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Taking Our Own Medicine: Learning "Learning with Multimedia" with Multimedia

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Abstract: In this paper we present the design of a course on multimedia-based learning and a case study carried out at the Darmstadt University of Technology. We describe the course, the interdisciplinary audience and the employment of computer-based communication and cooperation. In more detail we introduce VITAL, a computer-supported cooperative learning environment. We state the results of the evaluation of the course. Finally, we come to the conclusion that by using the computer as a communication and cooperation medium new forms of discussion arise which have more of a brainstorming character than a continuous coherent discussion.

1. Introduction

Currently, we are experiencing a boom in demand for the use of multimedia technology to support teaching and learning at various levels of education and training. Multimedia technology (we use this term in short to refer to multimedia, hypermedia and telemedia technologies) is a basis for enabling new forms of teaching and learning in domains such as virtual universities, distributed organisations and life-long learning.

In order to qualify students for designing multimedia learning units and environments we developed a seminar on "Learning with Multimedia" which is based on the following principles:

- Learning about new technologies in education should take place not only by hearing and reading about these technologies but by using learning software based on these technologies.
- Knowledge about learning with multimedia should not be learned isolated but embedded in an authentic context.
- The task of designing and realizing multimedia learning units and environments is complex and usually done not by a single person but by a team.

- These teams should consist of experts of various disciplines, e.g. computer science, pedagogy, and media design.

The course on "Learning with Multimedia" addresses these principles:
- The course includes lectures about educational technology as well as hands-on learning experiences.
- The learning software is used to learn about the content of the course - "Learning with Multimedia"
- During a larger part of the course the students work in small groups (2-5 members) on the task of designing a lesson about a specific subtopic of "Learning with Multimedia".
- Students participating in the course should have a background in a related discipline, such as pedagogy, computer science, psychology, or media design.
- In addition, seminar tutors should (re)present multiple perspectives on the topic, in order to foster interdisciplinary work in the teams.

In sum, our goal was to create a harmony between the content of the course and the methods used to deliver it. The ideal course should provide hands-on learning experiences punctuated with short demonstration and discussion sessions. At the end of the course, participants should be able to judge and design multimedia-based instruction.
The remainder of this paper is structured as follows: In the next section we describe the course "Learning with Multimedia". Then we sketch the virtual learning environment VITAL and the ways we used VITAL during the course. In section four we present some results of our evaluation based on interviews and questionnaires.

2. Course Description

The seminar took place in the summer term of 1999 at the Darmstadt University of Technology, Germany, lasting three months and taking two hours per week. The aim of the course is to learn about and discuss the basics of multimedia-based learning. The students are supposed to actively contribute to the seminar. The curriculum comprises the topics of learning with multimedia, web-based learning systems, tele-teaching, computer-supported cooperative learning, learning processes supported by computers, and new forms of teaching and learning. For this specific course the audience consisted of 15 students, ten with a more technical background (computer science and electrical engineering) and five with a pedagogical background. The lecturers of this course were also interdisciplinary: one with both a computer science and a pedagogical degree and one with a degree in Mathematics and Linguistics. The intention of the lecturers of this course was to teach the topics not only in a theoretical way but to give the students real experiences with these programs etc. The seminar was supposed to integrate the content with the way in which it was taught.

The students were divided into five interdisciplinary teams of three students each. Three of the teams included pedagogic students. These teams had two tasks: They each had to develop a lesson about one of the following topics:
- Hypertext learning system
- Cooperative learning methods
- Characteristics of geographically distributed learning
- Communication in CSCW (computer-supported cooperative work) / CSCL (computer-supported cooperative learning) systems

- Comparison of commercially available CD-ROM learning systems for Mathematics in elementary school
- Visualization with interactive simulations

The second task was to generate these lessons with computers and to present them as a computer program. To support communication and cooperation both within the teams and within the whole group the students were asked to use the virtual learning environment VITAL which is described below in detail.
(The lecturers were aware of the self referencing: A seminar about multimedia-based learning were the students are supposed to work in a multimedia-based way on producing lessons about multimedia-based learning.)

The course started with four group sessions. The students were given an overview about the technical and pedagogical problems concerning multimedia-based learning, and an introduction to the VITAL system. This period was followed by three weeks of team work. During this time, VITAL served as a blackboard for announcements and references to literature. The students were invited to come to the course room and, if needed, seek for advice from the lecturers, but had to find their own way of working within the groups. After this period, the intermediary results of each team were presented to the other groups. Here, problems concerning information retrieval, using VITAL, finding a common language between the disciplines, selecting the suitable sections to present in a lesson etc. were discussed. After another week of team-work the final presentations were made.

During the period of working in a team, the students had diverse possibilities to communicate. They could meet face-to-face either with or without a lecturer, they could telephone, email, use the chat tool of VITAL, or employ the learning repository provided also by VITAL. Some of the groups communicated nearly exclusively via the computer environment, and some groups used more the traditional means including email.
Also the final presentations were performed differently by the various groups. One team, having used exclusively VITAL all the time, used also VITAL as a presentation tool. Others did not use a computer for the presentation at all. The team preparing the lesson about learning with hypertext presented their results as hypertext. The discussion about this took place as an asynchronous session within VITAL. For ten days this hypertext system was part of the World Wide Web and each student had to read it and had to take part of the on-line discussion.

3. The Virtual Learning Environment VITAL

The course design included the provision of rich opportunities for the students and the lecturers to communicate and cooperate during the course. In addition to standard communication means such as phone, email and the world-wide web, we used the virtual cooperative learning environment VITAL (for Virtual Teaching And Learning) developed at GMD-IPSI (Pfister et al. 1998). VITAL aims to support small and medium sized teams of adult learners. Its main objective is to enable users to learn about a large range of topics (i.e., VITAL is domain-independent) by providing a virtual environment and a set of tools that are intuitive to use and conducive to the coordination, communication and cooperation processes that are typical for learning.

In VITAL, all users work with *cooperative hypermedia documents*. They can view documents and create new ones of arbitrary complexity by means of introducing new links. Users live in so-called

virtual rooms, which make up the *learning world*. Virtual rooms provide a metaphor that serves the purpose of supporting orientation and group-awareness in the learning environment. Users who occupy the same room have the same view on the presented material, they are aware of each other, can communicate with each other, and they are able to cooperatively manipulate documents. Virtual rooms are especially useful for providing smooth transitions between synchronous and asynchronous modes of learning, since persons in the same room have full group-awareness for synchronous work, but objects (texts, pictures, etc.) remain persistent in a room for later asynchronous work. Figure 1 shows some major components and functions of VITAL.

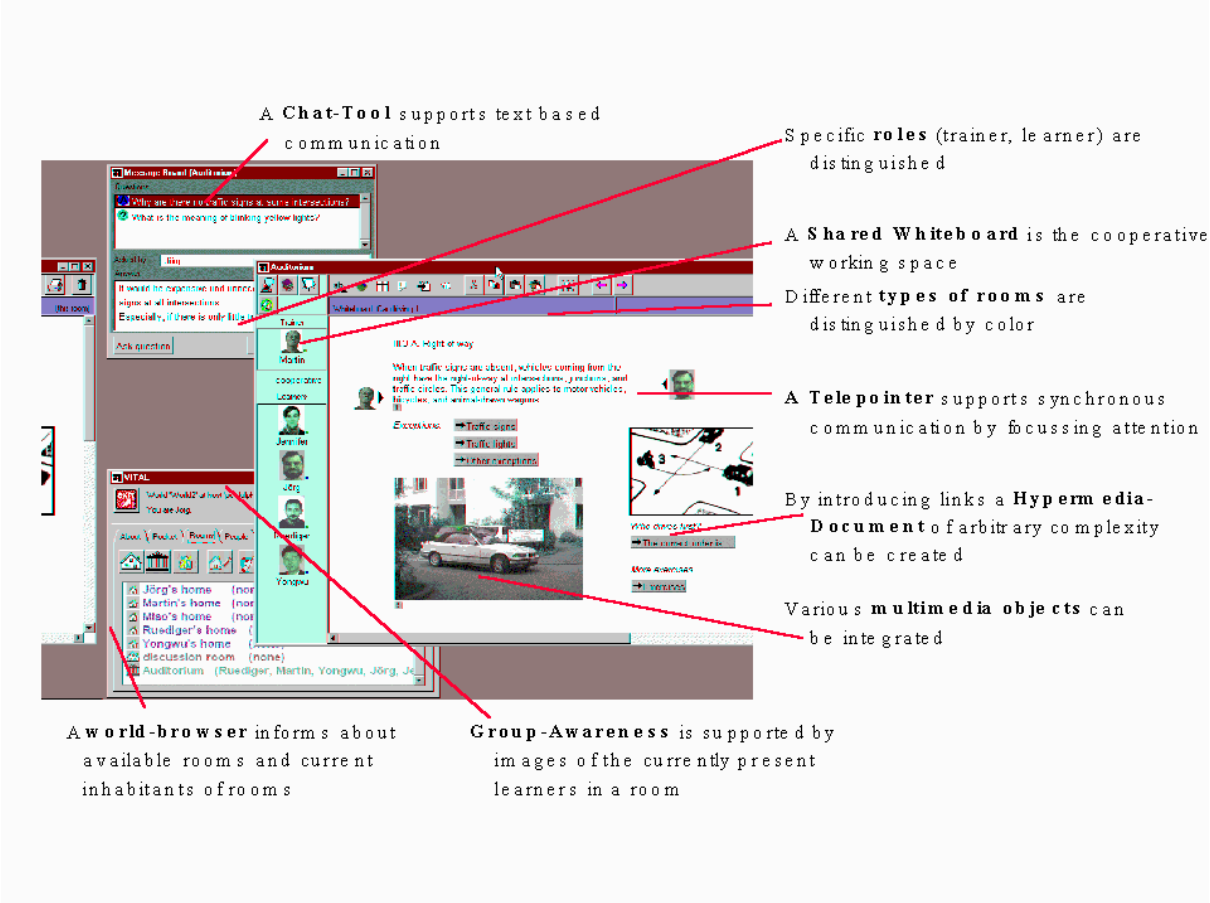

Figure 1: A VITAL auditorium window, a chat window, and the world browser

As can be seen in Figure 1, most of a virtual room consists of a shared whiteboard, where users can cooperatively view and create hypermedia documents. Group-awareness is supported by showing images of all persons currently in a room, and by using personalized telepointers. Synchronous communication is performed via a chat-tool, or by an audio connection. (The latter was not used in the case study because of technological constraints). Asynchronous communication is performed either by sending emails or by leaving text-messages on the shared whiteboard.

VITAL provides three types of virtual rooms: (i) *private homes* for individual study, (ii) *group rooms* for discussion and self-organized cooperative learning, (iii) *auditoriums* for presentation and teacher-guided learning. In an auditorium, two roles are distinguished, that of a learner and that of a trainer. The trainer controls the learners' access to the material presented as well as to the cooperation tools.

In the remainder we focus on the following three usage scenarios of VITAL in the course:

- Synchronous distributed group work:
  Students meet in virtual group rooms and communicate via the VITAL chat tool. The chat tool provides only text-based communication. In addition learners can refer to material on the shared whiteboard in the virtual room. The room also provides awareness of the other inhabitants of the room by the way of small pictures for each learner (see Figure 1).
- Asynchronous presentational discussion:
  The students use the learning environment for discussion by sticking their contribution at an arbitrary position on the whiteboard in the virtual group room used for the discussion. Technically students add a link to another hypermedia page. This link can be labeled to express the core idea of the contribution. The referred hypermedia page can contain information in various formats such as text, pictures, and tables.
- Learning repository:
  In this scenario VITAL is used as a persistent storage of arbitrary information. Thus, teams can deposit (intermediary) results for their colleagues or the tutors in their group room, the tutors can announce up-to-date information, provide references to the literature, e.g., in an auditorium, and monitor the progress of the group.

4. Evaluation

The evaluation of the course consisted of student interviews at the beginning and at the end of the course, and questionnaires in the middle of and at the end of the course.

An initial interview about their motivation to select this course discovered two main reasons for course selection:
The reason which was given by most of the participants was the interdisciplinary character of the seminar. The participants were curious about learning and working with students from another academic background. The second-most common reason was their interest in learning more about the topic of computers and learning.

In the middle and at the end of the course questionnaires were used to gather data from the students. The questionnaire consisted of 14 questions concerning the individual work and the team-work, the usage and usefulness of the communication and cooperation tools as well as of the tools for the realization of the team projects. Another set of questions addressed the satisfaction of the students with their group, the course, and the results of the individual work and the team-work. Due to the small sample size, all quantitative results should be taken as purely descriptive information (no statistical test were performed). Selected results are presented in Figure 2.

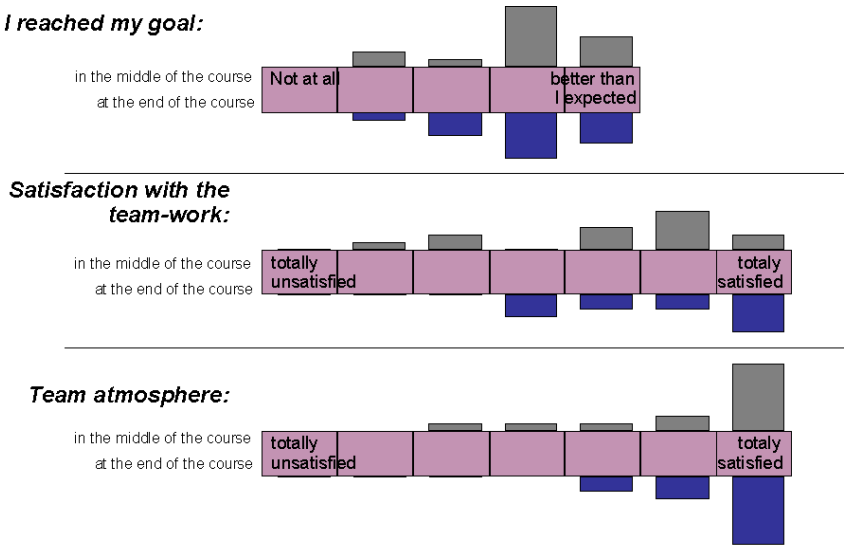

Figure 2: Selected questionnaire results

The general acceptance of the course, the groups and the results was rated as fairly high. With respect to the usage of the tools, results are more mixed. Though students generally had a positive attitude towards the tools a few students had serious technical problems.

In addition to the quantitative questionnaire interviews with the students were conducted. The issues can be grouped in the following way:

- The interdisciplinary constitution of both the complete group and the teams provided some difficulties but very positively effected the methods and the results of the team-work and the course as a whole.
- The sequence and the proportion of sessions with the whole group and periods of team-work was perceived differently by various students. A trade-off between the depth and quality of team-work and of the work in the course with the whole group was detected.
- The computer-supported communication and cooperation was different from earlier experiences of the students.

In the following, we concentrate on the last issue:
The students described their experiences with the computer-based communication and cooperation during the phases of team working. Three kinds of such a communication were used:

- Synchronous distributed group work: Two groups never used this possibility. One team used it quite a lot for social chat but not for issues concerning the course. Two groups communicated via the chat tool occasionally. Both complained that it is laborious not only to type everything instead of just speaking, but to have to make explicit that which in a face-to-face discussion is expressed by mime or gestures. There was also a problem of sequencing since there were three students in each team and it was not always clear who answered whom. Nevertheless, the students judged this kind of communication of high value, when used for organizational matters.
- Asynchronous presentational discussion: Many of the students were disappointed by the standard of the discussion. Whereas they liked the fact that each student and both of the two lecturers

joined the discussion, they remarked that the contributions are not intertwined, but rather disjointed statements.

- Learning repository: The usage of this component was not uniform. One team split their task into three subtasks. Each student solved one of the subtasks and placed her/his results into the repository. The others read and debated this contribution. They met only occasionally. Another group used it to exchange literature. However, the other three groups did not employ the learning repository. One reason for this was the limited word processing facilities as well as the limited number of import/export facilities provided by the system.

Based on the results of the quantitative and qualitative evaluation of the case study we come to the following conclusions:

- Traditional forms of discussion cannot be transferred easily into virtual learning environments.
- Synchronous creative, productive discussions are quite hard and should be avoided for groups of more than two or three members. However, arrangements are made much easier than by telephone as soon as more than two people are involved.
- Asynchronous discussion of a bigger group based on a thesis or a work known to everybody, has more of a brainstorming character and should only be used for this purpose.
- Repositories make sense when they are integrated in the existing tools. Then they are very helpful for exchanging documents and for giving external users an impression about the status of the ongoing work. They also serve very well as blackboards for announcements and background information.

The results match to evaluation results of other courses in which the learning environment VITAL was used in a different setting during a synchronous lecture (Pfister, 1999). For the next run of the course, we plan to replace VITAL by its successor, the CROCODILE system. The CROCODILE system provides so-called learning protocols (Wessner et al., 1999) which help the learners to structure their cooperative learning process.

5. References

Pfister, H.-R., Wessner, M., Beck-Wilson, J., Miao, Y., & Steinmetz, R. (1998). Rooms, protocols, and nets: metaphors for computer-supported cooperative learning of distributed groups. Proceedings of the Third International Conference on the Learning Sciences *(ICLS-98), Dec. 16-19, 1998. Georgia Tech, Atlanta*, 242-248.

Pfister, H.-R., Wessner, M., Holmer, T & Steinmetz, R. (1999). Evaluating distributed computer-supported cooperative learning (D-CSCL): A framework and some data (pp. 234-241). Proceedings of the 2nd International Conference on New Learning Technologies, University of Berne.

Wessner, M., Pfister, H.-R., & Miao, Y (1999). Using Learning Protocols to Structure Computer-Supported Cooperative Learning. In: Proceedings of the ED-MEDIA'99 - World Conference on Educational Multimedia, Hypermedia & Telecommunications, pp. 471-476, Seattle, Washington, June 19-24, 1999

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