Dagstuhl Seminar 00241

"Multimedia for Multimedia:
Learning & Teaching in the next decade"

Dagstuhl - June 11-16, 2000

Organizers: W. Effelsberg (Mannheim), E. Fox (Blacksburg), N. Georganas (Ottawa), R. Steinmetz (GMD Darmstadt)

1. Seminar summary

Since the beginning of the nineties learning and teaching has tried to take advantage of multimedia and Internet technology and applications. Various research approaches have been used:

- Multimedia Courseware implies a focus on the learning and teaching material itself: How shall the contents be structured, accessed, and presented? Which media shall be used? How can this be adapted to the teaching/learning situation?

- Teleteaching/Telelearning as well as Cooperative Learning Environments refers to learning and teaching at different locations making use of networking facilities to communicate audio, video and other data. How can we support the learning in a team (possibly distributed teams with cooperative environments)? How can teams be supported in the learning process? How can synchronous and asynchronous usage modes be integrated?

A wide range of conferences and workshops in this area shows that these issues are topics of interest in many research communities. However many of the contributions have been rather superficial and not focused. Therefore, in this Dagstuhl seminar we took a narrowly defined focus -multimedia courseware and tools for learning multimedia- but approach it from a number of different perspectives.

The seminar brought together researchers from different areas interested in and working on "multimedia for multimedia": Experts in multimedia technology and applications, pedagogical and cognitive aspects, curricula on multimedia, lectures of multimedia and related publishers. Also new/up-coming leading & visionary researchers have been invited to demonstrate the state-of-the-art and work in progress.

The participants discussed emerging requirements, exchanged experiences in teaching and learning in this area (including a large number of demonstrations), identified commonalities all over the world, and discussed the potential of new multimedia technologies. According to the goal of the seminar, not only to hear presentations, the participants elaborated on common experiences in teaching multimedia.

The seminar included presentations, demonstrations and discussions on the following topics:

- Existing curricula on multimedia

- Design of physical and virtual environments for the learning of multimedia

- Potential and problems stemming from the sharing of high quality media elements

- Demonstrations of tools

- Potential of existing and upcoming document formats (e.g. virtual environments)

- Usability testing of multimedia courseware

- Quality of service considerations

- Asynchronous vs. synchronous learning

- Next generation Internet and its impact

- Educating the multimedia educators

- Social economic issues of „multimedia learning"

In the seminar different approaches to the usage of multimedia for teaching multimedia were identified. Based on a comparison of these approaches the need for common multimedia curricula were discussed. Such curricula will allow the easy pooling and exchange of multimedia learning units and systems in order to improve the quality of multimedia training as a whole. As an outcome of the seminar the participants started to build up a worldwide network of experience to be used in the future by the whole research community interested in "multimedia for multimedia".

In this report, the abstracts of all contributions are presented. The organizers of the seminar, Wolfgang Effelsberg, Eduard Fox, Nicolas Georganas, and Ralf Steinmetz express their thanks to all participants for their valuable contributions.

2. Abstracts of all presentations

Networked Multimedia Learning in the next decade

Ralf Steinmetz (Darmstadt Univ. of Technology TUD-KOM, GMD-IPSI, httc e.V.)

Learning and Teaching „Multimedia" is – to my / our opinion – dominated by the following trends & implications in the next (at least) 10 years:

- To have an adequate presentation which adapts / scales according to
  - the used equipment & infrastructure
  - the learner's needs & learning goals
- to have reusable modules
  - metadata is crucial
- to support mobility, i.e. to learn at any time, at any location, at any environment
- to make use of cooperative learning
- to support many roles of the involved „roles":
  - author - similar content author
  - course designer
  - editor
  - broker
  - presenter
- to make teachware a valuable (well understood) good.

$\Rightarrow$ still a long way to go...

URLs: www.kom.e-technik.tu-darmstadt.de/Teaching/Visualization/visualization.html

Recommended Curricula for Multimedia

Ed Fox (Virginia Tech) & Shelly Heller (George Washington University)

Multimedia experts are in demand. Courses on multimedia appear in many types of schools and programs, and have different emphasis regarding coverage. To characterize current practice, and start to develop recommended curricula, we examined 27 URLs of courses on multimedia. These ranged from freshman through advanced graduate levels. Several were overview courses. About 1/3 focussed on applications, 1/3 on systems, and 1/3 on both applications and systems.

These 27 courses cover topics relating to other common courses, especially image processing, networking, communications, algorithms, OS, programming languages, graphics, data structures, distributed systems, music and ethics / social issues.

Subfields of multimedia commonly covered include video, compression, media streaming, audio, overview, authoring, tools, protocols, video conferencing, hypertext / hypermedia, coding / presentation, synchronization, OS and media. Based on this and other data, curricula recommendations are needed.

The purpose of a sharing community of resources in IMM is to provide benefits to educators and learners. To provide academic incentives for quality production, to provide guidance for the emergence of a set of scope and sequence for Multimedia-education and to provide a forum for cooperation and collaboration.

URLs: http://fox.cs.vt.edu

http://ei.cs.vt.edu/~crim

http://www.cstc.org

Determining the Appropriate Balance of Design, Technique and Theory in a Multimedia Curriculum

Jane M. Fritz (University of New Brunswick)

This presentation examines typical multimedia curriculum in an undergraduate computer science program and identifies existing challenges:

- What is the role of multimedia in computer science? Should multimedia be considered strictly from a technical reference within CS?

- What message is implicit in the absence of a standard multimedia text at the undergraduate level? An accepted standard has yet to be defined.

- What is the role of computer science in multimedia? How much technical expertise should be needed by multimedia development professionals?

- Are we in a transitional period? Will multimedia issues be subsumed by traditional causes such as databases, HCI, image processing and data communication?

- Should CS educators be concerned with what is missing on the computer science side:

  Graphic design principles, content focus, user understanding, multimedia project management, etc.

URLs: http://www.cs.unb.ca/profs/fritz/dagstuhl (after July 4th, 2000)

Multimedia and the University: Context, Cost and Culture

Chris Curran (Dublin City University)

The presentation addressed critical factors that influence the cost effectiveness of media-based university teaching. The particular focus was on the provision by universities of distance teaching programs.

The presentation drew on a range of empirical studies to illustrate the contextual and other issues discussed.

The diversity of solutions to resolving the conflicting demands of cost, context and culture, in on-line university teaching, was illustrated with reference to current developments in a number of on-line open, and virtual, universities.

URLs: www.dcu.ie

eMail: 106617.2404@compuserve.com

Electronic Note-taking

Thomas Ottmann (Universität Freiburg)

Nowadays, lecturers increasingly use the computer- and presentation software and electronic whiteboards instead of blackboard and chalk. They load prepared slides into the whiteboard, annotate them by graphical means (handwriting, highlighting, printing, etc.) and they enhance their presentation by animations, simulations, audio- and video-clips. Therefore the traditional way of note-taking by pencil and paper is no option anymore to capture the live event appropriately.

Electronic note-taking systems are designed for this task; they must be able to capture all data streams occurring in class. The capture streams are then integrated into real teaching and learning environments for offline-use. We review and classify existing systems, derive guidelines for system development and finally describe and demonstrate one of the most advanced systems of its kind: the AOF-system (Authoring on the Fly), developed in Freiburg over the last year. This system has been extensively used to routinely record (tele-) presentations; it also allows to control and annotate MPEG-movies and annotations. The basic architecture of the system is described.

URLs: http://ad.informatik.uni-freiburg.de/~ottmann/

Computer Networks and Teleteaching / Telelearning

Torsten Braun (Universität Bern)

The presentation introduced the "Virtual Telecommunications Laboratory Switzerland" project which is performed within the "Virtual Campus Switzerland" program.

The VTLS project has the goal to establish a distributed laboratory, in which students can perform experiments in virtual and real (remote) environments. The course to be developed intends to provide exercise modules for computer science students with basic knowledge in computer networking and telecommunications. Although the project's main issue is the development of content, several technical problems such as authorization, authentication and access control as well as organizational problems such as trouble shooting support and communication between teacher / student and among students have to be solved.

The different modules to be developed have to be integrated so that the students can perform one after the other.

URLs: www.iam.unibe.ch/~braun

www.iam.unibe.ch/~rvs/lectures

www.virtualcampus.ch

Application of Media Technology in Learning

Sepideh Chakaveh (GMD-IMK)

The presentation gives an overview of what is in general possible when applying the Media Technology at large to Learning.

A brief description of VR-technologies in hand are presented as well as outlining the possible requirements for PC & the Internet Medium.

The talk also entails multimedia presentations of some of learning tools where simulation & interactivity are the major elements.

Two general presentations are demonstrated in the area of Natural Sciences i.e. Physics & Culture (self study on the web in History of Music).

It is emphasized to couple correct content with Multimedia User interface which is self-explaining and intuitive for learning.

URLs: http://imk.gmd.de/delta

Transforming Different Textual Sources into a Learning System

Paul Müller (Universität Kaiserslautern)

When preparing the textual part of a lesson for a learning system, the author usually starts with documents which come from different word processors or other sources. A word processor at most supports a small number of formats, and the building layout isn't in general the one, which is required.

So beside all automatic translation provided by tools, generally the lesson author has to change the source document in incremental steps to achieve the desired format. An author isn't usually a programmer and the sources are heterogeneous, so support from a translation tool would be helpful. A general intermediate document format is necessary, which should be the source for the target learning system. This "middle"-format is also appropriate for enhancing the transformed documents with meta-tags in formats like Dublin Core or Learning Objects Metadata.

URLs: http://www.icsy.de

Teaching vs. Learning: Some Basic Considerations

Wolfgang Coy (Humbold Universität Berlin)

Learning, teaching and supporting technology form a difficult relationship. While learning depends on some basic wish "to know why" the pedagogical tradition developed a variety of theories how this learning process works – from an information theoretical transfer model to constructivist "emergence" theories.

While the transfer model ignores the historical fact that the printed book did not stop the lecture from being the dominant teaching form, the construction theory has to explain why we still need appropriate teaching materials.

Teaching and learning has been quite stable against a variety of technical approaches to "improve" it. Only few technologies like printed books, libraries, blackboards, copying machines and overhead projectors had some sustain influences. Computer & nets will have such influence – but probably on a smaller scale and more specific than often anticipated.

Several approaches to the use of multimedia and networks were demonstrated from our actual experience among them the web-server for the "Virtuelle Internationale Frauen-Universität (VIFU)", the OZ-teleteaching project and an experimental graphical much as a virtual room in computer science exercises.

URLs: http://waste.informatik.hu-berlin.de/

Psychological Aspects of Collaboration in Multimedia Environments

Hans-Rüdiger Pfister (GMD-IPSI)

Collaboration (or cooperation) in virtual MM-Environments need special support, i.e. special methods and tools. Cooperative learning has several advantages: motivation, elaboration of learning content, social embedding and learning to cooperate are improved compared to individual learning. However, in a virtual telemedia environment several psychological mechanisms need special attention. The talk focused on the aspects: construction of a shared knowledge base (group memory), and systematic structuring of learning discourses.

Shared knowledge is important if the group is considered as the unit of learning, not the individual. It is then important to provide information about "who knows what", i.e. location information about people who have specific knowledge. As a general framework, the transactive memory approach of Wegner is used. A tool is demonstrated with a simple tool called *SnapChat* (originating in the L³ project), which combines chat and a shared whiteboard where content of course can be imported and annotated by different learners.

Second, discourse structuring is important since much of indirect information is filtered out in computer-mediated communication. Based in the speechact approach discourses are analyzed according to the roles of speakers, types of messages and relations between messages. These information are made explicit in the UI and the learning system controls the discourse according to its type (e.g. explanation, pro/contra-discussion, questioning). As an example, an explanation discourse was demonstrated using a simple tool developed at GMD-IPSI.

URLs: www.ipsi.gmd.de/concert

Evaluation of Learning with Interactive Media

Peter Baumgartner (University of Innsbruck)

Every piece of Teachware implements a certain kind of learning theory – every function of an educational software has underlying (tacit) pedagogical assumptions. In order to evaluate learning tools one has to specify these aspects and look for their equivalents in the software itself.

With this proposition in mind I will distinguish three different learning and teaching models:

- (Neo-) Behaviorism

- Cognitivism

- Constructivism

Assuming that learning is not a single event but a social process these models may help us in each learning stage in a different way: starting with presenting factual knowledge to give orientation to applying this knowledge to solve predefined problems up to generating ("constructing") problems in complex real situations.

A case study dealing with a webbased teaching and learning environment (Course Info by Blackboard) I will show how to apply these methodological considerations.

URLs: http://iol.uibk.ac.at

peter.baumgartner@uibk.ac.at

Problem-based Learning in a Multimedia Environment

Johann Schlichter (TU München)

During their university education students often acquire large amounts of theoretical knowledge. But their knowledge mostly remains passive and cannot easily be applied to solve realistic problems. The web-based learning environment Munics (*Munich Net-based learning in Computer Science*) aims to improve this situation by supporting students in learning how to apply their knowledge in future workplace situations.

Munics is based upon the concept of problem-based learning with special emphasis on collaborative learning. The learning environment is centered around an authentic case study setting. In order to present the problem and its context to the students as close to real life and to the professional situation as possible, we used multimedia in the design of the learning environment, especially computer-generated animations and videos.

Problem-based learning means learning through own activity. Thus, the presentation of the problem was designed for interactive use, requiring the students to actively request the information instead of just absorbing what is presented.

Munics provides cognitive tools to support the students' cognitive activities. The students use these tools for collaborative work. Collaborative learning facilitates the construction of knowledge as well as it supports the students in acquiring important skills. Munics also provides a rich set of communication tools: a closely integrated chat-tool, a shared blackboard and a document repository facilitate communication and cooperation among students.

URLs: http://www11.in.tum.de/

Constructivist Learning Environments

Rolf Schulmeister (Universität Hamburg)

The CD-ROM "Die Firma" (The Company) situates foreign language learning, in this case learning of the sign language of the Deaf, within an authentic context. All eleven lessons are composed of video scenes taking place in a company setting. Learning starts with understanding (interpreting) the natural dialogues represented in the videos.

By utilizing the links between the dialogues, the translation and the vocabulary students try to discover the rules of grammar of sign language, and to construct linguistic knowledge.

Learning with the CD substitutes the live language course for the first three weeks. Students were given a feedback session once a week. They spent in the average 24 hours on learning with the CD. Our research question was if it was really possible to learn a foreign language by just trying to understand natural communication. The results are promising: a test by our deaf lecturers found out that the language understanding (reception) was really excellent, and that even the productive language capabilities were good.

Learning this way may be characterized as discovery learning. The whole setting, involving interactions among students and with lecturers may be categorized as constructivist learning. In a new project ViSi CAST (IST-Programme) we are working on language translation with Avatars in order to build feedback into the system.

URLs: www.sign-lang.uni-hamburg.de

   www.izhd.uni-hamburg.de

Learning Objects in the Context of Lifelong Learning

Giselher Redecker (Universität Bielefeld)

Due to the increasingly rapidly changing economical and especially to the transformation from an industrial to an information society, a large demand has arisen within the industrial, trade and service branches for affordable further education opportunities.

Within the framework of the pilot project: "L³ : Lifelong Learning - further education as a basic need" sponsored by BMB+f - "German ministry of Education and Research" - a network

based technical, organizational and didactical infrastructure for lifelong further education is developed.

Aside from the economical and organizational demands, didactical modules must be modified according to their uses within such a service infrastructure and expanded in order to be implemented within a generic approach.

This also entails developing design methods which can be reused within the bounds of the writing and learning process for didactical objects or so called learning objects. In order to achieve a maximum degree of reusability within the framework of L³ supported by a didactical metadata system capable of registering cooperation data.

URLs: www.l-3.de

Instructional Design to Deliver Telelearning Models

Gilbert Paquette (Télé-Université Montreal)

Explained is a telelearning delivery model that adds an environment of learning resources to any web site of a course. It is also a delivery platform in operation with several courses.

MISA is a knowledge-based method for design supported by the MOT knowledge editors and the ADISA web-based design workbench.

URLs: http://www.licef.teluq.uquebec.ca/gp/

The 7 C's Model for Learnware Development:

High-Quality 1-3 Hour Modules

Kevin Harrigan (University of Waterloo)

Our institution has been supporting the development of high-quality multimedia applications that address 1-3 hours of a 36-hour course. Our goal is to foster more use of multimedia technology in teaching and learning, as the current use of technology for teaching and learning is very low.

We support the development of these applications by offering a 3rd year Independent Studies course "The Design of Learning Activities with Interactive Multimedia". In that course teams of 4 students work with a professor to design and prototype a 1-3 hour interactive multimedia

application that addresses an instructional bottleneck in the course. After the course one or two of the students are often hired to complete the application.

We have done this with about 15 student teams with half of the project being completed projects. The professors have been very pleased with these applications and results of student use has been very positive. An interesting very positive side effect is that the students who take the Independent Studies course often say that the experience of taking the course has made them better 'consumers of education'.

URLs: http://watserv1.uwaterloo.ca/~kevinh/

Jets 2000: Java-Enabled Telecollaboration System

Nicolas Georganas (School of Information Technology and Engineering, University of Ottawa, Ontario, Canada)

The Multimedia Communications Research laboratory (MCRlab) has been developing Collaborative Multimedia applications, since 1984, in the areas of tele-medicine and tele-learning.

JETS (Java-Enabled Tele-collaboration System) was developed in 1996. It is a web-based tele-collaboration tool kit that allows synchronous sharing of applets. It is pure Java and thus portable.

Sample applets developed are: a shared whiteboard, H.263 video-applet, chat applet, VRML applet and other. A simple management system allows the "chairman" of a collaborative, browser-based, session to control the "floor" and enable / disable the shared whiteboard interactions.

JETS 2000, adds into JETS a real-time audio / video interaction through the Java Media Framework (JMF) and the ability to record a collaborative session in a SMIL file, which can later be played back through, e.g. the Real Networks G2 player.

JETS have received 1st prize at the ACM Quest for Java '98, and been licensed to industry.

URLs: http://www.mcrlab.nottawa.ca/jets

To/oL: A Learning Environment for On-line and Off-line Learning

Martina Zitterbart (TU Braunschweig)

Promise is a joined project of three universities (Braunschweig, Clausthal, Hannover) in Lower Saxony, Germany. It focuses on multimedia-based project-oriented learning of

Electrical Engineering / Information Technology. Promise comprises 12 individual projects including didactical consulting. The Institute of Operating Systems and Computer Networks, TU Braunschweig, is involved in content development as well as in tool development for asynchronous and synchronous learning.

To/oL (Tool for online / offline Learning) is a simple tool for handling course materials and as slides, animation and interactive experiments. It provides a free navigation through the material, guidance through a navigation bar and a glossary, among others.

Considering the content, focus was on dedicated issues related to basics in communication. In addition to slides interactive experiments are provided. Learners can configure individual networks and investigate issues, such as behavior and performance of sliding window protocols, configure domain name systems or local area network with bridges.

It should be kept in mind that To/oL and its content is an addition to the regular course material given to the students. It is not thought to replace current courses. However, it should improve them considerably.

URLs: http://www.ibr.cs.tu-bs.de/

Reusability Issues of Interactive Visualization Learning Modules

Abdulmotaleb El-Saddik (KOM, TU Darmstadt)

The production of interactive multimedia content is in most cases an expensive task in terms of time and cost. It must hence be the goal to optimize the production by exploiting the reusability of interactive multimedia elements. Reusability can be triggered by a combination of reusable multimedia components, together with the appropriate use of metadata to control the components as well as their combination.

At Dagstuhl, the reusability aspects of interactive multimedia visualization is discussed.

A component-based architecture to build up interactive visualization was introduced. This architecture differs from other known component architecture by the use of "dynamic" metadata in order to customize visualization according to user-needs of teacher-goals.

URLs: http://www.kom.tu-darmstadt.de/teaching/visualization/visualization.html

Course Sequencing in Adaptive Hypermedia Learning Systems

Stephan Fischer (GMD-IPSI)

Sequencing denotes the selection and ordering of topics, the selection of appropriate media units and their compilation into a course. We explain our architecture which consists of a

concept space and a media brick space. Structural information is stored in the concept space while didactic-rhetorical relations between media units are stored in the media brick space.

The talk explained algorithms how questions of the types "part of" and "application of" can be created automatically (multiple choice questions). The reminder of the talk provided a critical outlook with regard to the question of sequencing can be done in a semi-automatic or even in an automatic way.

URLs: www.multibook.de

www.darmstadt.gmd.de

sfischer@darmstadt.gmd.de

Adaptivity vs. Readability: How to employ metainformation

Cornelia Seeberg (KOM, TU Darmstadt)

The advantages of electronic learning systems are:

- Multimedia elements
- Individualized lessons   } due to modularity
- Easier maintenance

A problem is the missing coherence (which is given in a linear, traditional lesson) – due to modularity. Hence, one task is to overcome the gap between adaptability and readability.

The way from a linear book to an individualized multimedia electronic lesson takes three steps:

(1) Modularize the existing material, add multimedia material

status: huge set of unconnected modules

(2) Add metadata: Attributes, relations, classification in an ontology

status: good personalized search results, still no coherence

(3) Providing for didactic and rhetorical aspects

status: adaptive and coherent (well, at least: more coherent) lessons

A difficult task is the modeling of the ontology. Support can be provided by consistency checks (e.g. circles and short cuts). Also, a program based on the Dijkstra algorithm calculating the grade of relationship between concepts can be used for evaluating the correctness of the ontology.

URLs: www.multibook.de

www.kom.e-technik.tu-darmstadt.de

Interactive Simulation and Visualization of Algorithms and Protocols

Cora Burger (Universität Stuttgart)

We aim at improving the teaching process in the area of distributed systems and multimedia by means of applets. To this end, complexity, dynamics and many further aspects of algorithms and protocols have to be experienced by the students on one hand. On the other, effort to construct suited presentations must be reduced.

The overall architecture of HISAP (Highly Interactive Simulation of Algorithms and Protocols) copes with these requirements by containing the following components:

- Simulation model built by transforming the specification of the algorithm or protocol in some language or method like petrinet or SDL (Specification Description Language). It can be modified on the fly.

- Visualization and animation component that is based on the specification of presentation and triggered by the simulation model.

- Predefined scripts or sequential user input triggering the performance of the simulation model.

- Applet generator based on simulation model and visualization and animation component to get applets that can be run independently.

- Further facilities that are based on the simulation model and for instance check for correctness or estimate performance.

By offering different levels of interactivity, learners are supported and motivated to make experiments. Usage of specifications of algorithms and protocols as well as the applet generator care for reducing the overhead for teachers.

URLs: http://www.informatik.uni-stuttgart.de/ipvr/vs/projekte/ProtoVis/protovis_eng.html

Building a Federal Virtual University Through a Course Broker Middleware

Bernd Krämer (FernUniversität Hagen)

Global networking, digital economy, knowledge media and learning on demand are buzzwords characterizing the transition from the industry society to the information society. To serve the changing needs of the networked world, universities are advised to cooperate to share the costs of innovating their functions. They have to specialize and develop their individual strengths and remain competitive. They need to integrate their abundance of learning resources and teaching competencies and jointly succeed in the emerging global education market.

As a first step towards the realization of a federated European university, a consortium of distance teaching universities is developing a common virtual university portal with a novel course broker service at its heart. This computer supported broker service will assist citizens and enterprises in finding coherent course packages combined from courses of different providers. The courses found and course packages formed need to match the users qualification needs and learning conditions. This service will build on a broker middleware combining a search engine with a knowledge base of standardized course metadata. This talk outlines the architecture and functionality of the broker middleware and summarizes major challenges concerning its development and deployment.

URLs: www.cuber.net

www.curriculumbroker.de

L³ - Towards an Open Platform for Continuing Education

Torsten Leidig (SAP)

The talk gave a short overview of the L³-Project setup, goals and research topics. One of the primary goals for SAP is to provide the means for flexible, highly-customizable and adaptive training.

The Sibyl-Approach is concentrating on working out a core ontology for learning (pedagogical ontology) along with authoring as well as a runtime system which delivers training material based on conceptual evocation and educational / didactical agents.

The work on an formalized didactical ontology is jointly conducted with pedagogical experts from the university of Bielefeld.

The formalism used is 'conceptual graphs' (Sowa), which provides some advantages like:

graphical representation, relation to first-order logic and predicate logic, in progress of standardization, simple, conversion to other knowledge representation systems.

A possible delivering architecture was sketched and motivated by a short demonstration shown, which enables course-browsing using a conceptual evocation strategy.

URLs: http://www.l-3.de

Docs 'n' Drugs - Concepts for a Virtual Hospital

Michael Weber (University of Ulm)

Medical education nowadays faces several problems:

- Curricula are mainly based on teaching systematic factual knowledge

- Patient orientation comes in rather lately and in a limited fashion

- The ratio of "adequate" patients towards students disallow bed-side teaching in a large scale.

Still there should be a way for problem-based teaching.

Docs 'n' Drugs is a project aiming at a case-based, web-based tutoring system training the retrieval of relevant data, the classification of findings towards a diagnosis of virtual patient cases. The system comprises an authoring tool to feed systematical medical knowledge into a data base according to medical classification standards. Case-based refinements and additions are stored in the case data base. All this case data is combined and linked into didactical "learn flows" either in guided, semi-guided and guided navigational procedures.

Students use and follow the authored cases depending on their level of expertise. They collect relevant data, place differential diagnosis and go through quiz pages. When needing further help they may contact online tutors or an intelligent tutoring component gives hints and clues.

Authoring and tutoring systems are entirely written in Java enabling net-based usage for authors and students alike.

URLs: http://www.docs-n-drugs.de

Computer-Based Learning in a Heterogeneous Network and Computing Environment

Kurt Maly (Old Dominion University Norfolk)

The IRI (Interactive Remote Instruction) system is a distance learning system to the desktop over the internet. It is now in production use at Old Dominion University with half a dozen locations in the state of Virginia. We found flows in the system yet were encouraged by the enthusiastic response by students to build a new system IRI-H. It is entirely written in Java yet still provides video, audio and toolsharing in the virtual classroom; it supports therefore multiple platforms. It also works for heterogeneous network environments: no multicast internet access; low bandwidth, and long delays.

URLs: www.cs.odu.edu/~tele/iri

www.cs.odu.edu/~tele/iri-h

A Hybrid ATM / IP Videoteleconferencing System for Distance Learning

Joerg Liebeherr (University of Virginia)

There has been much debate whether ATM (Asynchronous Transfer Mode) or IP (Internet Protocol) is the better internetworking technology for multiparty multimedia applications. Proponents of ATM argue that only a connection-oriented network can satisfy the stringent timeliness requirements of high-quality audio and video data. Proponents of the internet emphasize the scalability and flexibility of connectionless networking. In this presentation, a multiparty multimedia telelecture system, called Distance Learner Controller (DLC), is presented that uses both ATM and IP, thus, attempting to exploit the advantages of both technologies, without suffering the drawbacks of either technology. The DLC system uses ATM for transmission of broadcast-quality video and CD-quality audio, and IP -over- ATM for low-bandwidth applications and conference control functions. The presentation describes the hardware and software components of the DLC system.

URLs: http://www.cs.virginia.edu/~jorg/

Using the Collaboration Systems MAC S for Tele-Teaching

Dirk Sturzebecher (TU Braunschweig)

The wide spread of the Internet has made group communication supported by computers feasible. Macs (Modular Advanced Collaboration System) aims at providing support for this. On the one hand Macs is a framework providing a variety of services to developers, but a number of modules supporting typical tasks and setups are provided as well. This makes the development overhead relatively small, reducing development time and increasing reliability due to the reuse of well tested components and services. The main aims of the framework are flexibility, portability and scalability.

The area of Tele-Teaching is one of the areas which are directly supported, here mainly by the lecture and discussion group scenarios, as well as by typical application modules in the form of audio, chat, video and whiteboard support.

Macs features various other scenarios and modules, with even more being researched / developed. A demo is available.

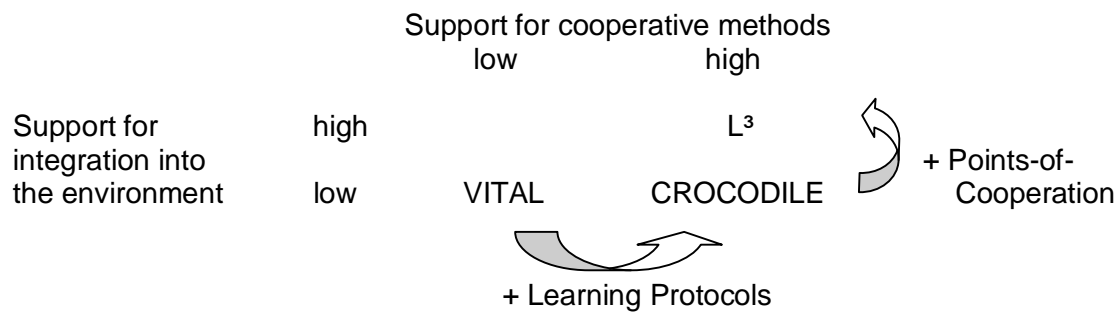URLs: http://macs.ibr.cs.tu-bs.de

Computer-Supported Cooperative Learning -

Scenarios, Tools, Experiences

Martin Wessner (GMD-IPSI, Darmstadt / Germany)

There is a wide gap between what computer-supported learning promised and the actual benefits of the usage looking at the various generations of instructional technology. Reasons for this are limitations in interactivity, individualization, feedback and reusability. Bringing the learner together with other learners and / or teachers can overcome these problems.

The CSCL (= computer-supported cooperative learning) research tackles those topics. It is an interdisciplinary research field combining expertise and experiences from computer science, pedagogy, psychology, media design and others. CSCL exceeds traditional telecommunication and GroupWare systems. It combines CSCW technology with cooperative learning methods and must be integrated into the learner's environment.

Three virtual cooperative learning environments developed at GMD-IPSI, namely the VITAL, the CROCODILE and the L³ - System are sketched and related to the underlying concepts of a virtual room, learning protocols and Points-of-Cooperation (PoC).

Support for cooperative methods
low   high

Support for   high   L³
integration into   + Points-of-
the environment   low   VITAL   CROCODILE   Cooperation

+ Learning Protocols

The VITAL software is available for download on the GMD-IPSI.concert - website.

URLs: http://ipsi.gmd.de/concert

Supporting Cooperative Learning of Process Knowledge

Jörg M. Haake (GMD-IPSI, Darmstadt / Germany)

Learning of cooperative processes (such as legal procedures or software engineering) in distributed organizations requires support for cooperative learning (by the team members who will perform the process later).

Such cooperative learning can be supported by

- Providing a shared hypermedia process model, which describes the team, the work process (= subject of learning), and the content of work;

- Integrating process support through the addition of computational semantics to the hypermedia object types; and

- Providing a cooperative environment for the definition and execution of these processes.

The resulting cooperation environment can then be used by the team as a medium for cooperative learning and working.

Such an environment offers new possibilities for learning in distributed teams:

- Animated simulation of processes, which supports understanding how a process should be executed,

- Guided tours through process examples by a remote export,

- Role-play within the team, while all practicing the task and looking at recorded practice runs,

- Adaptation of the sample process description to the task at hand. This provides a smooth transition into cooperative work / execution.

URLs: www.darmstadt.gmd.de/concert/dyce (describes the TOOLKIT DyCE to develop the prototype system XCHIPS)

joerg.haake@gmd.de

An Interaction Control Architecture for Easy Teach and Learn

Lukas Ruf (ETH Zürich)

Synchronous distance education with audio and video support is one of the fields TIK of ETHZ focuses on. While being familiar with highest-quality tele-teaching over proprietary network technology for a long time, we identified the shortcomings of the currently used product named Telepoly, and we are now on the way to bypass them within a new project called Easy Teach & Learn ® (ETL).

ETL emphasizes on the distribution of teaching contents. Not only several classrooms are targeted but also simple remote students being at home. All the locations are interconnected by high-speed, high-bandwidth Internet links to achieve the required audio/video-quality for lecture broadcasting and for interaction processes.

Interaction is allowed to students by the concepts of humanly controlled hierarchical session management. Being aware of the problems of bandwidth and other QoS constraints, emphasize is given on the aspects of resource (floor) control. It is dealt with the implementation of a management gateway called Focus Control Tool.

The Focus Control Tool encapsulates the fields of signaling for IntServ configuration, floor and focus control and by that filtering of received data streams to provide an application and OS platform portable but easy to use framework.

The talk given at Dagstuhl gives an overview of our activity and provides an explanation of the concepts.

URLs: http://www.tik.ee.ethz.ch/~etl

/~ruf

The Lecture-on-Demand Project at the University of Oslo

Vera Goebel & Thomas P. Plagemann (University of Oslo)

Interactive distance learning (IDL) is an evolving paradigm of instruction and learning that attempts to overcome both distance and time constructions found in traditional classroom teaching/learning. The electronic classrooms at two sites of the University of Oslo and two further sites in Norway overcome separation in space by exchanging digital audio, video and whiteboard information using the national academic ATM network (or multiple ISDN-connections). However, a limitation of these classrooms, respectively their way of application, is that it is limited to synchronous IDL, i.e., the students must be present in one of the classrooms during the lecture. To overcome this limitation we currently develop a Learning-on Demand (LoD) system to provide asynchronous learning capabilities to the electronic classroom. With such a system the students will be able to follow lectures from networked PCs whenever they want. Based on today's electronic classroom, we analyze the requirements for such a LoD system, describe its design and present the current state of our work.

URLs: http://www.ifi.uio.no/~goebel

http://www.unik.no/~plageman

EMuLib – Producing an Educational Library With Minimal Overhead

Wolfgang Effelsberg (University of Mannheim)

The production of high-quality multimedia teachware is very time-consuming; estimates range from a factor of 100:1 to 300:1, i.e. 100 to 300 hours of production time for one hour of teachware. University professors cannot spend so much time. As a compromise we propose to record audio and video during classroom sessions, automatically merge them with digital versions of the transparencies and put them on the Web. During the lecture the professor uses an electronic whiteboard, the *dlb* (digital lecture board).

We record the time-stamps when pages are turned and use them to cut the A / V streams into "slide-long" pieces.

The web version is created automatically after each lecture, with no overhead. The multimedia material is very well accepted by students, especially in time periods before exams.

URLs: http://www.informatik.uni-mannheim.de/informatik/pi4/projects

www.informatik.uni-mannheim.de/informatik/pi4/stud

Using Internet as a Multimedia Resource in Computer Science Courses

Javier Diáz (Universidad Nacional de La Plata)

The focus is on how Internet technologies are introduced and used in the standard Computer Science Curricula at the undergrade and grade degrees. Introducing the networks and applications on a "learning by doing" paradigm.

The principal result is the Virtual Java Simulation Lab now used in several courses in other Argentinian Universities. The Distance Learning version of a Master degree was the first of its kind in the University of La Plata and one of the first in the whole country.

It is based on a bundle of resources centered on a website list server & IRC. The page of each course is completed simulation, notes, videos of the lectures and Java Simulation for demonstration purposes.

The ongoing development for the Distance Learning Project includes online surveying and testing tools, a collaborative framework for sharing bookmarks and different Java applets providing a unified framework for e-mail, accessing material, etc.

URLs: http://www.linti.unlp.edu.ar

javierd@info.unlp.edu.ar

Learning and Teaching in the Future: Publisher's View

Hermann Engesser (Springer-Verlag)

Book metaphors widespread across cultures (book of genesis, book of nature, ...). "Book" and "writing" are endowed with a high degree of authority and stake a high claim to veracity. Knowledge is (up to now) organized on book pages. In the *Gutenberg-Galaxy* there are worldwide standards in Copyright, calculation, production, layout, new editions, etc.

Authors are experts in monolithic linear organization of knowledge.

Because the new possibilities of web-based MM-technology, a powerful competitor has emerged in the *Gutenberg-Galaxy* and is about to challenge the monopoly of writing and printing. In the *Turing-Galaxy* is no standardization but rapid development of tools, design and techniques and a fragmental complex and dynamic organization of knowledge in nets and links.

Second order authors should design flexible usable structures with media bricks (text, video, sound) and operators (links, search engines, agents). A new context between representation

and production will be established. What you can say and show with MM is what the user can learn and think. MM Modeling and simulation create new media experiences and new knowledge types. Permanent communication with the learner will change the work of the author also. Second order publisher should publish this on (online) market places, gates and portals. But the game goes on with context awareness of things that think, ubiquitous computing, smart devices,...

Mark Weiser: "When almost every object contains a computer, obtaining information will be trivial."

URLs: http://www.springer.de/comp-de/contact/engesser.html

Medibook: A Framework for Managing Modular Learning Resources

Achim Steinacker (KOM, TU Darmstadt)

The role of metadata for reusable learning resources is getting more and more important. User-friendly tools to create the appropriate metadata for the resources and tools for managing the descriptions and the generation of courses out of reusable objects however are still missing. People are still discussing how big a resource should be or who has to do the tagging. We have developed a set of tools where people are supported to create the metadata. Some of the features are automatic generation of metadata with extraction of information from the resource or the use of templates for recurring information. Furthermore we will show how the resources can be organized in a graph-oriented view and connected to terminological ontologies of specific domains stored in different repositories. Finally the use of these tools and access protocols can lead to an open architecture for the management and use of the modular resources.

URLs: http://www.kom.e-technik.tu-darmstadt.de/

Digital Lecture-Rooms

Christoph Trompler (TU Darmstadt)

Appropriate learning appliances have a major rule in the establishment and acceptance of computer-based learning and lecturing environments. With the Digital Lecture Hall (DLH) we hope to deliver a better solution for large scale lecture halls as through existing electronic classroom systems.

Digital Lecture Halls are targeted for student capacities of more than 150 local participants. Like in electronic classrooms the entire lecture is recorded (Multiperspective Video, Audio, the lecturers presentation and notes). The lecturer uses an electronic whiteboard as well as a tablet – both back-projected as input devices. Slides are created by the underlying Software

on the fly, leaving the lecturer the possibility to use arbitrary (whiteboard) applications. A seamless multi-projection area spans over the front wall of the lecture hall to display the current and previous notes of the lecturer and other applications (video, etc.).

Key concept of the Digital Lecture Hall is the integration of student owned mobile computing devices through the use of wireless networking. The students receive slides and annotations directly to their mobile devices and may add their personal annotations and send questions to the lecturer.

Further provisions exist to enable tele-teaching scenarios and asynchronous usage and to integrate CSCL-Applications (like voting, evaluation, etc.) into the environment.

trompler@informatik.tu-darmstadt.de

Ubiquitous Computing in Educational Scenarios

H. Ulrich Hoppe (Universität Duisburg)

The term "ubiquitous computing" originates – to my knowledge – from work at *Xerox PARC* in the 1980's. Its essence is still a challenge for underline interactive computing: Embed computerized devices or ambient objects into the physical environment seamlessly – or, in current terms, let the computer disappear as an explicit uniform object, let it go to the background.

Accordingly, conceive computerized educational environments as a combination of spatial arrangements, specific hardware devices and of situation-adapted software tools. When designing such "roomware" scenarios, start from pedagogically consolidated settings – do not let technology re-define pedagogy.

Two examples of this approach are given:

a) A "computer-integrated classroom" for early learning (K 1-2), particularly supporting literacy and different forms of collaboration,

b) An "interactive lecture hall" facilitating free-hand input for presentation as well as the immediate archiving of this input on a web server.

hoppe@informatik.uni-duisburg.de

3. List of demonstrations

The following demonstrations were given during special demonstration time slots in the evenings:

Applets for Educational Purposes (J. Diaz)

CSTC and JERIC (E. Fox, R. Heller)

Electronic Classrooms & Problembased Learning MM Modules from Medical Faculty (V. Goebel & Th. Plagemann)

EMULIB (W. Effelsberg)

EXPLOR@ and MISA/ADISA (G. Paquette)

FernUniversität's Virtual University (B. Krämer)

JASMINE (A. El Saddik)

JETS 2000 (N. Georganas)

L³ (T. Leidig)

TeamWave Workplace (R. Schulmeister)

VITAL (M. Wessner)

XCHIPS (J. Haake)