ for asynchronous discussion between synchronous sessions.

The course included six synchronous class sessions of 90 minutes, conducted from 9-10.30 Omaha time (CDT) and 16-17.30 Norway local time (CET). Figure 1 shows a screenshot of the setup for the synchronous course sessions in Adobe Connect.

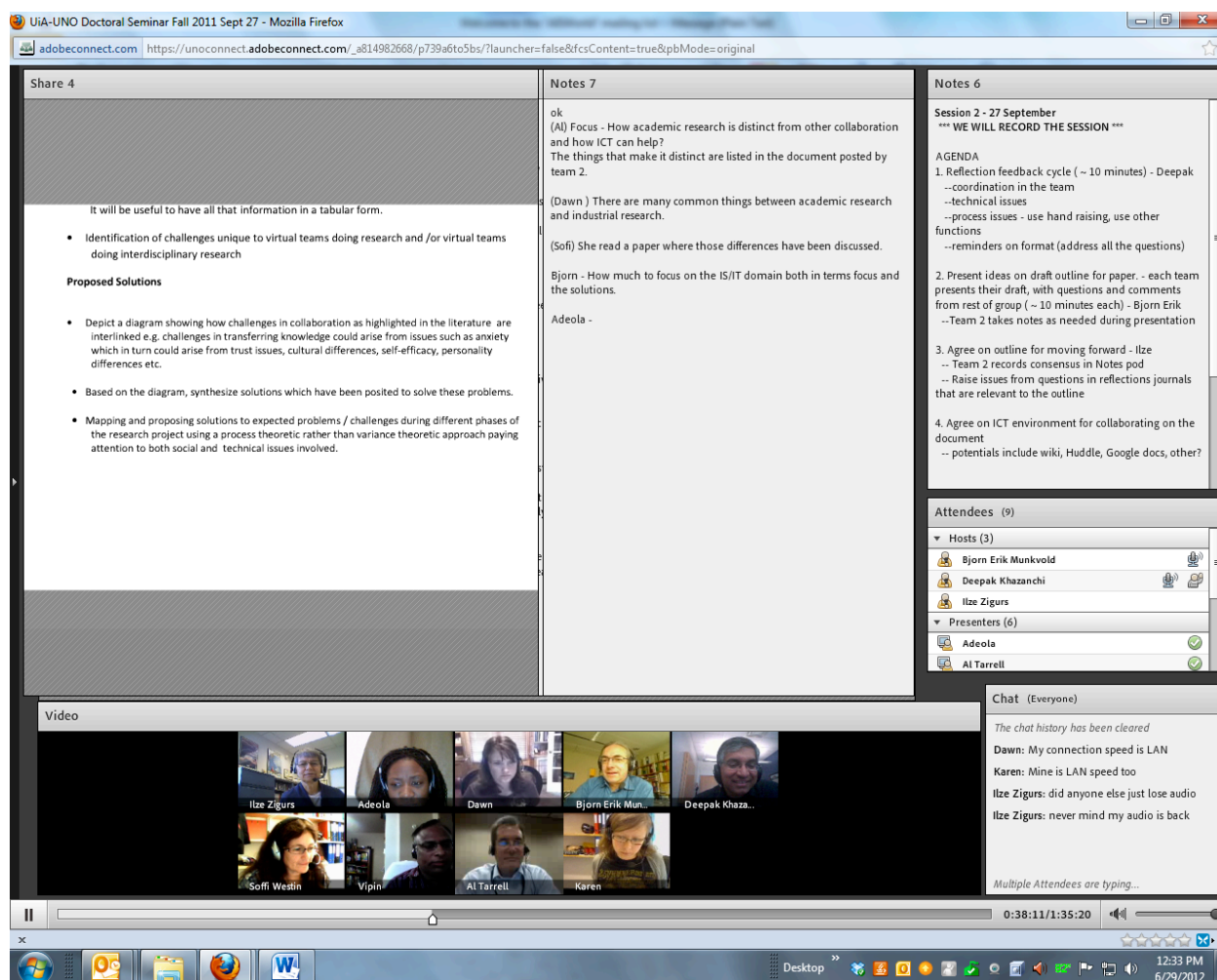


Figure 1. Screenshot from synchronous class session in Adobe Connect

The window pane in this tool can be configured in terms of what elements to include and their placement, and Figure 1 thus only shows an example configuration. The bottom left pane shows the webcams of the nine participants. The three top panes show material controlled by the presenter (which could be any participant granted presentation rights). In this particular example, the left pane displays a section of the joint paper being discussed, the middle pane displays notes from the meeting (taken by an instructor or student), and the top right pane shows the agenda for the session. Below the agenda is the list of attendees, also displaying the 'raise hands' function used for signaling who wants to speak. The bottom right pane displays the chat window, which was kept open during all sessions. This was mainly used for reporting technical problems and obtaining assistance from the other participants, without disturbing the session.

The course objective was stated as to "learn how to be a researcher in a distributed virtual environment, including process, practice, techniques, and collaboration technologies". The objective was operationalized through a series of readings and discussion on the following topics: (a) technology environments for virtual research collaboration, (b) planning a distributed research collaboration, (c) executing the virtual collaboration, and (d) dealing with challenges and discontinuities during the process. For each major theme, students were asked to consider what is known about the topic, what challenges the virtual environment brings, innovative ways of dealing with the issue, and best practices for the virtual research context.

To enable experiential learning, the course centered on developing a joint conference publication on the topic of virtual research collaboration. The possible framing for this publication was on the agenda already for the first of the six synchronous sessions, and in the second session each sub-team presented

their draft outline of the paper for discussion in the group. In the remaining four meetings, different draft sections developed by the sub-teams were presented and discussed, with the paper gradually being developed into a complete article. For each session the instructors had assigned 2-3 research articles on key topics of virtual research collaboration that were prepared as a basis for discussion, and throughout the course the list of readings was supplemented by the students from their on-going research into the topics. In the two last sessions there were also 'live' guest lectures from industry by managers of global R&D operations, focusing on their experiences from virtual research collaboration. A third lecture/interview of this kind was recorded by the instructors and posted in the course repository.

In the time between the synchronous sessions, the three sub-teams interacted by email and Skype in developing their deliverables related to the joint paper. There was also some use of the discussion board in Huddle, intended for asynchronous interaction among all the participants.

In addition to the co-authored publication as the main deliverable for the course, each student kept an individual reflection journal which was updated every other week and posted in the course repository in Huddle. The reflections were expected to cover what the students had done over the last two weeks, what they had learned and how they can use this, and what issues they had struggled with and how they could mitigate these.

4. EXPERIENCES FROM THE ONLINE PHD COURSE

In this section we highlight key experiences from the course, as observed by the instructors and reported in the students' reflection journals.

Course format

As the course was intended as a pilot to gain experience with the format of online PhD seminars, we decided to limit the scope to a relatively low course load (2,5 ECTS for UiA and 1 credit hour for UNO). As reported by the students themselves, this naturally affected their efforts and the priority given to the course, e.g., in engaging in the asynchronous discussions between the online sessions. Instead, most of their work was focused on the sub-teams' deliverables for the joint paper.

Several of the students also pointed out that bi-weekly seminars were experienced as too infrequent and limited for being able to discuss and resolve the issues evolving related to the joint paper, and for keeping the momentum in the course:

"The biggest challenge for me is knowing that we don't meet again for two weeks and I seem to let other things get ahead of what I should/need to do for this class. Knowing that I have another week to work on things makes it difficult to keep this class forefront. I also often forget to check the discussion forums". (Student 1)

"I think it might have been better to interact on a weekly basis (at least early on) to counteract our nonfamiliarity and remoteness." (Student 4)

Media use

The media setup for this course was similar to the online master course reported in Munkvold et al. (2011). The use of Adobe Connect for the online sessions functioned well. After some initial problems with configuration of audio and video for some of the participants, the sessions started on time and ran smoothly. Except for one participant questioning the need for video, there seemed to be a general view that video created a presence closer to a face-to-face seminar than with audio and text only. As a side effect, this also reduced the possibility for multi-tasking, a common distraction in online meetings (Cameron and Webster 2005). The synchronous tool also worked fine for bringing the guest lecturers from industry into the course, giving them the flexibility to contribute from their preferred location. For example, one of the speakers contributed from a hotel where he was attending a conference. For one of the guest lecturers, two of the instructors recorded an interview in Adobe Connect, as he was not able to be present during the seminar hours.

All sessions were recorded in Adobe Connect, with the URL to the recording included in the discussion notes from each seminar posted in the Huddle course room. However, apart from the recorded guest lecture, the seminar recordings were not used much. The Norwegian participants experienced problems with severe latency during playback of the recordings, which we were not able to solve. This seemed to be related to the number of participants in the session, as the recording of the guest lecturer and two instructors worked fine. Further, two of the students did not have access to Huddle from their work, due to firewall restrictions.

In addition to the problems with restricted access, there were several other problems with the course repository (Huddle). Due to a change in license policy, the student participants were initially provided with a limited trial account instead of regular accounts under the university license, and there was also a bug disabling email notification for new discussion entries. This clearly limited the use of Huddle for asynchronous interaction. However, the student engagement in these discussions also proved varying:

"I thought that all of us would be engaged in a very lively discussion during the following two weeks. Unfortunately, nothing of that sort has happened so far [three weeks into the seminar]" (Student 3)

"There are just 15 posts from 9 people (actually only 11 as 3 are "thank yous" and two are duplicates) in 18 days in the "Share suggestions for the Joint Paper" discussion thread in Huddle." (Student 3)

The synchronous sessions thus were the main forum for interaction in the course, and if a student (or instructor) was not able to attend it was perceived challenging to catch up:

"My feelings of disconnection with the project are growing – I think since I missed the last synchronous session" (Student 4)

In comparison, the three sub-teams reported extensive interaction using Skype and email. Different preferences were reported for communication channels, depending on the schedule of each student. Two of the sub-teams preferred textual communication (email and/or chat) over audio and video.

Creating common ground

'On paper', the group of students and instructors taking part in this seminar would seem relatively homogeneous, with all having their educational background and research experience in the IS/IT discipline. The three instructors also have a long-standing collaboration, with common interest and experience in teaching and research on virtual collaboration. Two of the PhD students had also attended seminars on virtual collaboration in their respective institutions.

Given this background, the instructors' idea was that the group would quickly be on the same page regarding the relevance and need for learning about collaborative research practices, and that the group could delve 'directly' into the specific practices of virtual research teams and collaborative research projects.

However, as the discussion in the PhD seminar evolved, it turned out that the entire framing of the course was not obvious to the students. While the instructors viewed the course topic as a given part of 'being a researcher in the global community', the students tended to view the topic as something new and 'special' that was not related to their other doctoral work. Thus, more time in the course than planned was spent on reviewing and discussing basic literature on virtual teamwork, with equally less attention devoted to the specific characteristics of virtual research teams. The guest lectures from industry contributed well in motivating the focus of the course. And similarly, after attending a three day 'Space and Cyberspace Symposium' led by the U.S. Strategic Command, one of the participants reported that:

"This really brought home to me the need for this type of knowledge" (Student 4)

A lack of shared understanding of the focus of the joint paper did to some extent persist throughout the course, and it proved difficult to reach closure within the time frame of the 90 minute, bi-weekly seminars. As mentioned previously, the attempt to continue the discussion asynchronously in Huddle did not work well. The instructors thus found it necessary to use some time in the seminars for revisiting the overall purpose and framing of the course and trying to establish a common understanding on how the joint project was developing. While this would seem to clarify matters there and then, there were several

examples of how the sub-teams as well as individual students after the sessions would express different understanding of the further course of actions:

“Even though we all heard the same thing, it is interesting how people interpret the message differently” (Student 1)

Some students pointed to the number of participants in the seminar as being a challenge:

“By bringing more people together in a team it seemed that there was more group conflict, ambiguity, and less shared understanding” (Student 1)

Regarding potential differences between the students from the two programs, this was not observed to be of much influence:

“The differences have not been between Norwegian students and US students; rather totally individual. Which is my experience at work as well; individual differences play a larger role than cultural differences”. (Student 5)

It should also be noted here that the six PhD students were of four different nationalities.

Team coordination

As for any virtual team effort, the course proved to be coordination-intensive. This involved coordination at both the team level and for each of the three sub-teams.

At the team level, the main mechanisms for coordination were the agendas developed prior to each session, and the discussion notes taken at each session which also included action items for the two-week period until the next session.

“The agendas have been very helpful and serve as a guide for the discussions. These agendas are prepared in advance and meet the needs of the group” (Student 1)

The students took turns in recording discussion notes, but it sometimes proved necessary for the instructors to fill in with more extensive notes.

In developing the joint paper, the instructors decided that it would be most efficient with introducing a sequential process where each of the sub-teams developed a section of the paper and then also were responsible for the revision of the entire manuscript (i.e. “holding the writing stick”) for a scheduled period. However, with the sub-teams struggling with arriving at a common focus on the paper, each revision tended to change some of the direction of the paper. As reflected by one of the students:

“It is interesting to see how as the paper goes round, each team has tried to restructure the paper to suit their own understanding of what we are doing” (Student 2)

Adding to this ‘problem’ was that the sub-teams were not always explicit in providing the rationale for their revisions, and simply uploaded the new version for the next sub-team to take over. Even if all changes in the document were marked, with extensive modifications it was difficult to keep track of the changes introduced. There was also one ‘incident’ where the two members of a sub-team each uploaded their separate version of the document to the course repository. While their intention was to get input from the other members on these alternative versions, the lack of instructions on this led the others to think that the sub-team had not been able to coordinate themselves. Based on this, the instructors emphasized the need for providing explicit information to the team about the suggested process for comments and revision, also indicating a deadline for comments to be incorporated in the next version. Further, ‘revision notes’ should be provided as part of handing over the writing stick to the next sub-team.

At the level of each sub-team the coordination was reported to function more ‘friction-free’, with each team gradually developing a communication rhythm that suited their individual schedules of work and family obligations. While the time difference was reported to be a challenge, some of the students also took advantage of this:

“Learning how to write jointly in view of our time differences was interesting. [My team partner] and I achieved this by structuring our work in shifts. So I would write into the early hours of the morning, go to bed and hand over the writing stick to him. Then he would take over and do the same”. (Student 2)

The relatively intensive interaction in the sub-teams, by email and/or Skype, also seemed to support the socio-emotional aspects of the teamwork and all sub-team members reported a positive experience from having a ‘virtual partner’:

“It is nice to have someone to air issues with and together move towards an understanding, or a better understanding on where we are going. I see this as a valuable part of this course; I am never alone, even though there is an ocean and half a continent between us”. (Student 6)

Role of the course facilitators

Rather than taking the role as team leaders, the three course facilitators presented their view on the group as a virtual research team of nine participants with equal role and responsibilities in terms of contributing to the discussion and the development of the joint paper. Yet, this proved to be a challenging idea for the students. In cases where the team progress slowed down or there were conflicting views on issues, the students would most often wait for the instructor to address or resolve this, rather than taking a proactive stance themselves. This is illustrated by the following quotes:

“There seems to be some discontinuity in the roles of the professors – the group is often described as a group of 9 ‘equals’, but the students still look to the professors for guidance, and usually take their input as formal direction. Recommend the instructors as a group better define their roles as either ‘contributors’ or ‘observers’ and then all agree to follow that definition.” (Student 4)

“Apart from the synchronous class meetings held every other week, some sort of intervention from the professors is needed in between to “keep the things moving”. The professors are considered the leaders/facilitators, by default, by the students (howsoever mature the students may be, they are still “students”!). Alternatively, each team can take turns in playing the role of a leader/facilitator.” (Student 3)

As a result of this, in the final part of the course the instructors decided to step up and present a detailed plan for finalizing the joint paper within the submission deadline, which was appreciated by the students.

“The instructors provided a very structured work environment and that was extremely helpful for keeping the team focused and moving forward. As an example, the instructors provided a plan for final development of the submission. This plan is very helpful for ensuring everyone remains focused on the final deliverable and sticks to tasks in the absence of meetings.” (Student 1)

Thus, it proved difficult to change the traditional perception of the instructors as group leaders.

5. DISCUSSION

The experiences reported resonate well both with former studies on virtual student projects at the bachelor and masters level, and with the literature on ‘real’ virtual research teams (e.g; Cummings and Kiesler 2005; Pennington 2011; Söldner et al. 2009). While the students found it challenging to develop and maintain a common focus throughout the course, they all concluded that the course was a positive experience providing a good learning outcome. The experiential format of the course here proved effective in bridging theory and practice. As expressed by one of the students:

“Our group and its effort represent a great ‘theory to practice’ laboratory that helps drive home the conclusions we are reading about in several of the papers provided.” (Student 4)

This comment reflects the course’s foundation in experiential learning theory (Kolb, 1984), which involves cycles of experiencing, reflecting, thinking, and acting. The cycle between concrete experience and reflective observation was triggered when students wrote regular journal reflections on what they experienced in and between class sessions. The cycle between reflection and abstract conceptualization came in the discussions that focused on formulating the elements of the paper (the course artifact). Active

experimentation occurred in the sub-teams, as they worked with different drafts, which fed into the synchronous “all-hands” sessions in which concrete experience during the session once again triggered another learning cycle. The challenges and experiences that occurred during these cycles are discussed in detail below.

Despite a relatively homogeneous participant profile in terms of educational background, the team experienced difficulties in developing a shared vision. As pointed out by the students, this could probably have been mitigated by more frequent synchronous interaction, especially in the first part of the course. Further, assigning more credit hours to the course would give incentive for more engagement in asynchronous discussions. However, the problem was also partly based on the lack of a common foundation in the research on virtual teams, showing the need for presenting and establishing common core concepts also in a doctoral course.

Some of the students pointed to the number of participants in the team as a complicating factor. However, in terms of number of participants in a doctoral course, six is a relatively small number. Also, when related to collaborative research projects such as in the EU Framework Programmes, the number of partners engaged in virtual collaboration will often be even greater than the number of participants in this course. Thus, we mainly see the students’ reflection on team size as related to the co-authoring challenges. As illustrated in this case, using Word or similar word processing software for keeping track of changes in a co-authoring team with as many as nine contributors is not an ideal solution, and alternative co-authoring tools should be explored. Lack of predefined routines for notification on document changes also resulted in coordination problems between the sub-teams.

The problem of the ‘drifting focus’ of the joint paper in the revisions by each sub-team can be seen as an example of ‘nonconsensual negotiation’ as termed by Evaristo (2001). He reported a case of the development of a multipartner EU grant proposal, where each partner adjusted the contents according to their own interest so that “multiple sets of agenda were beginning to be reflected in one single document”, but “without formal recognition that negotiation was indeed happening” (p. 89). In our PhD course we also applied this term as a basis for discussing this observed practice in our paper revisions.

The instructors’ vision of the course participants being a virtual team of nine equal participants did not work as intended. Even for this mature group of students, the instructors were considered as leaders ‘by default’, and were expected to provide guidelines and bring closure to the discussion. This shows the importance of clarifying leadership roles for the team (Zigurs, 2003), especially clearly communicating who will take leadership roles if it is someone other than the instructors. Our experiences further illustrate the need for structural mechanisms in the virtual work, in the form of agendas, discussion notes and written team instructions (Dubé and Robey 2008; Munkvold and Zigurs 2007). Establishing and maintaining this structure also comes under the responsibility of the virtual team leader(s) (Malhotra et al. 2007).

Overall, we see that the main coordination problems experienced were at the level of the entire team rather than for the sub-teams. All three sub-teams reported being successful in establishing effective virtual collaboration, and also achieving a level of team bonding that they wished could have carried over to the entire team. This indicates that the use of smaller sub-teams may be an effective learning component in a virtual PhD course like this, and shows how frequent communication is required for building social relations (Powell et al. 2004).

Finally, the problems experienced with the course repository (restricted access, wrong type of accounts, notification of discussion entries not functioning) and the playback of the session recordings, illustrate how virtual course settings are vulnerable to technical ‘hiccups’ so that backup plans should be considered.

Based on the experiences reported we suggest the following guidelines for a virtual PhD course of the nature presented in this paper:

- Define a course load that provides sufficient incentives for engagement in both synchronous and asynchronous interaction throughout the course period. Without this, there is a risk that a virtual course gets a lower priority compared to ‘local’ course activities.

- Select a platform of collaborative tools that works for all participants. This requires a mapping of possible restrictions in access due to company policies or network limitations. Dedicate time for configuring audio and video for each participant.
- Regardless of the topic being focused in the course, we suggest including some readings on virtual research collaboration, as a basis for reflection on the virtual interaction in the course.
- Allocate sufficient time to develop a shared vision of the objective of the course and the problems to be addressed. This may require more extensive synchronous interaction in the first part of the course.
- Discuss and agree on the leadership role. If this is to be rotated among the participants (or sub-teams), common expectations and practices for this role need to be established.
- Implement structure in the virtual work in the form of meeting agendas, record-keeping, and guidelines for efficient coordination and hand-over of tasks and deliverables among members of the virtual team(s) (e.g. revision notes for new document versions).

Overall, we can conclude that the students achieved the learning goals of the course. As noted above, their subjective assessment of the course was that it was a positive learning experience. Objectively, the artifact that was the shared creation of the team – a jointly-authored paper – was also a success, as it was accepted at a peer-reviewed conference and published in the proceedings. The sometimes “rocky” process by which the outcome was achieved was an essential part of the experiential nature of the course, as indeed we can argue that a rocky process sometimes teaches more than a smooth one.

Finally, we should point out some limitations of these findings and opportunities for further investigation. While based on the students’ reflections as reported in their journals and expressed in the seminars, the analysis presented in this paper represents “the instructors’ cut”. A more systematic and in-depth evaluation from the students’ perspective may thus have brought out other considerations. Further, the setup of this PhD course only represents one possible configuration in terms of number of students, media use and course deliverables. Further research is thus needed to develop guidelines for different course configurations. It also remains an open question to what extent the findings apply to virtual PhD courses with a different theme or content. We argue that the findings related to process and technology challenges would apply regardless of course content, but the supposition needs to be confirmed in other settings.

6. CONCLUSION

We have previously argued for including training in virtual team work in undergraduate and graduate study programs, to prepare students for a global workplace (Munkvold et al. 2011). Based on the experiences reported in this paper, we extend this argument to also include doctoral programs. Both in academic or industry settings (or combinations thereof), R&D is increasingly conducted in global, collaborative projects. Researchers must therefore be able to work effectively in virtual research teams. Further, the virtual mode in general provides increasing flexibility for bringing together students, instructors and guest lecturers from different doctoral programs and institutions, regardless of location. This in itself would be considered sufficient motivation for exploring further this format. For example, virtual PhD courses or seminars could be an effective learning mode to incorporate in the planned Norwegian research school on IS (coordinated by the University of Oslo).

As exemplified through the course presented in this paper, students were able to interact and work together in a virtual mode to achieve intended learning outcomes. Based on our experiences, we have presented several recommendations for organizing virtual PhD courses, and highlighted potential challenges that need to be addressed. These practices should then also be considered relevant for working in virtual research teams, as exemplified by the ‘real’ co-authoring project conducted by our team.

Future studies should provide experiences and best practices from other online course formats at the PhD level, involving different numbers of institutions, students and cultures, with varying duration, frequency and organization of the sessions, and use of different media for supporting the learning process.

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7. REFERENCES

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