A COURSE CURRICULUM AND A MULTIMEDIA CONCEPT FOR AN
INTERNATIONALLY ORIENTATED DEGREE COURSE

AXEL HUNGER and STEFAN WERNER
Gerhard-Mercator University of Duisburg, Department of Data Processing
Bismarkstr. 81, 47057 Duisburg
tel: + 49-203-379 2707
fax: + 49 -203-37 04 39
e-mail: Swerner@uni-duisburg.de

Abstract: A so-called "reformed" degree course in
"Computer Science and Communications Engineering"
has started at the Gerhard Mercator University of
Duisburg in the winter semester of 1997. This degree
course is being financed by the "Federal Ministry of
Education, Science, Research and Technology" and is
aimed at students of all nationalities. The course will
include a number of innovations within the German
university system: lectures will be held in English and
German, holders of related-subject Bachelor degrees will
be able to enrol in a higher semester. German students
will have to spend a mandatory period abroad and there
will be a choice of final qualification: either a German
Diplom or an international Master's degree. Owing to its
reformatory character, the degree course will in itself
become an object of study during its five-year pilot phase.
A further aim is to develop and gain experience in
applying new teaching concepts. This paper presents the
course curriculum and an initial multimedia concept to
support administration and teaching purposes.

1. COURSE CURRICULUM

The course curriculum focuses on the new media and
communication technologies that have evolved over
recent years through the fusion of computer science and
information technology. Apart from the fundamentals
of engineering, the basic study period also covers the
essentials of electrical engineering, information science
and information theory that are needed to study this new
field of knowledge. The major study period then
concentrates on the mandatory subjects of data
processing, information technology and communication
networks, while also offering the following electives for
in-depth study.

<table>
<thead>
<tr>
<th>Elective</th>
<th>Concerned with:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Processing and Information Technology</td>
<td>information processing, data storage and manipulation, data processing, software engineering, computer systems.</td>
</tr>
<tr>
<td>Communications Technology</td>
<td>Information transfer, encryption, networks, equipment, systems.</td>
</tr>
<tr>
<td>Technical Electronics</td>
<td>technologies and components used in</td>
</tr>
</tbody>
</table>

TABLE 1: ELECTIVES

1.1 INTERNATIONAL FLAIR

The degree course has been designed to serve two pur-
poses. The first is to make it easier for foreign students to
study at the Gerhard Mercator University of Duisburg.
The second is concerned with providing German students
with an opportunity to qualify themselves for the global
labour market through the undermentioned,
internationally orientated course components:

• English-language lectures during the course, also by
guest lecturers from the UK and the USA,
• language courses (German and English) for newcomers,
• at least one semester abroad for German students,
• support for foreign students in finding accommodation,
etc.,
• support for German students in organising their stay
abroad,
• tutorials to support students and to integrate foreign
students in a common degree course and
• studying in a multi-cultural environment.

1.2 CAREER PROSPECTS

A new professional field concerned primarily with in-
formation and communication technology, networks and
multimedial services has emerged in recent years. These
new areas all promise high future growth rates and good
prospects for job beginners as well as for diverse careers.

This degree course will endeavour to equip students
with the necessary technical expertise to enable work in
these areas. The completion of course projects, disserta-
tions and practical training all provide ample opportunity
for team-orientated work on the latest in research and
development. In addition to obtaining a specialist qualifi-
cation, students will also be able to practise their English
and gain an insight into international cooperation and
foreign cultures. This will provide perfect training for the coming internationalisation of the labour market.

1.3 FORMALITIES

The course covers a minimum of 9 semesters, during which time students will be required to complete courses with an amount of 180 SWS (hours per week per semester), six months of industrial training and preparatory and the final thesis. On successful completion of the course, students will be able to choose between graduating as a Diplom-Ingenieur or Master of Science. The entrance requirements are the following:

- basic knowledge of German language
- adequate knowledge of English language (e.g. TOEFL 500)
- For the first semester:
  - general university entrance qualification ("Abitur") or
  - special university entrance qualification ("Fachhochschulreife"), restricted to certain fields of study), provided preparatory courses are attended with success.
- For the fifth semester:
  - preliminary exam ("Elektrotechnik" for German students) plus fulfilment of certain conditions.
- For the fifth to seventh semester:
  - Bachelor's degree in an appropriate subject area.

FIG. 1: STRUCTURE OF THE NEW DEGREE COURSE

2. OVERALL MULTIMEDIA CONCEPT

From the reform character of this course results both the demands and possibilities of the introduction of the new media in the fields of teaching and administration. Therefore the multimedia concept integrates technologies and applications that are currently available (e.g. Internet, e-mail, chat), own developments (e.g. CSCL-Tools) as well as relevant research topics (e.g. high performance protocols). In the following chapter each aspect will be explained in more detail.

2.1 MULTIMEDIA SYSTEMS FOR ADMINISTRATIVE PURPOSES

The use of the Internet for informative purposes and the construction of an intranet for administration tasks is obvious. For administration purposes databases of the course of study, the study regulations and the exam regulations are developed. These are also provided via the Internet for informative purposes. Furthermore special services both for interested students form foreign countries, e.g. application forms, and for beginners, e.g. time-tables, commented lecture registers, exchange of information for everything which is important in the first weeks at a new university and a black board are implemented.

2.2 MULTIMEDIA SYSTEMS FOR ADVERTISEMENT PURPOSES

The world-wide advertisement for students is a main task during the starting period of the course. Therefore an Online-Information-System (Internet) and an Offline-Information-System (CD-ROM) are developed.

Online-Information-Systems can be used as long as the offered information are texts and graphics. In contrast to this the world-wide-spread of video- and audio data is not without problems which has one of its main reason in the bandwidth offered by the Internet. For this reason a multimedia offline information system was developed for the use on exhibitions. This system (CD-ROM: Living and Studying in Duisburg) contains information about:

- Duisburg and the University,
- the courses of study, and the study and exam regulations,
- a commented lecture register and
- video clips with greetings from foreign students from Duisburg.

First experiences with this system were made at the education exhibition “Qualification Asia 97” in Jakarta. The system is furthermore spread world-wide for advertisement purposes (e.g. at the German embassies and foreign offices of the DAAD).

2.2 MULTIMEDIA SYSTEMS FOR EDUCATIONAL PURPOSES
The motivation for the use of new media in the university education can be different. For the internationally orientated Degree course they are:

- the wish of a reduction of the study time,
- the search for possibilities which help the students in their abroad period of the study to take part in lectures in Germany.

The classical course in technical orientated subjects includes lectures, seminars and practical training. The courses are normally at the same place and time. The media which are used are black boards, overhead projectors and manuscripts. With the usage of new media there is the possibility to differ from this form of organisation. With the example of the subject Software-Engineering the place and time invariant courses shall be supplemented by components which are variable in place and time. The new components shall be seen as and extra offer and supplement. In detail these are:

- multi-media CD-ROM's for lectures and seminars,
- tools for carrying out the online-practical training (CSCW-Tool) [4].

### 2.2.1 MULTIMEDIAL UNITS OF LECTURES AND SEMINARS

In the nearer future many courses will use Multimedia-Tools. Here we describe with the example of the course Software-Engineering how Multimedia can support the study. For the lectures of Software-Engineering a multimedia-CD-ROM is developed, which contains apart from the subject of the lecture seminars, learning control programmes and preparation courses for exams. The aim is

- to give students the possibility to “take part” in the lecture during their stay abroad,
- to offer foreign students an alternative to the lecture which is offered in German Language,
- to provide basis material that offers the students the possibility to take part in a distributed practical training.

The Software Engineering syllabus will not only concentrate on the basics of classical software engineering and the methods and models it employs, but also on the aspect of spatially distributed software engineering. This aspect has long become a reality within the industry. In the compulsory practical training a given problem is solved in individual group work.

### 3. CURRENT RESEARCH ACTIVITIES

The software-engineering methods [7] and tools as presented in the course Software-Engineering are particularly suitable for the development of distributed real-time software applications. It would therefore be a good idea to employ “spatially distributed” teaching methods into a multi-medial teaching and learning environment and thus largely turn the subject of the course into its teaching method [6]. The possibilities and limits of telecooperative software in the usage in a practical training with students at different places are therefore examined from a didactical point of view [4].

Current research activities focus on the development of a CSCL-Tool to be used in a spatially distributed practical training.

### 3.1 A CSCL-TOOL FOR A SPATIALLY DISTRIBUTED PRACTICAL TRAINING

The present form of centralised practical training was subjected to critical analysis in the summer-semester '97 with regard to its didactic aptitude for the special requirements posed by the new degree course. The main results of this study are published in [4]. The following "future"-scenario is a first result of this analysis:

- three students will form a team,
- students will be able to co-ordinate four of altogether six hours per week themselves,
- the two remaining hours will be held at a fixed time of the week and
- each group will be allocated a tutor during this time, whereby each tutor will be responsible for only one group.

The technical conditions will be customised to provide video conferencing and collective data processing facilities in order to satisfy the special demands posed by this form of practical training.

The most important added values of the system will be:

- the consideration of special requirements from a didactic point of view [4],
- a specially for the usage in a CSCL-environment designed communication component,
- a database to archive the various documents and
- a tool to provide version control (methods drawn from configuration management systems will be used here).

### 3.2 THE USER INTERFACE

The System can be broken down into various elements such as input equipment (e.g. camera, microphone, keyboard, telepointer), output equipment (e.g. monitor, speaker, printer) and the main system which is connected to a server. The main window of the user interface is divided into individual windows with differing functions. Only one toolbox will be visible upon starting the pro-
gram, with which the necessary tools (e.g. video, chat or work window) can then be called up.

The working process starts with interpersonal communication. For this reason, particular importance is attached to ensuring audio and video transmission facilities. The video windows will therefore all be situated at top centre of the monitor in order to guarantee direct visual contact with the other party. The video windows will always retain the same relative size to each other so as to avoid any of the group members being either subconsciously favoured or disadvantaged. Further, it will not be possible to cover video windows with others. This prevents a loss of direct visual contact with any of the group members, which would hinder cooperation.

The workplace constitutes the central working area and is divided into one or more public and private windows, however, will only be visible to the respective user. This window can be used to try out new ideas or to import drafts that were produced off line. In order to show other group members private drafts, parts of the private window can either be imported to a public window via the cache or be temporarily declared a public window. Results can then be discussed and processed.

![User Interface Layout](image)

3.3 PROTOCOLS FOR REAL TIME GROUP COMMUNICATION

The communication components will have to satisfy particularly high demands arising from both the substantial data volume (which will also require real-time processing) and the actual nature of the multipoint communication itself. Group communication can be enabled by either several point-to-point links (unicast), point-to-multipoint (multicast) or by multipoint-to-multipoint connections (multipeer). However, concepts and technologies to support multipoint communication are not only needed for the application alone, but also for lower level systems, communication protocols and transmission systems, e.g. flexible error and flow control, multicast addressing, resource reservation.

The demands placed on high-performance protocols of group communication exceed the capabilities of commonly used network protocols such as TCP/IP, especially with regard to transmission rate. These classic protocols are therefore unsuitable for our present purpose. Current research and development activities are therefore concentrating on improving available frequency ranges as well as on improving or redeveloping transmission protocols. Protocols styled on the ISO/OSI reference model, form a particular focus of present research. These high-performance protocols include XTP, TP++, AMTP, RTP, ST2 and RSVP. Many of these approaches share a common flaw: they were exclusively developed for specific services and networks, which means they are not always compatible for use with other systems and subnets. For this reason, one our current research activities focus on this specific field.

4. SUMMARY

This paper presented both, the development and the implementation of a new internationally orientated masters-/diplom degree and a CSCL-Environment-Concept as a framework for conducting spatially distributed practical training. At present, work is continuing into concept implementation under special consideration of all relevant frequency ranges (where we have lots of experiences) version management, process flow [1], communication schemes [2], protocols [3] etc. A prototype scheme is planned to commence for a trial period in the summer semester of 1998.

5. BIBLIOGRAPHY


