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# Augmenting Online Learning with Real-Time Conferencing: Experiences from an International Course

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Norsk konferanse for organisasjoners bruk av informasjonsteknologi

# NOKOBIT 2011

Universitetet i Tromsø 21. – 23. november 2011

## NOKOBIT-styret og redaksjonskomité

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Bendik Bygstad  
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Norges teknisk-naturvitenskapelige universitet  
Høgskolen i Nesna

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# AUGMENTING ONLINE LEARNING WITH REAL-TIME CONFERENCING: EXPERIENCES FROM AN INTERNATIONAL COURSE

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## Abstract

*This paper reports experiences from the use of real-time conferencing to support synchronous class interaction in an international online course. Through combination of video, audio, application sharing and chat, the students and instructors engaged in weekly interactions in a virtual classroom. This created an environment for rich interaction, augmenting the traditional use of course repositories. Further, this gave the students hands-on experience with real-time conferencing tools which are increasingly common in the workplace. The paper also discusses experienced challenges related to combining the use of multiple synchronous communication channels and presents implications for further use of real-time conferencing in online courses.*

## 1. INTRODUCTION

Educational institutions are incorporating an increasing share of online learning as part of their study programmes. While first and foremost this trend is driven by the need to provide flexible learning arrangements in the educational market, there is also a growing awareness that an ability to work effectively in virtual environments is becoming a key skill for employees in today's global business environment (Larsen and McInerney 2002; Rosen et al. 2006). By a virtual environment we mean a work context where the participants are distributed in space and/or time with limited possibility for face-to-face, co-located interaction, thus relying on information and communication technology (ICT) to support communication and information sharing. The term virtual environment thus incorporates the concepts of virtual teams, virtual projects and virtual organizations (see Dubé and Paré 2004 for a discussion on the nuances between these concepts). An increasing number of university courses are incorporating some form of virtual work to give the students hands-on experience with this form of work (Chen et al. 2008; Rutkowski et al. 2008). Yet, an international survey on practices for teaching virtual collaboration showed that most of these course offerings are based on learning management systems (LMS) such as Blackboard, only incorporating instant messaging/chat as a synchronous communication channel and with limited use of video- or desktop conferencing (Davis and Zigurs 2009). Also, a survey of 440 organizations (mostly in the US) on training practices for virtual teams showed that only a third of the organizations provided such training in any form (Rosen et al 2006). With more than half of these training programs still being conducted in a traditional classroom setting, the authors identify training in real-time conferencing as a future need.

By real-time conferencing, also sometimes referred to as desktop videoconferencing, web conferencing or teleconferencing, we here mean systems offering integrated video, audio, instant messaging and application sharing from a PC (Munkvold 2003). While this type of system is becoming common in the workplace (Malhotra and Majchrzak 2005; Riemer and Frößler 2007), there are still few reports on the use of this type of technology in online education.

We contribute to fill this gap by presenting experiences from an online international course on working in virtual environments. In this course, Adobe Connect™ was used as the real-time conferencing tool for

supporting weekly synchronous class sessions. Based on the students' reflection reports and a web survey conducted after the course, we present the students' perceptions and experiences with the course format and the different communication media in use. Based on these results we discuss implications for design and implementation of real-time conferencing in online education. Considering that Adobe Connect™ is now also offered as a service for Norwegian educational institutions through Uninett (<http://www.uninett.no/adobeconnect>), we think the experiences presented here can be useful for academic institutions in Norway. We also analyze our findings in light of relevant research such as media synchronicity theory (Dennis et al. 2008) and discuss some implications for further research.

The article is structured as follows. Section two provides a brief overview of related research, and section three introduces the format and communication media used for the online course. Section four presents experiences from the use of real-time conferencing in the course, related to media channel perceptions and preferences, and positive and negative effects of the virtual setting. Section five discusses the research findings and presents lessons learned for use of real-time conferencing in online courses, and section six concludes the paper.

## 2. RELATED RESEARCH

There is a rich body of research on the perceptions and use of different communication media in different use contexts, and we briefly present selected research with relevance for our study.

The media choice literature has identified a combination of factors that affect media choices: critical, mass, media richness, situational influences, social influences, media symbolism, and the individual characteristic of medium experience (Webster 1998) (see Dennis et al. (2008) for a review of different media choice theories). Media synchronicity theory (MST) focuses on the ability of media to support synchronicity, defined as "*a state in which individuals are working together at the same time with a common focus*" (Dennis et al. 2008, p. 581). Media synchronicity is then defined as "*the extent to which the capabilities of a communication medium enable individuals to achieve synchronicity*" (ibid., p. 581), thus implying that synchronous communication is a necessary but not sufficient condition for achieving synchronicity. According to MST, communication performance results from matching media capabilities to the communication processes required to accomplish a task. A set of capabilities is defined to categorize media as having low (e.g. email), medium (e.g. instant messaging) or high (e.g. videoconference) synchronicity, with examples of such capabilities being transmission velocity and parallelism. Further, MST distinguishes between two core communication processes – conveyance and convergence. As most tasks will include both these processes, MST suggests that the use of multiple media will lead to better communication performance. However, the authors also point to the potential result of cognitive overload and impaired communication performance from simultaneous use of several media. A more comprehensive review of MST is beyond the scope of this paper, and we refer the reader to Dennis et al (2008) for further details. However, in the discussion of our findings we will draw upon some of the implications presented by MST.

As regards empirical research, there are still few reported studies on the combined use of communication services offered in real-time conferencing systems. Instead, we highlight some findings from adoption and use of videoconferencing and instant messaging

The widespread diffusion of videoconferencing has been relatively slow, and many studies have pointed to the observation that while audio is a major contributor to group accomplishment, video does not add much to the experience (Pollock and Grudin 2005). Referring to McGrath's (1991) typology of group activities, Pollock and Grudin (2005) argue that former studies have focused solely on team execution. Instead, they argue that video may be more important for member support, and especially when the participants do not know each other. Further, while today's IP-based videoconferencing solutions generally provide excellent audio and video quality, Pollock and Grudin (2005) point out that there are still adoption challenges such as privacy concerns and the need for adjusting lighting conditions in offices.

Studies on the adoption of instant messaging in the workplace have documented how this channel is used not only for short coordination messages, but also for complex work discussion (Isaacs et al. 2002). Also,

multitasking while engaging in instant messaging sessions is reported to be frequent, with users reporting benefits from being able to respond to IM questions from coworkers while talking on the phone, processing email etc. (Cameron and Webster 2005; Nardi et al. 2000).

In addition to the literature on communication media and their effects, we touch briefly on the relevant research in pedagogy as it relates to ICT and the current study. The research on “e-learning” or technology-mediated learning has grown considerably in the past two decades, as the design and use of online learning environments continue to evolve (see, for example, Alavi 1994; Hiltz 1997; Shen, Hiltz and Bieber 2006). A key design recommendation is to include cycles of conceptual understanding of the ICT, combined with actual use, and concluding with reflection on use (Chen et al. 2008). In general, an environment where interaction and sustained communication are emphasized is essential to student learning in distance courses, as argued in an analysis of theoretical foundations of distance learning (Garrison 2000). The components of interaction and cycles of understanding were foundational to the design of the learning environment for the current study.

We draw upon the theoretical concepts and empirical results introduced here in the later discussion of our findings from the online course.

### **3. COURSE FORMAT AND MEDIA USE**

#### **3.1 Course overview**

The graduate seminar titled Working in Virtual Environments was conducted over 15 weeks during fall 2009, as a joint course between University of Agder (UiA) in Norway and University of Nebraska at Omaha (UNO) in the US. Seventeen master students followed the course, of which fifteen students were registered in a Master programme in Information Systems at UiA and two students were registered in the Master in Information Systems programme at UNO. Three of the students in the UiA programme were one semester international exchange students, from Austria, Czech Republic and Germany. The course was an elective in both programmes.

All scheduled course activities were run as virtual sessions, thus interaction in the course was independent of geographical location. As noted above, the course was structured similar to the model of virtual teamwork training presented by Chen et al. (2008), comprising the following three steps in the learning process:

- Abstraction Conceptualization (conceptual learning at the beginning of the class)
- Active Experimentation and Concrete Experience (learning by doing the project)
- Observational Reflection (learning by reflecting on project execution)

The course deliverables were a combination of individual and team-based tasks:

- One team case analysis.
- Four individual case commentaries.
- One team project, focusing on developing a virtual work trainee program for a global company.
- Individual reflection journal, including weekly journal entries reflecting on learning outcome, teamwork and personal experiences.

Four teams of students were established with 4-5 members, with all teams comprising students from at least two countries. While both the US students were working part-time, most of the students in the Norwegian course were full-time students.

The core technologies used in the course included:

- Adobe Connect™ for weekly class sessions and instructor meetings.
- Shared workspaces in Huddle™ for course repository and student project repository.
- Course blog (Wordpress) for discussions on course readings.

For the team project, the students were responsible for selecting their own portfolio of collaboration technologies, and in line with the focus of the course they were encouraged to try out different options. A project room in Huddle was created for each team, but some teams preferred other tools as their project repository such as Dropbox and ProjectPlace. For all four teams, Skype was the preferred tool for synchronous meetings and chat.

The main focus in this paper is on the experiences with use of the real-time conferencing tool for the synchronous class interaction in the course.

### 3.2 Use of synchronous technologies

The course included 13 synchronous class sessions, most of these run as 75 minute sessions in the afternoon Norway local time (CET) and morning US time (CDT). Figure 1 shows a screenshot of the setup for the synchronous course sessions in Adobe Connect.

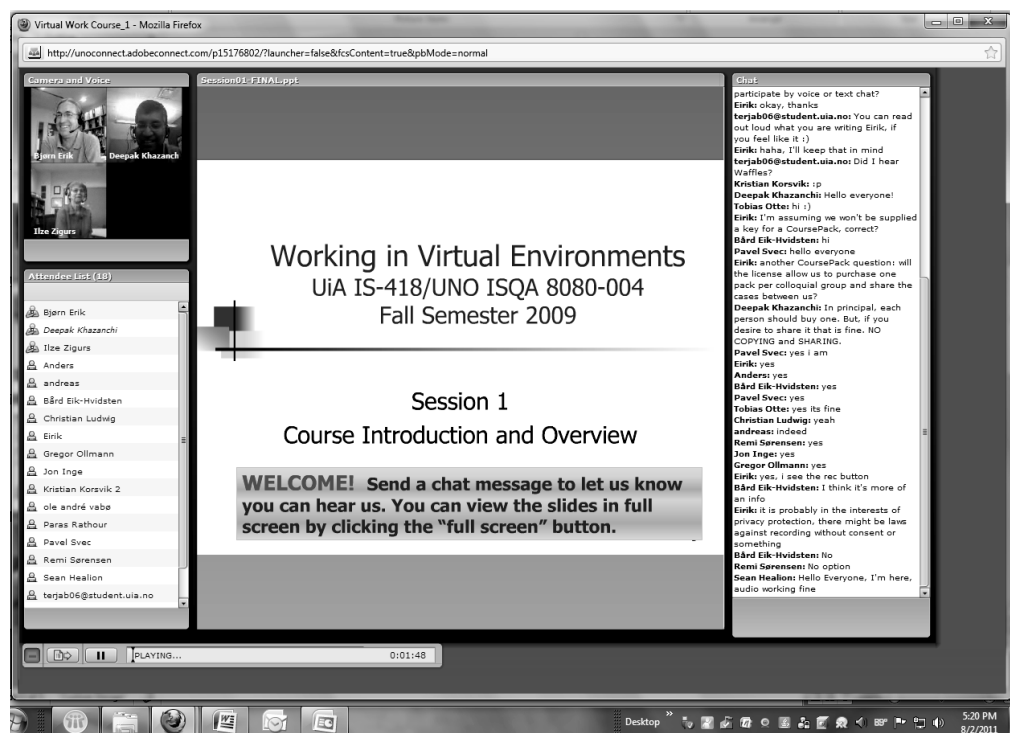


Figure 1. Screenshot from synchronous class session in Adobe Connect

The window pane in this tool can be configured in terms of what elements to include and the placement of these, and the screenshot shows the standard setup chosen for the course sessions. The top left pane shows the webcam of the presenters. While the system allows displaying video for all participants, we decided to only display the instructors' webcams as default. In addition, a student's webcam would be displayed when making a presentation in class, although use of video for this was not mandatory. The bottom left pane shows the attendee list, also indicating who has presentation status. While the system allows for each participant to control their microphone rights, we decided to 'control the floor' by having the instructors grant microphone rights based on the student using the 'hand raising' function in Adobe Connect. The middle pane displays the material controlled by the presenter (which could be any participant granted presentation rights). The right pane displays the chat window, which was kept open

during all sessions. While it is possible to conduct private chats between two participants, this was only observed to be used at a few occasions (e.g. an instructor assisting one of the students with a technical problem). Another function allows the presenter to easily set up ad hoc polls for getting the participants' responses to a question, including immediate display of the results.

The system also has a function for recording the sessions, including all audio, video, and chat. The instructors decided not to include this as a regular feature in the course, based on two concerns. First, if all sessions were recorded and made available online, we saw a potential risk that some students would not participate in the online session and instead just watch the recording after (class attendance was not mandatory in the two courses). Second, as this course could be characterized as a pilot to try out this format, we were not certain that the sessions in this version of the course would be 'polished' enough for being suitable for later reuse of recorded sessions. However, we still experimented some and recorded a few sessions. Some of these recordings were also distributed to students who missed the session due to illness or travel. And the recording function proved particularly useful for pre-recording a guest lecture from an industry manager. He was scheduled to present in one of the online sessions, but since he knew there was a risk he could be called for an important meeting at this time we decided to pre-record his presentation. While this presenter was experienced with this form of online presentations, the tool also proved very simple to use for this function. When he was actually prohibited from presenting 'live' during the session due to being called to the corporate meeting, we instead had each student view the recorded presentation during the class.

In the next section the participants' experiences with these different synchronous functions are presented.

### **3.3 Data collection**

With the primary focus being on the students' learning outcome from this course, the instructors did not develop a rigorous research design for this study. Yet, a web survey conducted at the end of the course in combination with the students' reflection reports and the instructors' observation and experiences together provide rich insight into the students' experiences with the format of the course and their use of different media for supporting their virtual work. The web survey focused on the students' perceived learning outcome from the on-line course format and the virtual team work, and their experiences and preferences related to use of the different technologies. The students' reflection reports presented more detailed reflections on learning outcomes from the weekly sessions, the team process, and experiences with the different technologies.

## **4. EXPERIENCES FROM REAL-TIME CONFERENCING**

### **4.1 Media channel perceptions and preferences**

As shown in Figure 1, the conferencing tool provided the opportunity to combine video, audio, chat and application sharing.

In the survey results, a slight majority of the students (52,5 %) agreed or strongly agreed that it was useful to be able to see a video image of the instructors in Adobe Connect during the class sessions, while 4 students (23,5 %) disagreed and 3 students were neutral. Similarly, eight students (47 %) regarded it to be useful to see the video of their fellow students during their presentations, with four students disagreeing and 4 students remaining neutral. However, only one of the students expressed that he would prefer to see video of all the students during the whole class sessions, and 82 % of the students disagreed. This indicates that the use of video should be used mainly as a rich communication channel during presentations, and not as an "always on" channel even if the conference tool and network bandwidth allow for this option.

For the audio part, we learned that it was important that the students used headsets and not external PC speakers, as the latter tended to result in problems with echo and noise. However, even after stressing this repeatedly, some students continued to use speakers. In the first sessions, the Norwegian instructor experienced problems with the audio quality, also sometimes even losing his audio completely. When this happened it proved extremely useful to have co-instructors that could take over the lecture, to avoid

having to discontinue the session. To solve this audio problem the Norwegian instructor had to relocate to an office that had access to the student campus network, as the problem seemed to be related to restrictions in the employee network.

Network connection was also reported to cause problems for some of the students participating from home. Due to this, one of the students decided to participate from a computer lab at campus, but found that this restricted his ability for audio participation as he was not alone in the lab. Thus for the following session he relocated to his 'home office':

*"Unfortunately for me, I decided to stay at home so that I could use voice chat if needed. This turned out to be a big mistake. Due to the unstable Internet connection at home, the session was a real mess for me. There was too much lag/latency and speed problems that when someone spoke, they would cut in and out. This resulted in people talking over each other and the voice chat lagging behind what was currently on the screen (slides and chat). For me this session was horrendous, and as a result of trying my best to understand and participate, I ended up with a headache. So from now on, I no longer believe that I have to use voice chat in these sessions to participate."*

Yet, apart from some 'sporadic' problems like these, the audio worked fine for both instructors and students during the sessions.

The sessions were typically organized with a first part for presentations of literature or projects by the instructors or students, followed by discussion among the participants. During the discussion parts the instructors sometimes experienced difficulty in engaging a broad discussion among the participants, and typically a smaller number of the participants were most active in all sessions. While this could also be regarded as common in a traditional classroom setting, the virtual setting offers much more restricted possibilities for the instructors to stimulate questions. Simply posing a general question to the group, e.g. "any thoughts on this", often resulted in total silence, and also even when probing certain participants by name this would not guarantee a response. This indicated that the threshold for contributing through audio at least for some participants was considered to be greater in this online forum than in a classroom situation. Adding to this is of course the fact that not all of the Norwegian students were experienced in discussing in English.

Interestingly, there would often be a more active discussion going on in the chat room in parallel with the audio discussion. In the web survey we asked the students to explain whether and why they preferred chat instead of audio for discussion, and 10 out of 13 responses to this question confirmed this preference. Examples of reasons stated for this included:

*"True. The text chat was faster, and I felt higher expectations towards my answer when using voice."*

*"I think it is difficult to talk to people that I have never seen or met before. And I do not have any experience in talking to larger groups of people virtually which made me a little afraid of speaking in class."*

Several also pointed out that chat was perceived as more effective for making a short comment or question, rather than raising your hand to ask for the microphone. Some also referred to experiencing some audio problems as the reason. However, some of the students also indicated a clear preference for audio:

*"I did not prefer the chat over audio. I type slowly and many times the class had moved on before I got my chat completed.[...] By the time I think of what I want to type, type it, and submit the class has moved on and my remark is no longer relevant. Sometimes students start conversation with each other and that is very distractive to the presentation."*

*"The chat function doesn't work as effectively as speaking because other comments post at different times, and people begin to respond to multiple topics at once. It can be convoluted."*

While the chat was preferred by many of the students for the discussion, several students were skeptical about the parallel use of audio, slides and chat during presentations.

*"One problem was that the chat and voice occurring simultaneously distracted me from following the presentations so a clearer "line" between each form, and when, would be nice."*

*"An observation made during the session was that it was distracting to have live video, audio, a presentation, and a chat all ongoing at the same time. But this is more about just training oneself to focus on the correct area at all times. I found that I was looking at the speaker when he/she talked instead of looking at the Powerpoint slides. And then some chat text appeared which took attention away from this."*

*"I found it very hard to listen to the presentation and discussion and at the same time typing my response or question (and not in my native language)."*

In some sessions the instructors would also experiment with the polling function and adding supplementary slides in parallel with an ongoing presentation. However, this was not received well among all students:

*"I don't like that the instructors added slides while the discussion was ongoing. It was a bit disturbing. We don't need more things to read while we listen to the students presenting their work."*

## **4.2 Pros and cons of the virtual setting**

The advantages of virtual teamwork are well documented for both business and education (Powell et al. 2004). The possibility for team members to contribute regardless of physical location provides increased flexibility and increasing availability of the team's shared competence resources. Also for this course the flexibility offered by the virtual setting proved useful both for instructors and students. For one session one of the instructors participated from a hotel while attending a conference and the students reported participating from several locations: at work, from their home or sometimes from a computer lab. From the web survey, only two of the students expressed a preference for taking this course as a 'traditional' face-to-face course. Still, this flexibility in geographical location did not come without challenges, as reported by several students in their reflection reports:

*"I have to admit that sometimes it has been difficult to concentrate during the lectures, as sitting by a computer at home offers a lot of opportunities for distractions."*

*"The biggest struggle I had this first session was all the noise in my apartment. I got a couple of visitors under the session so I missed out a couple of minutes. So the next time I should plan this better."*

For the US students working, participating during their office hours was a challenge:

*"For me the worst thing was that most of the activities took place during the day in the US. Like most grad students in my university, I am a part-time student with a full-time job. Taking breaks during the workday for the course was difficult."*

This also affected his participation in the team project:

*"As always, synchronous communication has been somewhat difficult for our group due to the time difference. I'm almost never available before 5 pm CST due to my job, which is midnight in Norway."*

We have already reported on the challenge of engaging discussion in the virtual settings, and ascribed some of this partly to 'stage fright' and a higher threshold to speak in this setting. However, an additional explanation that should also be considered is that some of the students were multitasking:

*"Everyone was very quiet today – I wonder if others do just log in so their name appears on the roster, then devote their attention elsewhere?"*

The course format also implies several challenges for the instructors. In online sessions the lecturer lacks the visual feedback cues from the classroom, although some conferencing tools offer functionality for giving feedback on the pace of the lecture and raising hands for questions. The polling function in Adobe Connect also enables administering ad hoc polls to the students to get quick feedback on course-related questions. Further, the chat channel can be kept open for continuous feedback and questions. Still, compared to the traditional setting, giving online lectures from your office (or elsewhere) can be a lonely experience.

Some of the students expressed similar challenges with presenting in the virtual class sessions:

*"While I'm both used to and comfortable holding presentations in the standard Powerpoint-assisted format, doing so virtually in Adobe Connect turned out to be a different beast entirely. The lack of eye*

*contact between my audience and me left me unable to gauge their reactions and general mood. This left me without something presenters normally take for granted, a basic reassurance that the audience is on your own page and paying attention. For all I knew, their faces might have been one big question mark. This led me to pause a few times to ask for confirmation from the lecturers that what I said was “making sense” – a kneejerk reaction to this unfamiliar situation. This, in turn, made me lose my stride and struggle to regain my train of thought.”*

This indicates a need for training in holding virtual online presentations.

The challenges of facilitating online audio discussions have already been mentioned, as well as the risk of other factors distracting the students’ attention. Having three instructors in this course (at two different locations) clearly mitigated these challenges, both in terms of maintaining the flow in the sessions and as backup in case of technical problems.

## **5. Discussion**

In this section we reflect on the reported experiences in light of related research, and discuss some implications for the inclusion of real-time conferencing as part of online learning. We also point out some limitations of this study.

As a basis for the reflection and discussion, it is useful to summarize the key ‘parameters’ of this course setting:

- 17 students from five countries, with a majority of these being Norwegian students in the same graduate study program. However, since this was a first semester course for the Norwegian students all participants had little or no prior history of working together.
- 13 synchronous sessions conducted over a period of 15 weeks.
- Default use of Adobe Connect as the conferencing tool for the class sessions, but with some discretion on which communication channels to use for participation (video, audio, chat).
- Apart from an instruction sheet with links to tutorials for setting up Adobe Connect and adjusting the audio, the course did not include any specific training in the use of the conferencing tool.

Overall, the students reported the experience from this course to be positive, perceiving the hands-on exposure to virtual work and collaboration technologies to be highly relevant for their professional career. This was of course also what the instructors had both expected and hoped for, as similar positive experiences are normally reported from virtual student projects (e.g. Davis et al. 2009; Rutkowski et al. 2008; Sarker and Sahay, 2004).

The real-time conferencing sessions provided the opportunity for interaction and discussion both among the students and with the instructors, which would not have been possible if restricted to an asynchronous mode only. While our study did not enable direct comparison of student satisfaction and learning outcomes for a synchronous versus asynchronous version of a similar course, the fact that the students at their own discretion based a major part of their project work on the use of synchronous communication tools can be taken to indicate that inclusion of synchronous media in their communication repertoire is preferred when available. Further, attendance at the weekly class sessions was nearly 100 %, despite the fact that attendance was voluntary.

One of the propositions derived from media synchronicity theory is that individuals working together without well-established norms, and working on unfamiliar tasks using unfamiliar media, will have the greatest need to use media supporting high synchronicity. While this characteristic could be seen to fit with the context of this course, at least for the first parts, the students did not express any strong preference for media with high synchronicity. Only half of the students perceived video of the presenters as useful, and all but one preferred not to display video of all participants. Further, most of the students



preferred chat over audio for class discussion. Also, several students expressed a dislike with parallel communication from audio, presentation slides, and chat during the sessions.

The perceived limited contribution from video supports former research (Poltrack and Grudin 2005), and may also represent important implications for use of real-time conferencing in online courses. Even in this group with limited to no prior history, the opportunity for 'live feed' of the participants was not considered necessary. Although many students today have laptops with integrated cameras, offering 'one click' access to this function, use of video among the younger generation may seem to be limited. This is supported by anecdotal evidence from the first author's observations of the media use of his two teenagers, where webcams are hardly ever used as part of chat sessions with their friends. Whether this pattern will also carry over to the context of higher education and later work of course remains to be seen. So far, research on the use of instant messaging in the workplace (Isaacs et al. 2002; Nardi et al. 2000) or in teen life (Grinter et al. 2006) has not addressed the use of videoconferencing in combination with instant messaging.

Several situational factors seem to have contributed to the preference of chat over audio. The importance of a face-to-face introduction session for virtual projects is commonly acknowledged (Powell et al. 2004), and with this part missing for this online course some students reported an increased 'stage fright' for audio interaction in a virtual classroom 'full of strangers'. In addition, there were instances of network instability causing audio problems, showing that technical challenges may still have an effect. However, some students also pointed to the higher capability of rehearsability offered by chat compared to audio, i.e. the possibility to rehearse or fine tune the message before sending (Dennis et al. 2008).

The reported challenges of processing simultaneous information from the different channels of the real-time conferencing tool (audio, video, presentation, chat) support the concerns raised about potential cognitive overload from this form of multimedia use (Cameron and Webster 2005; Dennis et al. 2008). Similar, Ho and Tang (2001) discuss how information overload may result from a combination of information quantity and the diversity of information formats.

The findings related to the pros and cons of the virtual course format illustrate how making effective use of the flexibility does require some configuration of the location from where to participate, regarding audio and video setup. Further, the need for developing online presentation skills is evident. The lack of 'control' of the audience (especially without the use of webcams for all participants) also implies a risk of increased multitasking that may result in reduced attention to the presentations given by instructors or fellow students. As evidenced in a recent study by Iqbal et al. (2011), this form of multitasking can be expected to become more common both in co-located and distributed settings, which may require adjustments to the presentation format.

What then are the lessons learned for the design and conduct of this type of virtual course?

First of all, for real-time conferencing to be successfully included in the course portfolio, a stable and well functioning platform is critical. As demonstrated by this study, while conferencing systems such as Adobe Connect today are off-the-shelf products, there is still a way to go before this is fully plug-and-play. We have reported on some audio problems experienced both by instructors and students, and although several of these were eliminated throughout the course there were still occurrences of poor sound quality and latency during presentations. Similar experiences have also been reported in corporate settings, with resulting delay and 'hassle' in setting up online meetings (Päiväranta and Munkvold 2010). Further, the video quality of the students' webcams was sometimes poor due to non-optimal lighting conditions, pointed out as a common challenge for desktop conferencing (Poltrack and Grudin 2005). Thus, rather than jumping into the contents of the course, in a next round we would dedicate more time to checking the audio setup for each student, make sure that they all acquired a headset with microphone, and also provide some guidelines for use of webcams.

Another change we would consider is to include some form of kick-off seminar. While a physical meeting is not an option in a global student project like this, the next best alternative would be to arrange a session where the students at each location gather in a classroom equipped with video conferencing, for a synchronous introduction session. This will then create a setting which gives much better opportunity for the participants to introduce themselves to the class than merely posting their profiles in the course

repository. Such a session would then of course be natural to combine with introduction to the course contents and format.

As mentioned, this study used the three-phase model of conceptual learning, learning by doing, and learning by reflection on the project execution (Chen et al. 2008). During the first phase, the conceptual learning took the form of individual reading of selected papers presenting research experiences and best practice for virtual teamwork, posting of case commentaries in the course blog, and discussion of readings in the synchronous class sessions. This was then intended to provide a basis for the team projects. However, we did not impose any detailed guidelines on the team process or media use, leaving it to the students to agree on their preferred collaboration strategy for developing the project deliverable. This is in line with the strategy suggested by Dillenbourg (2002), in his discussion on the use of so-called collaboration scripts in computer supported collaborative learning (CSCL), defined as “a set of instructions prescribing how students should form groups, how they should interact and collaborate and how they should solve the problem” (p. 1). He argues that while such scripts may enhance the effectiveness of collaborative learning activities, e.g. by integrating different activities and also supporting time management, it may also increase the cognitive load of the learners and may disturb the ‘natural’ interactions and problem solving processes. There is also a risk that the pedagogical goals specified in the script may be difficult to adopt for the team as a basis for developing a shared goal required to establish ‘real’ collaboration. In general, Dillenbourg argues that the scripts need to be kept simple, and that they should be malleable enough to be adapted to the students’ mode of collaboration. In further versions of the course we may consider imposing some more prescriptive instructions on the use of the different communication channels in the conferencing tool, e.g. to limit discussion sequences to audio or chat only. As most of the CSCL research has so far focused on asynchronous collaboration (Hrastinski 2008), the experiences from synchronous interaction reported in our study may also contribute to this body of research.

We made limited use of the recording function of the conferencing tool in this course. Our initial concern was that making recorded lectures a standard ‘service’ to the students would reduce attendance during the ‘live’ sessions and thus decrease the outcome for those present. However, in a similar course run at University of Agder the instructor experienced that the recorded lectures were also used frequently by the students after attending the class, for repetition and further study of the topics. Thus, the potential of this function warrants further experimentation.

Finally, we should make clear several important limitations of this study. First, the data collected focused on perceived experiences, and did not use any validated instrument or measurement scale. For this, the number of students would anyway have been too limited. Second, while spanning a period of 15 weeks which is actually quite long compared to much of the similar research on ad hoc, virtual teams, this type of study clearly cannot capture the media preferences and use patterns that develop over a longer period. Third, the semi-virtual nature of this course, with the majority of the students being co-located on campus for other study activities, may represent a limitation for transferring our findings to a fully distributed course setting. Yet, despite these limitations we argue that the findings reported can be of use for further inclusion of real-time conferencing services as part of online courses.

## 6. Conclusion

Real-time conferencing tools such as Adobe Connect are today easily available for use in academia and business. However, there is still a need for more knowledge on how to effectively incorporate these tools in an online learning setting. This paper has presented experiences from the use of real-time conferencing to support synchronous class interaction in an international online course. Through combination of video, audio, application sharing and chat, the students and instructors engaged in weekly interactions in a virtual classroom. This created an environment for rich interaction, augmenting the traditional use of course repositories. Further, this gave the students hands-on experience with real-time conferencing tools which are increasingly common in the workplace.

We argue that training in virtual team work should be a standard element in graduate study programmes, to prepare the students for the global workplace. This could either take the form of a dedicated course on this topic, like the one presented in this article, or as a module integrated in one or more of the existing

courses in a study programme (e.g. in the form of a virtual student project). In any case, this type of training should include use of real-time conferencing of some format, and the lessons learned from our study may then be used as a basis for design and implementation of this experience. However, more research is clearly needed to develop best practices for combination of different communication media for different configurations of online courses, and to define the level of prescriptive guidelines to present to the students to enhance their learning outcomes. Further research on the communication media preferences and use patterns of the coming generation of students will also provide important implications for future development of online synchronous learning.

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