



A Virtual University Providing an Online Master Program in a Public-Private Partnership: Challenges and Solutions

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1 INTRODUCTION

The challenges and findings presented in this paper are based on experiences from a completely online master program delivered on the Internet, the "International Master of Business Informatics (MBI)". This program was designed by the Virtual Global University (VGU) in a private-public partnership with the European University Viadrina (EUV) in Frankfurt/Oder, Germany. Organizational, technical, and legal problems that had to be solved in the development and implementation of this program are discussed.

In the next section the structure and specific features of the MBI program are described. Section 3 discusses organizational problems in creating an online master program provided by a virtual organization [1] like VGU. Legal problems to be attacked are the focus of section 4. In section 5, challenges posed by the multimedia technologies used in the MBI program are discussed, in particular problems that have to be solved when video streaming is a preferred mode of delivering courses. A brief summary and conclusions are given in section 6.

2 BACKGROUND: THE INTERNATIONAL MASTER OF BUSINESS INFORMATICS PROGRAM

The International Master of Business Informatics program is a two-year program in the field of information systems, focusing on the synergy between information technology (IT) and management concepts. The mission is to teach Business Informatics (BI) students how to use IT effectively to develop solutions for today's business challenges.

The MBI program comprises four major areas: basic technology, methods, management, and applications.

- **Basic technology** includes courses on applied computer science, computer networks & Internet technology, website engineering, programming, and information security.
- **Business Informatics methods:** While most courses include some methodological approaches, a special focus on BI methods is set in courses like information systems development, database management (DBMS), information systems architectures, business intelligence, and business process modeling.
- **Management** oriented topics are studied in courses on management information systems (MIS), information management, knowledge management, management & organization of IT departments, and software engineering management.
- **Applications:** Important application domains of Business Informatics are investigated in courses on enterprise resource planning (ERP), e-commerce & e-business networking, industrial information systems, and electronic finance/electronic banking.

Courses are assigned to semesters according to the curriculum illustrated in Figure 1. Full-time students study in principle five courses in each of

the first three semesters, while the fourth semester is dedicated to writing a master's thesis and doing an internship or a project. Electives may be chosen by the students depending on their individual preferences.

The MBI program is mainly targeting students with a business background. Students lacking that background are required to take business courses in the first two semesters. Likewise, students without sufficient programming knowledge have to take Introduction to Programming in their first semester. The majority of MBI courses is multimedia based as further discussed in section 5.1. Most courses stimulate intense interaction with and among students with the help of electronic media like a discussion forum, e-mail, and chat.

Although many students live in Germany, the target group of the MBI program is international. Figure 2 shows the distribution among countries of origin.

In the past years, many virtual courses and a number of so-called "virtual universities" were developed in Germany, yet most of them do not offer complete degree programs. In the field of Business Informatics, two master programs are provided as virtual programs, leading to similar degrees as the MBI. The VAWI program is a three-semester program provided by the University of Duisburg-Essen and Bamberg [2]. In the Winfoline program, students are sharing courses from four universities (Goettingen, Saarland, Kassel, Leipzig), partly over the Internet [3].

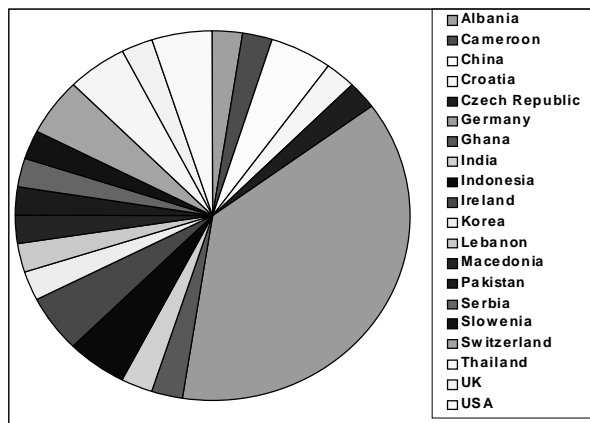
Those programs unfortunately do not lend themselves to a straightforward comparison with the MBI since the general concepts are quite

Figure 1. MBI curriculum

Semester 1 (winter)					
Management Information Systems	Introduction to Computer Science	Data Management	Website Engineering Fundamentals	Alternatives	
				1 elective	Business I ¹⁾
				see list of electives	
Semester 2 (summer)					
Information Systems Development	Process Modeling	Computer Networks & Internet Technology	Advanced Website Engineering	Alternatives	
				1 elective	Business II ¹⁾
				see list of electives	
Semester 3 (winter)					
Information Management	Enterprise Resource Planning and Beyond	Information Systems Architectures	E-Commerce & E-Business-Networking	1 elective	
				see list of electives	
Semester 4 (summer)					
1) Master's Thesis and 2) Internship or Project ²⁾					
Electives					
Business Intelligence	Software Engineering Management		Information Security	Java Programming	Computer & Systems Architecture
Management & Organization of IT Departments	Distributed Business Information Systems	Distributed Databases for E-Business	Knowledge Management	Industrial Information Systems	Electronic Finance/ Electronic Banking
					Modeling and Simulation
1) Students without a business background are required to take Business I and II in the first two semesters.					
2) Students without sufficient programming knowledge have to take Introduction to Programming in the first semester.					

1) Students without a business background are required to take Business I and II in the first two semesters.
2) Students without sufficient programming knowledge have to take Introduction to Programming in the first semester.
3) Three months master thesis, plus three months internship (before or after thesis) or a project of one semester.

Figure 2. Countries of origin of MBI students



different. VAWI and Winfoline are mainly based at the two and four, resp., universities involved, the faculty is not virtual as in the VGU, students study partly in face-to-face classes, the language of instruction is German, and the extent to which mul-timedia is used is significantly less than in the MBI program. Legal problems are not comparable either, since those programs are directly em-bedded in a university, so the private-public partner-ship set-ting including a virtual organization does not occur. Therefore we will not deepen the dis-cus-sion of the two programs and refrain from comparing them with our experiences in a private-public partnership.

3 ORGANIZATIONAL CHALLENGES

The MBI program is taught by a network of Business Informatics professors from Germany, Austria, and Switzerland collaborating in the Virtual Global University (VGU). The Virtual Global University is a private organization founded by those professors. Its School of Business Informatics (SBI) has a virtual faculty dispersed across three countries. The locations of the faculty are shown in Figure 3.

The central infrastructure of the program is located in Frankfurt/Oder (Germany). Since all courses are taught by SBI faculty members from their respective locations, course administration is also decentralized to those locations. Local teams are responsible for providing and updating teaching materials, guiding and supporting students throughout each course, conducting and evaluating online tests, etc.

Different models for studying and interacting have been developed: completely virtual and blended. In the first model, students study exclusively on the Internet, using electronic media both for receiving and learning course content and for communicating with SBI faculty directly. For example, students discuss everyday problems like questions about homework assignment with the lecturers or their assistants in a forum or by e-mail.

The second model takes into account that learning cultures and mentalities are different in dif-ferent parts of the world. Therefore a system of tutors and contact persons in distant locations is being built with cooperation partners in various countries. Tutors provide course-specific support for students in those countries.

A variant of the blended mode is currently introduced in Germany. One experience with students in Asian countries was that those students prefer very much to go to Europe and study there instead of staying at home and studying via Internet. This desire is boosted by the observation that in third-world countries studying online does not enjoy the same esteem as studying in a brick-and-mortar university. This is somewhat contrary to the perception in Europe and the US. Here we have not found such a distinction regarding the reputation of a study program between the two modes of studying.

For these reasons, a combination of face-to-face courses and online courses was introduced in winter semester 2005/06. Students may begin the MBI program with one or two semesters of traditional classroom instruction at the European University Viadrina in Frankfurt (Oder) and continue with a series of virtual courses taught over the Internet.

4 LEGAL CHALLENGES

The idea of a virtual Business Informatics program with a virtual faculty was born by a group of distinguished professors dispersed over three countries. While these persons were highly moti-vated to create a high-quality master program and in fact are teaching that program, they are not authorized, according to German law, to award a master's degree. All degree programs have to be approved by the state government, i.e. by the ministry responsible for higher education in that state.

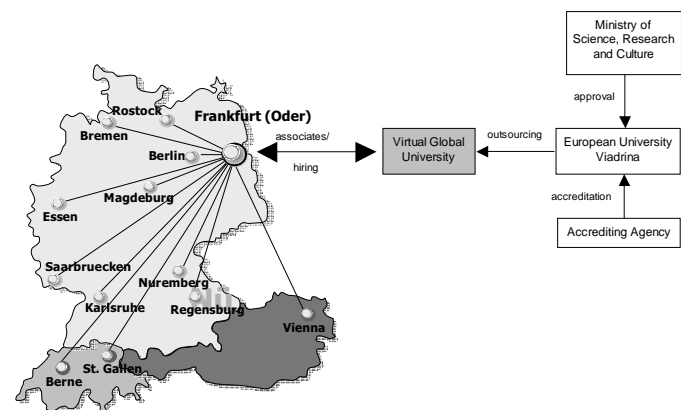
Therefore a legal arrangement had to be found according to which an approved degree could be awarded. As a solution to this problem, a public-private partnership was created. The public partner in this arrangement is a state university, the European University Viadrina, while the private partner is the Virtual Global University. In order to establish a solid legal relationship, the VGU had to be established as a private limited company. Associates of that company are the professors who teach in the MBI program.

To meet the legal requirements, EUV set up the MBI program with the same procedure as its face-to-face programs, going through all committees and councils of the university. For example, EUV's Faculty of Business Administration and Economics passed examination regulations according to which the MBI program is conducted. EUV enrolls students onto the MBI program, giving them the same legal status as students studying a face-to-face program in Frankfurt (Oder). Students also receive their master's degree from EUV. Thus from the ministry's point of view, the MBI program is a degree program of the European University Viadrina.

In reality, EUV has outsourced the teaching to the Virtual Global University. All of the workload is on VGU staff - on the faculty of the virtual School of Business Informatics (SBI) and on the MBI program office run by VGU. The legal basis of that deal is a contract between VGU and EUV determining rights and duties, including liability in the case should VGU become insolvent. VGU is responsible for conducting courses according to EUV's study and examination regula-tions. Should SBI faculty members be unavailable or unwilling to continue teaching then VGU is obligated to provide equivalent substitutes of the same level of academic qualifications. Students pay their tuition to EUV, and EUV pays VGU for teaching the courses - after subtracting its commission.

The external view of the MBI program that is transported to stakeholders and to the public is that VGU provides expertise and teaching for the program, while EUV is responsible for ensuring that the program's

Figure 3. Organizational structure and participants involved



academic and educational standards are maintained at an appropriate level.

In addition to government approval, accreditation had to be sought for the MBI program. The requirement that new study programs have to be accredited was a quite new in Germany, just being introduced in 2001 when the MBI program was under development. According to the legal status, EUV had to apply for accreditation (not VGU), notwithstanding that all bureaucratic work was left to VGU staff. The accreditation procedure required significant flexibility in interpreting accreditation regulations and requirements, both for the accrediting agency and for VGU. After successfully completing that procedure, both sides were proud that for the first time an online master program was accredited in Germany.

The organization of the MBI program and the roles and participants involved are summarized in Figure 3. The locations of the faculty are shown in the map on the left.

5 TECHNICAL CHALLENGES

A range of technologies is available for web-based education [4], yet many courses and programs in today's virtual education are still text based. For the master program underlying this paper, multimedia technologies above the text-based level are playing a major role in the instructional design although traditional modes of instruction are also employed.

5.1 Technologies for Providing Courses

Most courses are based on multimedia technologies like video and audio streaming, hypermedia (linked web pages), synchronized presentation material, and Web-supported textbooks supplemented by multimedia. Course materials are accessible throughout the entire course of study, available to students for viewing and/or downloading at any time.

In the subsequent sections, different approaches to the production and delivery of multimedia-based courses are outlined and illustrated by examples. Specific attention is paid to videos as a major instructional medium since this mode poses significant technical challenges on the course developers. The underlying paradigm is that of web lecturing [5]. Like in a traditional classroom, a lecturer shown in a video explains the matters that are subject of the course. For illustration he or she uses transparencies, slides, computer screens or online material that is displayed on the student's monitor, synchronized with the video of the lecturer.

Web lecturing is a direct mapping of face-to-face lectures. Its advantage is that most teachers have substantial experience in giving "lectures". Therefore the step towards creating web-based courses is only a minor one. On the other hand, lecturing has the well-known disadvantage that

it is not very "interactive" [6, 7]. Therefore it needs to be accompanied and enhanced by specific interaction features.

Video-based courses: Our first trials to approximate the look-and-feel of a real lecture in a real classroom were videos taken in a lecture hall and provided for viewing. With powerful video processing and en-coding tools and easy-to-download video players (e.g. Windows Media Player [8], RealPlayer [9]) available today, video recordings were the primary choice as media type for MBI courses.

However, the limited size of the window on the monitor's screen is a problem when both the person giving the lecture and the material used for illustration are recorded in one video. While a small window of, say, 9 x 6 cm, is sufficient to see (and hear) the speaker explaining things, it may be too small to allow the user to recognize what is written on the transparencies. For transparencies with large fonts like in Figure 4, the one-window approach may still be all right. However, when online computer screens are recorded in this way, nothing will be readable for the viewer any more.

This problem can be avoided if the person giving the lecture and the material used for illustration are presented in separate windows. Production of this type of video is more complicated since now the two components need to be synchronized.

When computerized presentations are used, for example Powerpoint slides, they are converted to a sequence of static GIF files. Since GIF files are smaller than videos, less bandwidth is needed. In return the size of the window in which the GIF files are shown can be made quite large.

If a real-time program presentation, for example a demo of a CASE tool or an ERP system, is shown and discussed by the lecturer, a second video containing the presentation material has to be recorded by means of a screen recorder (e.g. Screen Corder [10]). Figure 5 shows a screendump of a video-based course from the MBI program where both the lecturer and the presentation material are recorded and played in separate windows.

Audio-based courses: Video production is a non-trivial task requiring experience and plenty of time. Low transmission rates are hampering the delivery of videos over the Internet. One way to bypass part of these problems is to use only an audio track instead of an audio-visual presentation of the speaker. Sound can be used nicely in combination with Powerpoint slides or other presentations to form something like a "narrated slide show". Like in a real classroom, the speaker explains the things illustrated on transparency or slide; however, he or she is not visible. This is clearly less "lively" than a video accompanying the presentation material but a lot easier to produce.

Just listening to an audio track may be tiring for the viewer. More than in a video-based course, there is some risk that the viewer may miss important points which are discussed by the lecturer but perhaps not stressed sufficiently. For this reason, audio-based courses can be enhanced by supplementing the lecturer's monologue with text passages transcribing the speech in full or in parts.

Figure 4. Demo of a recorded lecture video



Figure 5. Video with online screen recording



To make this type of presentation appear more personal, a picture of the lecturer is included in the web pages. An alternative way is to start each lesson with a short video introduction by the lecturer and then present the actual content of the lesson in an audio track and static slides.

Hypertext courses: This type of course follows the traditional text-based approach. Structured course material is used as in a conventional distance education program. However, all material is provided electronically and can be viewed with a browser. Hyperlinks connect text, graphics, and exercises in a meaningful way. Video clips and voice annotations may be included as well.

Animated courses: Enriching text-oriented or audio-based course material by animations is a good way of making the content more interesting and keeping the student's attention. Animations of different types are used in several of the MBI courses. Content-specific animations are occasionally employed to illustrate certain concepts, for example, the flow of calculations in material requirements planning within the MBI course "Enterprise Resource Planning and Beyond". On the other hand, entire courses can be based on animation technology. "E-commerce and E-business Networking", for example, is totally based on Macromedia Flash [11] regarding the production and presentation of course materials.

Multimedia incorporated in textbook courses: An increasing number of textbooks comprises not only written and printed text but also supportive features provided on the website of the author and/or the publisher (for example [12] and [13]). Nowadays the support goes far beyond additional exercises or examples not given in the book. Many books have a complete learning environment in the Web, providing videos, audio clips, and interactive exercises. Selected courses of the MBI program are based on web-supported textbooks, thus enriching the traditional text-based approach to virtual education with built-in multimedia features.

5.2 Using and Synchronizing Video Streams

From a technological point of view, courses based on video streaming are the most advanced ones in VGU's multimedia mix for the MBI program. Following the paradigm of lecturing and visualizing, the user interface requires one or two Media Players.

In the upper right corner of Figure 5 a video of the lecturer is running in a streaming compatible format. The area left of the player is used to show visual materials accompanying the lecturer's explanations. In the simplest case these are text slides, tables, diagrams, charts, etc., similar to information that would be written on a blackboard or an overhead projector in a conventional lecture.

Basically there are two different approaches to provide visual material plus video lecturing for such a course. The first way which is fairly easy to achieve is to split up the lecture in separate topics and store the respective video clips in separate files. If the topics are associated with slides, then each topic, including the video clip, will be started separately.

Although this solution is easy from a technical point of view it is not always feasible. Moreover, only static images can be used as accompanying visual information. Displaying online recordings of program runs as in Figure 5, for example, or videos shown by the lecturer is not feasible in this way. So the general solution is to provide and integrate two video streams.

Integrating separate video streams proved to be difficult due to severe restrictions imposed by the tool used (Windows Media Player). The object model of this tool provides little of the functionality needed to run two videos in a synchronized manner. Even if more connection bandwidth is available than required by the sum of the bit rates of two video streams, one cannot expect that the bandwidth will be divided in proportion to the bit rates of the streams, nor even equally. The methods and properties available to the developer do not support tasks like controlling the stages of client-server interaction and (re-) distributing connection bandwidth among two players adequately.

This shortcoming implies that two video files will rarely start playing simultaneously even if they have exactly the same parameters (e.g.

resolution, codec, file size). The synchronization task is thus left to the producer of a course. To guarantee proper appearance and behavior of video-based courses we developed and implemented an algorithm for synchronizing and monitoring two video streams ourselves. Its major tasks are [14]:

- Synchronizing playback start,
- Monitoring synchronized playback of two videos,
- Corrections if synchronization is off,
- Setting two players to specific positions on demand.

For the student there is no difference in the graphical user interface no matter whether static files or videos are displayed. Technology dependent peculiarities are hidden behind the user interface.

6 SUMMARY AND CONCLUSIONS

While the benefits and advantages of virtual education are quite convincing, developing a complete online master program based on multimedia technology and a virtual organization is a challenging task. In the MBI program, "virtual" refers not only to the fact that students study on the Internet but also that a virtual organization is providing the program and that students form virtual classes. In such a case, technological challenges of producing and delivering courses via Internet constitute only one part of the problem. Equally numerous and difficult to solve are organizational and legal problems. Some of these problems were discussed in this paper. Although in our case the specific legal environment in Germany represented the system of constraints, similar bureaucratic rules and regulations exist in other countries, implying that similar problems in establishing a virtual degree program have to be solved likewise.

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