

NEW LEARNING MODES IN THE PRODUCTION OF PRESENCE - DISTANCE TECHNIQUES FOR EDUCATION

HILDING SPONBERG, Dept. of Technology, Gjøvik College, Pb. 191, NO-2802
Gjøvik, Norway (Tel: +47-61135251; Fax: +47-61135249; E-mail hilding.sponberg@hig.no)

CLAUS J. S. KNUDSEN, Division of Media Technology and Graphic Arts, Royal
Institute of Technology (KTH), Drottning Kristinas v.47 D, SE-100 44
Stockholm, Sweden (Tel: +46-8-790 6376; Fax: +46-8-791 8793; E-mail:
clausk@gt.kth.se)

LEIF HANDBERG, Division of Media Technology and Graphic Arts, Royal
Institute of Technology (KTH), Drottning Kristinas v.47, SE-100 44
Stockholm, Sweden (Tel: +46-8-790 6802; Fax: +46-8-791 8793; E-mail:
leifh@gt.kth.se)

Abstract

This paper focuses on new learning modes that combine physical and virtual learning spaces and techniques. Synchronous distance technique combined with new dramaturgy and narrative techniques create new learning modes for distance learning. In a series of courses called "Networking Multimedia" students are trained on pedagogical use of video conferencing, integrating several different media tools.

The research was based on analysis and evaluation of a large number of video recordings from previous exams and questionnaires among the students. Typical exam projects varied from playing games, give interactive instruction, interactive music performance to virtual marriages, combined ISDN and IP-based videoconferencing and multiple remote control of PCs over the world. During these courses, we have seen that relatively simple techniques can be used for producing programs with a high level of participation and presence – and for the best projects, the technology becomes transparent.

Keywords: Telepresence, presence production, virtual learning space, international cooperation, distance techniques, sense of presence, networking multimedia.

1. Introduction

Since 1997, 4 courses in "Networking Multimedia" [12] have been given between Gjøvik College [1] in Norway and The Royal Institute of Technology (KTH) [2] in Sweden. Similar courses have been given to other countries [11]. 170 students have participated using distance techniques to support the learning process. All three writers of this paper have been involved in the courses with personal experiences from different point of views. Hilding Sponberg has been responsible for the course locally at Gjøvik College, while Claus J. Knudsen has been lecturing and guiding from Stockholm. Leif Handberg [5] has his main experiences from evaluating the students at a distance from Stockholm.

Terminology and definitions

In this research area there is a lack of clearly defined terms. The term *space* is being used for both a physical and non-physical space. The non-physical space may be called intangible, virtual or fiction and is defined by a common sense of space shared by participants at a

distance. Enlund [6] has argued that we can use quite simple media technology to produce a sense of presence that can be delivered over distance in time and/or space, a telepresence or virtual reality. This is also supported by the studies by Nass and Reeves [13]. It is a sense of shared space, time and presence produced for the human imagination, depending on several other individual preconditions like emotional state, associative context and the suspension of disbelief. The sense of presence at a distance, using technology and interactive storytelling, can only occur when persons are "present" in the shared virtual space. In this paper we are using the term presence production to describe this process.

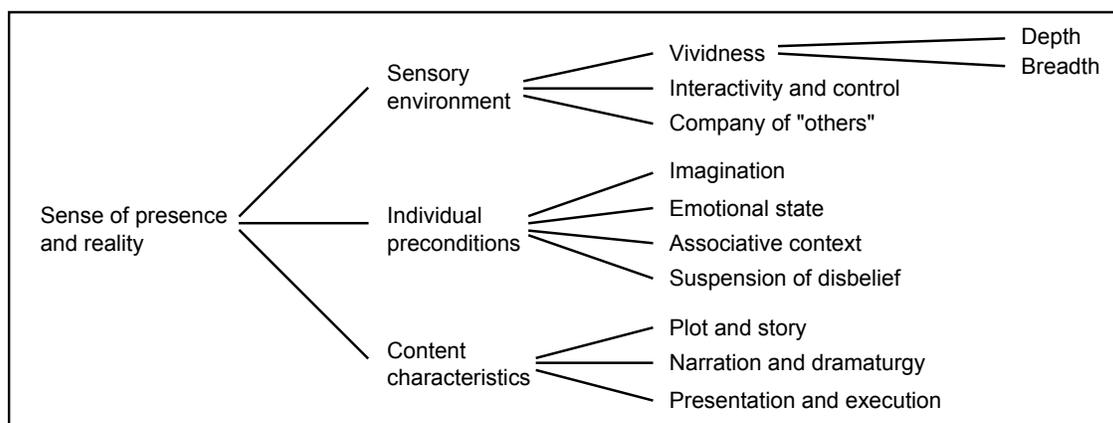


Fig. 1 Factors creating a sense of presence and reality [6].

Objectives of this paper/study

Based on experience and results during 4 years, running the course "Networking Multimedia" and questionnaires from the last years students, the authors want to bring forward new pedagogic ideas and viewpoints on using live video/audio for real-time multi-way communication in a shared virtual space.

2. Methods

Several different methods were used for collection of the empirical material for this paper. Distance lectures, guiding, tests and examinations have been recorded on both local and remote sites for further investigation of production methods and content. A questionnaire was handed out and answered by the students of the latest course, in spring 2000. Together with physical observations, student reports and notices, the material has been analysed and the findings are presented in this paper. Some of the examination productions have been selected to visualize different use of interactive real time streaming media.

3. The course in "Networking Multimedia"

The 170 students participating in the 4 courses comprise two different groups. For one group of 80 students, from the 2 year program "Computer and Multimedia" at Gjøvik College, the course was compulsory. For the other group of 90 students, most of them from graphic arts engineering studies, the course was one out of several free choices.

Objectives of the course

The main objectives of the course in "Networking Multimedia" were to let the students:

- Develop competence for acting at a distance useful for them as future employees.
- Know about distance technologies for implementation of flexible learning modes.
- Explore and experiment with presence production of various kinds.

Course content

The course gave the students theoretical background for the distance technology such as compression algorithms, sensory and display technology, telecommunication applications and system requirements. In addition to this, interactive storytelling and television production skills were implemented such as emphasis on making the technology transparent, camera techniques, choosing the optimal picture frames, lighting, clothing and video editing. In order for them to be able to use the technology for maximum outcome with regard to presence and multi-way communication, the students were lectured and trained in the first part of the course. At the second part the students formed project-groups and prepared the final exam.

Exam projects

Topics chosen for the student project may be divided into typical groups, such as:

- *Games, competitions*, e.g. “Who wants to become a millionaire?” and “bit by bit”, a game between two competing groups at a distance being the first to discover the object coming up on the computer screen piece by piece centrally controlled over the Internet.
- *Instruction*, e.g. software education or support, paper folding, LEGO building, guitar play, card tricks and computer work ergonomics.
- *Role play and ceremonies*, e.g. marriage, trial processing and theatre “the superman”.
- *Multipoint cooperation*, e.g. controlling a building process and composition of music.
- *Interactive information package*, e.g. interactive TV news and travel agency.

4. The distributed lecturer and evaluator

The lecturer at KTH, had many years of local experiences from teaching at Gjøvik College before working at a distance. The local lecturer and the remote lecturer had also worked together and built a basic trust relationship physically before acting remote. This influences the ability to orientate at a distance in the virtual environment at Gjøvik College in a positive way when sitting at KTH, Stockholm. The environment at KTH for producing presence during the lectures was constructed as a part of a small physical office to study flexible distance learning techniques in combination with ordinary office environment. The necessary techniques were tested out to achieve exact colour temperature and brightness for lighting, ergonomic positioning of video mixer, keyboard, mouse and whiteboard. Actually sometimes the camera was covering a small part of the monitor. The PC – video output was connected to the video-mixer so the lecturer could easily alternate between camera and computer sources.

5. The local student group and the lecturer

The local tutor at HiG lectured on theory and demonstrated the practical use of videoconferencing on campus – using examples from previous student projects and professional use for distance education. In addition he organised all practical activities and guided the student groups in the planning process for the exam. There was a number of different approaches to the technical infrastructure, often very complicated, chosen by the students. Often experiments had to be carried out in order to develop a desired technical solution.

6. Distance techniques and storytelling

The distance lectures from KTH, Stockholm focused on networking interactive storytelling to achieve the feelings of presence and reality when communicating over distance in space and time. This knowledge was going to be used by the students during their group-work and preparation for exam production. When producing the distance education within the course, the main goal was to create a learning situation as real as possible combining the production

of presence with effective use of real time tools to illustrate important factors when communicating human to human at a distance. At the same time some of the students were invited to exercise presence production basics during the distance lecture to illustrate some of the theories for the local student group.

The content of the interactive storytelling lessons was based on learning material from the “Film School in Sidney”, Australia, and the lecturers collected learning material. One of the goals was to produce media transparency for a minimum of distortion between the coded content and the viewer perception in the multi-way communication. Another goal, when producing presence, was to involve the persons acting in the virtual space. There are three important factors for increasing the sense of shared presence [8]. These three factors are *vividness*, *the degree of interactivity*, and the *number of other persons present both real and virtual*. The vividness of the “Networking Multimedia” course involved two senses for defining the virtual learning space (sensory breadth): the senses of hearing and seeing. In addition to this, physical objects like camera treatment could be controlled remotely by using a simple remote control unit with memory. Also video sources could be selected remotely. The other component of vividness, the quality of the sensory input, (the sensory depth) involved the limitations of distance technology being used to create the feeling of shared space.

Singhal and Zyda [8], Steuer [9], have pointed out the importance of vividness for a shared sense of space and they distinguish between shared sense of space and the shared sense of time and presence. They connect interactivity to the sense of shared time. The sense of presence they connect to virtual persons or avatars present in the shared space. These ideas had to be taken into consideration when the project was executed. The group of students was limited to 40 to achieve media transparency when remote lectures took place. Often the students were split into two groups surrounding one 32` monitor each for better eye contact. The sense of real time was achieved through interaction between some few selected students and the remote lecturer during the teaching process.

Students and lecturers involved in the production of shared sense of presence in the distributed learning-space were framed into a standard television format by using storytelling theories from film and television production. The standard format, 3:4, was sometimes housing both the incoming and the outgoing stream of video called “picture in picture”. This loss of active space for the storytelling on remote site was taken into consideration when the composition of the frame was created. The display format and resolution was also important for the sense of shared space. At KTH, Stockholm, the display monitor was 14 inch watched from a distance of one meter. At the student site, several monitors of 32 inches were watched and combined from 2 to 4 meters depending on the interactive story being “told”. See the figure below.

Fig. 2

Interactive storytelling and presence production at Gjøvik College.

A variety of distance technologies were used during multipoint communication between KTH and other studios at Gjøvik.



Storytelling on film and television distinguishes between two categories of storytelling elements. The first point of view is “what you see and what you hear”. Selections like human expressions and choices of environment must be motivated to support the concept of the program and the plot of the story. The other point of view is “how you see and how you hear”. The importance of choosing the right technique and motivate for the right use or treatment to support the “message”. This is partly knowledge from the film industry to create “an apparently unmediated perception of another world” [10].

Eye contacts in the shared space

The position of the camera and the display for incoming picture is essential for producing eye contact and thereby the sense of presence at a distance. Several techniques are developed to produce the sense of eye contact like “stereo camera picture processing” and “mirror technique” (teleprompt). The main principle is to place the camera eye in the position of the human eyes on the incoming picture displayed. The display at KTH, Stockholm, was some times partly covered by the camera to achieve eye contact, as earlier mentioned. To illustrate the importance of the eyes when sharing emotion at a distance the lecturer isolated his enlarged eyes by turning the rest of the frame into black using a video mixer. The students were, at this moment of the lesson, asked to comment on their own personal experience by watching the lecturers’ eyes. *The experience from the test often demonstrated that eye-to-eye contact is essential for the sense of emotion and trust when communicating in a shared distributed space.*

Distance technique for performing art in a shared virtual space

In one of the student projects, “Superman”, a sense of shared dramatic space and presence between actors at a distance were produced in real time to play theatre together. Two physical spaces were connected together by distance technique. The cameras framed the actors involved with blue background, and standard colour key technique was used to mask out the actors’ personal video. The actors’ videos were fed into a shared virtual dramatic space by using a video mixer and a computer-generated environment. Several monitors were used for the actors to help them sense presence and relations to the other actors in the shared virtual space. The “dramatic space” had a complex limitation of fixed monitors and the lack of eye contact when producing the audience point of view, the objective one. The fixed monitors and cameras limited the possibilities for the actors involved to move from one position to another inside the dramatic virtual space. Producing local and remote camera/monitor treatment for the actors and the audience could solve this static experience of the play.



Fig. 3 The Superman is "flying" across the earth. Colour key technique is mixing the actor on to a live video in studio at Gjøvik.



Fig. 4 "Lois Lane" is acting in Stockholm but mixed in to the local virtual environment in the studio at Gjøvik.

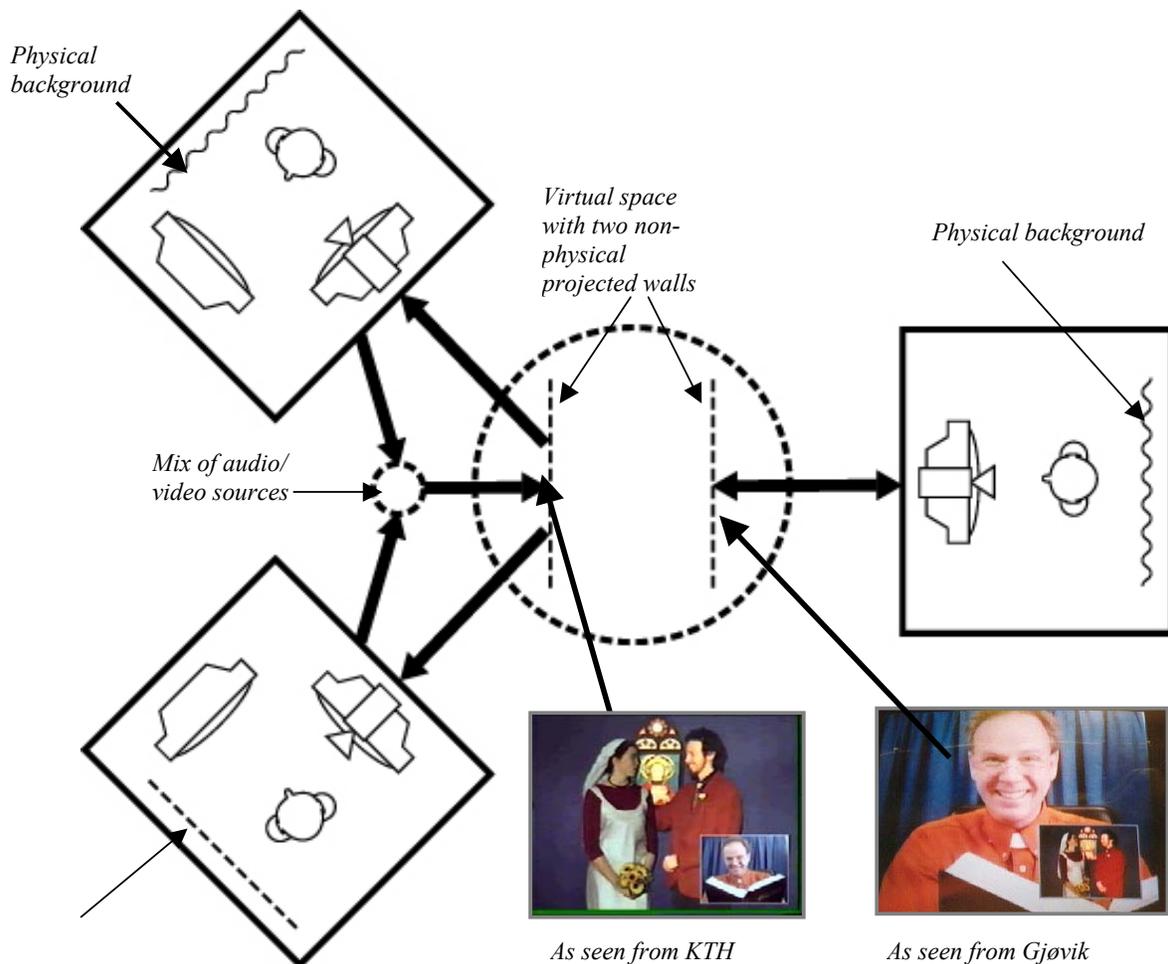
In another student project "the virtual marriage", three physical spaces were interconnected by multi point distance techniques. Colour key techniques were also used here to produce a sense of shared space and presence between the couples in the virtual church. One was keyed into the others physical environment. A "priest" at a distance, who could sense the presence of the "bridal couple" in front of him on a monitor, carried out the ceremony. The couple could sense the "priest" by watching the front monitor and sense the partner by watching a help monitor as seen in fig. 5.

Lighting for sensory depth

A lecture on using light to create depth in the television media was given at a distance. The lecturer created real time examples by using his own light set up and face to show the effects of changing shadows, light level, softness and colour temperatures. The students asked questions and practiced their own laboratory work effectively by showing up the results of their creation to the lecturer at a distance for comments. During this type of distance lectures no local guiding was needed for the students at Gjøvik College and the distance technique supported the learning process well.

Distance support for the student groups

Guiding and support was given from the lecturer at KTH, Stockholm, during the student process of brainstorming, writing storyboards and testing their program and technical concept for their exam. The students often demonstrated parts of their group work by using the distance technique. The lecturer at KTH could monitor the students' test productions and give them real-time support by commenting and give examples on solutions. A number of projects combined the presence production with remote controlled devices over the Internet such as a remote controlled interactive Smartboard connected to a networking computer. This solution supports a higher level of interaction and sense of shared presence and space with the remote site. Often websites, videoconferencing and remote controlled software on the Internet were combined with the presence production on the ISDN for engaging, simultaneously, several senses.



The blue-screen background was mapping out the person by use of colour keying.

Fig. 5
Virtual marriage

Publishing on the Internet from a shared virtual space

When human-to-human communication takes place in a shared virtual space, the publishing or broadcasting of the interaction must be produced in addition to the participants' video conferencing. If we compare with a real non-distributed physical space where a discussion takes place, we do not usually, as an audience, "sit inside a participants' head" when we are watching. The participants' point of view is often subjective as they choose themselves where and what to focus during the discussion. The audience point of view can be called objective as they are watching the discussion passively from outside and don't usually participate actively. The virtual space must be produced with the participants' and audiences' point of view to achieve the sense of reality and presence for all the parts. This must be taken into consideration when placing the camera because the camera-eye often represents the participants' eyes on remote site. The video conferencing technologies to day do not support these separate needs for objective camera viewpoints with all the participants together in the frame sharing a high sense of presence through eye contact at a distance.

However, some few technical solutions are on the market for publishing subjective video sources to an audience on the Internet, real-time or on demand. One of the two stream-station technologies monitors all the subjective video sources in the same frame. The other technology automatically switches to the full frame subjective video source with greatest level of audio information at the moment [14], [15], [16]. None of the publishing technologies affects the incoming pictures for the participants. With text-based feedback from the audience on the Internet, participants can read messages while performing in the shared virtual space. The recorded lecture was used as a learning material for self-study, repetition or for involving audiences on the Internet.

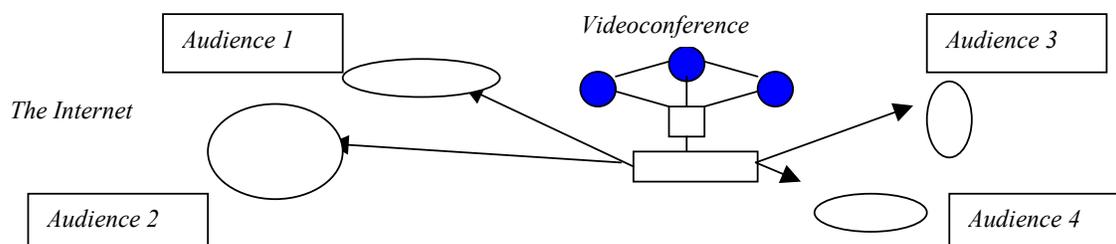


Fig. 6 Publishing/broadcasting videoconferences with text feedback from the audience

7. Evaluation

At the examinations, the students were evaluated in four categories:

- Storytelling.
- Interactivity (Ability to create and maintain interaction).
- Technical complexity (width and depth).
- Technology using skills.

These were evaluated separately and then put together to a final grade. Before the examination the students groups had to prepare the examiners with sufficient information and material, e.g. instructions by e-mail, instructions on a web site, sent physical material, manuscripts etc. The evaluation took place through observations of the production process at the local student site and the process of presence production and interaction on the remote site. The examiner was sitting in the same physical room as the acting lecturer at KTH. Since 1997, 55 exams have been carried out, each with a time limit of 20 minutes. For the 5 best projects, when all the four evaluation criteria were high and also very well mixed together, the technology became transparent. This was not obvious from the beginning of the presentation but was most often recognised after the presentation since the level of interaction had been very high. The use of a large number of technological elements did not necessarily give high credits. In some projects too many media elements were used. I.e. in some cases it had not been necessary to have on line video because the audio had been enough to sense presence and maintain communication.

The questionnaires

Questionnaires were handed out to the 20 groups from the two-year program “Computer and Multimedia” at Gjøvik College participating at the course, spring 2000. Answers have been received from 5 groups. The questions were about the course content, the student experiences, and technical infrastructures in the studio, the examination, student’s own evaluation and general questions about the participation. The tendencies in the answers were quite equal. The course was for this group of students compulsory. Even so, all students would have joined this course if it had been optional. The students hoped to experience an exiting semester and theirs

hopes were partly fulfilled. They believed the competence achieved would be of importance in the future. Both the theoretical content and learning material were evaluated as "good", but they wanted more practical experiences. Three of the groups had the sense of technological transparency on their exam. This fact was interesting and the exams will be further investigated in the future work. They all felt uncomfortable in front of cameras at the beginning. This situation did not change explicitly during the course, except for some very few students - which was surprising. One of the explanations may be the fact that students with this problem selected other jobs in the group to avoid the framing experience. In the future this aspect will be further investigated. Cooperation within the groups worked well and most students stated they had a chance to work, both, with content and technology. 100 % of the students made the statement that the exam implementation was most satisfactory.

8. Discussion

The course "Networking Multimedia" permitted a great variety of learning modes to take place. In addition we experienced many types of human-to-human communication mentioned in chapter 3, exam projects. It was important to train the students in thinking the "space" from physical to non-physical and back - to reduce the border between these two rooms – the human-machine interface.

Technical quality and the human senses

The sense of presence is created through transport of audio-visual sensory-content between persons at a distance. The distance technology is the carrier of the content, but a better technical quality is not the only key to trigger human senses. Still, the more human senses are triggered the more emotional involvement and feeling of reality may be achieved. However, the term quality is connected to a broader area than just technology and bandwidth. The content and the story itself and the way of telling the story, are critical factors for creating the feeling of technological transparency. Often, however, the noise from the production and heavy technological involvement in the studio, may limit the suspension of disbelief.

The students' experience

All the answers from the questionnaires indicated a positive attitude to the course content. The students believed that the knowledge of producing presence would be useful in their future way of working. The students experienced the technology transparent when the storytelling and the technology supported the characteristics of the human-to-human communication. The lack of sense of presence for half of the students may be partly due to the fact that they worked in a technical atmosphere with a lot of cameras, cables and monitors. For the observers in Stockholm, all this technology was invisible and gave the participants an increased sense of presence. The students, who felt uncomfortable in front the camera, experienced no changes after the course.

Distance technology for effective learning

It is often said that the physical room is the optimal space for learning. Is this statement true? There are reasons to believe that this may not always be so. We will have a look into one situation with a distance lecture. Let's join the audience in a videoconferencing studio. Many people are following the lecture. The lecturer, on his side, is looking into the camera and is monitored on the viewers' screens. Every single person among the audience can feel that the lecturer is looking at him/her respectively. This feeling of presence we often miss in the physical classroom. The remote lecturer may control the camera of his audience and zoom in persons for increased feeling of presence with individuals. When the cameras and monitors are arranged for maximum eye contact, the lecturer and the audience, mutually, obtain the

sense of presence with each other as. The presence production, the use of multimedia to illustrate the topics and the possibilities for recording the lecture in fact increases the effectiveness' of the learning process.

9. Future work

In the next study we will focus on research questions such as:

- How do we obtain technical transparency?
- Advantages/disadvantages when using distance technology for learning.
- How do we build trust and comfort in front of the camera?

10. Conclusions

Today it is possible to achieve a high level of presence at a distance by using quite inexpensive standard hardware and software tools that will become cheaper and cheaper. The situation is similar to what happened in the graphic arts industry in 1985 when "desktop publishing" was established and everybody with a computer became a potential publisher. The competence in layout and typography was, however, low and there were lots of examples of bad communication, and still is. *It is not enough just to have the tools; you must also know how to use them.* What is coming today is "desktop video" for "everybody". In order to succeed in transferring a message or maintaining a communication process that produce a sense of presence, it is necessary to understand which skills are needed – skills that our students, hopefully, achieve, to a certain extent during the course "Networking Multimedia". Finally, the fact that this is one of the most popular courses of Gjøvik College, give the authors inspiration for dedication, putting efforts into future development and research in "Networking Multimedia"

11. Acknowledgements

Thanks to our students for their eagerness to explore new possibilities when using distance technology and Prof. Nils Enlund for his support.

12. References

- [1] Gjøvik College, URL: <http://w3.hig.no>
- [2] Royal Institute of Technology (KTH), URL: <http://www.gt.kth.se>
- [3] Hilding Sponberg, URL: <http://w3.hig.no/~hildings>
- [4] Claus J. Knudsen, URL: <http://www.gt.kth.se/~clausk>
- [5] Leif Handberg, URL: <http://www.gt.kth.se/~leifh>
- [6] Enlund, N.: "The Production of Presence - Distance techniques in Education, Publishing and Art", ACS'2000 Proceedings, Szczecin, 2000, pp. 44-49.
- [7] Knudsen, C.: "Distance learning applications across multiple platforms and networks", Proceedings of the 1999 Telecommunications for Education and Training Conference, Gjøvik, 1999, pp. 289-296.
- [8] Singhal, S., Zyda, M.: Networked Virtual Environments—Design and Implementation, Addison-Wesley, Reading, 1999.
- [9] Steuer, J.: "Defining virtual reality: Dimensions determining telepresence", Journal of Communication, 42, pp. 73-93.
- [10] Bolter, J.D., Grusin, R.: Remediation—Understanding New Media, The MIT Press, Cambridge, 1999.
- [11] Virkus, S./Sponberg, H.: "Collaborative Learning and Teaching: A «Net-based Multimedia» Project between Estonia and Norway", Proceedings of the 1999 Telecommunications for Education and Training Conference, Gjøvik, 1999, pp 154 - 158
- [12] Sponberg, H., "The Visual, Virtual Learning Space", Lisbon 2000 European Conference Proceedings, Lisbon, 2000, pp. 159 - 162.
- [13] Reeves, B., Nass, C.: The media equation, Cambridge University Press, New York, 1996.
- [14] Polycom, URL: <http://www.polycom.com>
- [15] Tandberg, URL: <http://www.tandberg.no>
- [16] Video-streaming tests, URL: <http://studenter.hig.no/Course>