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Virtualisation of Universities
Digital Media and the Organisation of Higher Education Institutions

DISSERTATION

zur Erlangung des akademischen Grades

Doktor der Philosophie

Alpen-Adria-Universität Klagenfurt

IFF - Fakultät für interdisziplinäre Forschung und Fortbildung
(Klagenfurt - Graz - Wien)

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Oktober 2006

Ehrenwörtliche Erklärung

Ich erkläre ehrenwörtlich, dass ich die vorliegende Schrift verfasst und die mit ihr unmittelbar verbundenen Arbeiten selbst durchgeführt habe. Die in der Schrift verwendete Literatur sowie das Ausmaß der mir im gesamten Arbeitsvorgang gewährten Unterstützung sind ausnahmslos angegeben. Die Schrift ist noch keiner anderen Prüfungsbehörde vorgelegt worden.

Thomas Pfeffer

Wien, 5. Oktober 2006

Preface

When I formally began my investigation of the virtualisation of universities, trying to combine the organisational development of one of the most complex and change resistant institution society has to offer with the rapid and volatile advancements of information technologies, I hugely underestimated the enormous challenges lying ahead of me. While in the first case changes sometimes have to be observed with a microscope, the second often needs distance to grasp the full scope of epochal transformations. In both cases, it took some time to understand, what I have seen.

Additionally, I underestimated the practical implications of my endeavour. Working as a higher education researcher and relying on project funding from various sources provided me with different perspectives on my topic, but also created the difficulty to draw a comprehensive picture on the basis of heterogeneous sources and approaches. This study therefore is composed out of papers and research findings from different projects, which are integrated by some additional chapters.

Many people helped me to perform my work and to master these challenges. First and foremost I would like to thank my supervisors Ada Pellert and Klaus Scala, which were co-founders of the innovative PhD program on organisational development at Klagenfurt University. Ada, an innovative researcher, powerful academic manager and very good friend, with whom I had the fun to work in different contexts and circumstances, gave me all the room it took me to nurture my ideas, the confidence that I can make it, and the scientific advice, when it was needed. Klaus, a highly experienced consultant, complemented this with specific feedback on the practical implications of organisational development.

Second, I would like to thank my home institution Klagenfurt University, especially the faculty (and former institute) for interdisciplinary studies (IFF) and the department for higher education research, both very innovative organisations and good environments for scientific work. Since I can not name all my colleagues here, I address my thanks to the representatives of these organisational units, Roland Fischer, the dean of IFF, and Hans Pechar, the head of the department for higher education research. While I sometimes disagree with Prof. Fischer about the long term future of universities (especially with respect to information technologies), he always has been a strong captain, safely steering IFF through the troubled waters of past and current political reforms. Hans, an excellent researcher and outstanding cook, built up the department together with Ada Pellert, generously shared his many international contacts and helped me to de-

ously shared his many international contacts and helped me to develop my academic profile as a higher education researcher.

I also would like to thank my colleagues at the PhD program on organisational development, Berta Schreckeneder, Daniela Castner, Maria Schuster, Sabine Petsch, Stefan Teufl and Stephan Proksch. Our meetings always have been stimulating, interesting and funny. It was good to learn from each other and to know that others tackle similar problems.

Apart from these long term working contexts, I also want to mention some shorter events, which where essential for this work, mainly according to their timely sequence:

In 2001, I had the opportunity to present my first, preliminary ideas for my investigation at the first international summer school for young higher education researchers, which was held at University of Twente. The format of this summer school, which was organised by CHEPS (Center for Higher Education Policy Studies) and led by Marijk van der Wende, provided an excellent framework for the vibrant exchange of PhD candidates from all over the world.

In 2002, I received a grant from the University of California at Berkley in the context of the program Higher Education in the Digital Age, which allowed me to visit the CSHE (Center for Studies in Higher Education) for two month and to get familiar with specific formats (e.g. brown bag talks) and the high standards of scholarly communication at American universities. Among all the inspiring and friendly colleagues I met, I especially want to mention Diane Harley, a very energetic researcher and Sheldon Rothblatt, a real gentleman, incredible host and one of the most entertaining story tellers and academic stage performers I ever met.

From 2002-2004, I participated in the project PlaNet ET (Platform and Network for Educational Technologies), led by Ada Pellert, Peter Baumgartner and Roland Mittermeir. In this project, which created concepts and materials for staff development, as well as means for organisational development, I most closely worked with Alexandra Sindler, an expert for media didactics with unbelievable enthusiasm and the gift to motivate others (especially me), and Michael Kopp, a reliable and competent project manager.

Between 2004 and 2005, I had the chance to contribute to the development of an eLearning strategy at Klagenfurt University, my home institution. Among all the members of the strategy group, I especially want to thank Martin Hitz, then vice-rector for research, a very competent and modest academic manager, for his trust to involve me in this project.

From 2004-2006, I worked as a sub-coordinator in the European eCompetence Initiative for staff development in higher education. In this case, I

would like to thank Dirk Schneckenberg and Johannes Wildt, who managed and led this consortium of 26 institutions in a very relaxed and confident way.

During the last five years, I also had the opportunity to occasionally work for the Austrian Ministry of Education in smaller IT-related projects. I always enjoyed to exchange views with Felicitas Pflichter and Angela Weilguny, and to learn about the specific perspective of policy making in public administration.

Last, but not least, I would like to thank my family and friends for their constant support and limitless patience, in particular for trying to avoid the crucial question: when eventually I will finish my thesis.

Thomas Pfeffer
October 2006, Astana, Kazakhstan

P.S.: A special message for PhD candidates: Follow your instincts!

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Chapter 1

Introduction

„Our conceptual tools should be determined
by the purpose of our inquiry,
which is to understand higher education.
We should shape our tools to the practical empirical terrain,
not distort the inquiry to fit into the tools."

Simon Marginson (2004)

The purpose of this inquiry is to shape conceptual tools to understand the impact of new information and communication technologies (ICTs) on the organisation of universities.

Traditional research based universities, the most typical representatives of the higher education system, find themselves challenged by the speed and the wide range of technical innovations, but also by a vast variety of implicit assumptions and explicit promises, which accompany the distribution of digital media. This makes the empirical terrain very confusing, both for theoretical, as well as for practical considerations. This study therefore aims at developing conceptual tools to better understand, what challenges new ICTs create for higher education institutions, and how universities can react or pro-actively make use of them.

The position I take in this venture is that of an higher education researcher, who is interested in the structures and processes that constitute higher education institutions and higher education systems. The title ‚virtualisation of universities' expresses an general observation and a basic assumption. The observation is that universities increasingly use digital media (computer and the internet) to accomplish their tasks, a transformation that takes place in a rather evolutionary than in a revolutionary way. The assumption is that this process increases the potentiality for universities, both with respect to the options universities have, as well as to the challenges they face.

Chapter 2 shortly sketches the evolution of information and communication technologies. It analyses the emergence of digital media as the most recent step in the long history of communication technologies, which also comprises language, script, print and broadcasting. The comparison makes it obvious that each of these technologies created new symbolic layers and

distinct levels of reality with very specific communicative opportunities, rather than to substitute each other. It also helps to better understand the specific characteristics of new information and communication technologies, which are based on the symbolic layer of digital code.

In chapter 3, I provide a brief overview of the broad variety of uses of new information and communication technologies at universities. Universities are characterised by a unique combination of three functions, which distinguishes them from other institutions in society. All of these functions have to do with the treatment of academic knowledge. Research is the creation of new scientific knowledge, education is the dissemination of knowledge, while publishing and archiving serves the function to preserve knowledge. Strongly believing that scholarly communication is the basis of all academic activity, I claim that all of these academic activities are effected by digital media, that uses of new information and communication technologies can be found in any of these three functions.

The preservation of knowledge by publishing/archiving is an often underestimated task of universities. It is based on the physical representation of knowledge in knowledge resources, a representation which increasingly becomes digital. This digitalisation carries severe consequences for the process of publishing and archiving, since both become increasingly interconnected and change their sequence. In chapter 4, I distinguish three types of knowledge resources: scholarly publications, course materials and academic software, as an entirely new type of representation. I elaborate on the similarities between these types of knowledge resources and propose to treat their digital forms as public goods, rather than as private commodities. This also has consequences on the self-understanding of universities as providers of services, like research and education, rather than as vendors of commodities.

Still dealing with the preservation of knowledge resources, chapter 5 focuses on the preservation and distribution especially of learning materials. To overcome limitations of personalised perspectives on education, which necessarily have to focus on interaction in courses, I propose to distinguish between course, organisation and society as possible contexts of education to become able to observe effects, which go beyond the boarders of the classroom. Since learning materials and learning interaction as complementary elements of educational arrangements differ considerably with respect to their potential for dissemination, I discuss concepts for sharing materials and potential organisational arrangements to make collaboration and exchange happen.

Shifting the focus from preservation of knowledge to its dissemination via education, in chapter 6 I propose to regard education as an institutional

achievement, rather than as the isolated task of individual teachers. To get a holistic view on the single institution, I suggest a conceptual framework of six dimensions to describe the organisational use of ICTs, three of them (product, content, market) focusing on external relations, three of them (personnel, organisation, technology) dealing with internal relations of the university. I elaborate this framework with the help of various examples, proposing to use it for determining the goals and effects of digital media at universities and to locate the purpose of different technology initiatives for comparisons.

In chapter 7, this conceptual framework is used to describe the development of an institutional eLearning strategy at Klagenfurt University, my home institution. After shortly sketching the history of political initiatives to foster eLearning in the Austrian higher education system and my own attempts to investigate other institutions, the main part of this chapter describes my own participation and experiences in an organisational development process at Klagenfurt University that aims at implementing a comprehensive eLearning strategy. The concept has not only proven to be useful for descriptive purposes, but also as a means to orient strategic developments and to structure the internal debate.

While the concept of six dimensions for the organisational use of information and communication technologies is more appropriate to provide a static snapshot on institutions, chapter 8 deals with the dynamic development of competences for the effective use of educational technologies at universities. Reducing the range of dimensions, I conceptualise the effective use educational technologies in higher education as being determined by three aspects: actors in education, educational products and educational technologies. Based on the analysis of 33 effective practice descriptions, three necessary competences are identified: pedagogical, technological and organisational competences. Rather than suggesting fixed and stable skills, I propose to distinguish consecutive levels for each of these competences, which helps to understand differences between various states of universities and their need as institutions to continually improve their pedagogical, technical and organisational capacities.

Summarising my main findings and conclusions in chapter 9, I present arguments, why universities should deal with new information and communication technologies at an organisational level. ICTs are a fundamentally new cultural phenomenon, which creates functionally different communicative forms that can not be provided by traditional media. Universities have to make adequate use of these forms contribute to their development to empower and prepare their faculty members and students for participation in the digital networked society. This comprises all academic

activities, especially research and education, which are deeply interwoven and influence each other. Maybe the biggest challenge is to prepare for the organisational change for innovation. If technology is just put on top of existing structures, it just will create increased costs for the institution and additional pressure for the individual scholar. To make change and innovation possible, especially teaching structures have to become more flexible. To adapt organisational framework conditions, reallocate resources and coordinate between various stakeholders, it is not enough to rely on crucial bottom-up initiatives. Rather the design and coordination of the digital structure and the related workflows of a university should be regarded as a top priority of the central management, to enable innovation in academic units and activities. Last, but not least, it has to be emphasised that the adequate use of information and communication technologies can not be achieved in a single, short term step. Rather, universities should prepare for long term and continuous innovation, which best is accompanied and guided by institutionalised research and development.

Chapter 2

The evolution of information and communication technologies

„Social systems consist of communication."

Niklas Luhmann

To create a better understanding of the fundamental effects of new information and communication technologies, like the computer and the internet, the following chapter[1] describes the emergence of digital media as the most recent step in the long history of the evolution of information and communication technologies. The comparison with other communication technologies, like language, script, print and broadcasting, makes it obvious that each of these epochal steps created new symbolic layers and specific levels of reality with distinct communicative opportunities. Each of these technologies expands the options for communication and effects the structures of society.

SOCIAL SYSTEMS AND COMMUNICATION

Modern sociological systems theory in the tradition of Niklas Luhmann (1984, 1997) conceptualises society as a large network, consisting of nothing but communications. This perspective awards information and communication technologies a crucial role for society. To assess the specific importance of computers and the internet, it is helpful to explore them as the most recent step of a longer evolution and to put them in the context of other, more established information and communication technologies.

The paradigm of general systems theory is not only used in sociology, but also in many other research fields, like physics, biology, psychology, ecology, etc. To be regarded as systems, entities have to be autopoietic (self-produced). Systems distinguish themselves from their environment and produce themselves by the closure of their own, internal operations.

[1] This summary on Luhmann's systems theory, with special focus on distributive communication media, largely draws from the excellent introduction by Berghaus (2004).

Bodies have to reproduce themselves (their cells) by their own biochemical operations, minds have to think their own thoughts. This does not neglect causal relationships between systems and their environments: bodies need energy (food), psychical systems or minds need external stimulation (information) for their existence. The theory postulates autopoiesis only on the level of the basic operations of a system.

Communication systems

The basic operations of social systems are communications. Luhmann defines communications as operations, which comprise three selections: information, message and understanding. Communication only takes place, if Alter selects an information and chooses a form to impart it, while Ego has to understand that. Understanding in this context can include misunderstanding and does not require consensus or acceptance. It is just necessary that Ego interprets Alter's act as a purposeful message and not just as incidental behaviour. This makes the crucial difference between directly perceived and imparted information. Communication therefore needs at least two actors and is more than the mere sum of their actions, since Ego's understanding is necessary to synthesizes Alter's two selections of information and message. Communication can be continued, if Ego understands Alter's act as imparted information and uses this understanding for the selection of an own message.

Given this conceptualisation of communications as operations and of social systems as communication systems, it becomes clear that (from a theoretical perspective for analytical purposes) human beings are preconditions for, but not part of social systems. Physical entities (bodies) or minds (thoughts) can not be processed by communication. However, individuals (similar to physical objects or thoughts) can and have to be constructed as topics of communication, and/or as ‚persons', which serve as addressees, whom the distinction of message and information can be attributed to (Fuchs, 1997).

NON-VERBAL COMMUNICATION

The main precondition for interaction is the perception of being perceived. This condition of reciprocal perception is given in a situation, where both actors are present. Here, even simple signals or gestures can be intended as and, more important, be understood as messages. However, signals and gestures are of limited communicative potential. They only work in the presence of both actors and in the presence of the objects they refer to, and

therefore only work in given situations. Additionally, they are ambiguous, since non-verbal acts of impartation are not easily distinguishable from non-communicative acts or behaviour.

LANGUAGE

This situation changes dramatically with the evolution of language. Language uses the medium of acoustical signs (words). The repetitive use of specific sounds and sound groups led to this evolution of language. Linguistic signs abstract from physical reality and generalise sense for reuse. The main function of language therefore is not to ‚represent' physical reality, but to create an independent layer of linguistic reality and/or to multiply reality.

Spatial and timely expansion

Language hugely expands the reach of communication, both in spatial and in temporal terms. While both Alter and Ego still have to be present to communicate, language enables them to talk about objects or topics which can be absent. Language makes it possible to communicate about objects and topics, which are beyond the reach of direct physical perception, but also about events in the past and in the future. Doing this, communication creates its own time, e.g. by compressing long series of events into short sentences, or by reflecting on short incidences over a longer time span. It even becomes possible to linguistically create phenomena, which do not have any equivalent in physical reality (e.g. goods, myths, fairy tales, but also ideologies, theories, explanations).

Yes and No

Language also expands communicative options in two other directions. The use of highly specified acoustical sings (words) makes talking an undeniably intentional activity, which is solely specialized for communicational purposes. However, this does not substitute non-verbal forms of communication, but rather adds more options, like the shift between or the mix of two modes of communication. Additionally, language duplicates reality by creating a Yes-version and a No-version of reality. Linguistically it becomes possible and necessary either to accept or to reject a proposed version of reality to continue communication.

Given this huge potential of language, it is fair to say that language was the fundamental prerequisite for the evolution of society and that it still is the basic communication medium. Only with the help of language it was

possible to reliably distinguish communication from physical events and non-communicative behaviour.

SCRIPT

Quite probably, early signs and symbols have been developed for the primary purpose of documentation to support the memory of individuals, e.g. to create lists for inventories or notes for travelling messengers to help them reminding oral messages. These documents stored information for the transport over time and space.

Written communication

Only on the basis of a broader, more common use of signs and symbols writing also gained communicative functions, the potential to create physical representations of messages, which could be understood by others. The effects were dramatic, since the transport of written messages expanded the reach of communication beyond the reach of situations of joint presence. While in oral communication, both the sender (Alter) and the receiver (Ego) have to be present, written messages can travel long distances in time and space, before they are read (understood) by a reader and before communication is completed. For written communication to take place, it is no requirement any more that Alter and Ego meet face to face. They do not even have to live at the same time.

Asynchrony and potentiality

In any case, handwritten communication is asynchronous and has to deal with the timely expansion of the communication process. Written communication creates its own time, on both ends of the communication process. The author has more time to select relevant information and to choose between different forms (words, sentences) to impart it. The reader, on the other hand, does not need to immediately react to a written message, but has more time to reflect upon possible interpretations of how to understand it. While the spoken word vanishes immediately after being pronounced, a written document is a fixation of information in a message over time. Such a document can be repeatedly read and therefore easier checked for its relevance and consistency than oral statements. In writing the authors's selection of information becomes more obvious. Potentiality of maybe (comparable alternatives) and systematic critique enters communication.

Additionally, script again created a new layer of reality. It split language in two forms of perception, an acoustical and an optical one. These two

forms of language each have a reality of their own, are loosely coupled and not in a rigid point-to-point equivalency. Script can document, but not completely substitute the simultaneous involvement of participants in a oral dialogue. Alphabetic scripts can mark differences between sounds, but can not fix the sounds themselves. On the other hand, written communication creates facts that would not exist without it, like lists for stocks, taxes and liabilities, like notes, codices and contracts.

More information

These characteristics of script hugely expanded the range of distinguishable facts and aspects. They also lead to an increased importance of information, of new and surprising facts. In oral societies, talking predominantly focused on the social aspects of belonging and participating. The value and amount of new information was comparatively marginal. The authority of a speaker can be determined by his/her personal charisma (due to which the speaker can talk even without saying much), while the authority of an author rather has to be determined by his/her subject-orientation and factual competence, his/her knowledge and expertise. In written communication, the personal relationship to the author becomes less importance, while the value of impersonal information increases. Written communication sharpens the experience of difference between information and message, since it allows to better focus on the information that is imparted and to create more specified and distinct threads of communication. In this sense, written communication is more communicative than oral communication, because it carries more information and provides the possibility for more differentiated and complex communication.[2]

Script fundamentally transformed the communication capacity of societies, which caused extreme effects on their structure and complexity. Archaic societies, which exclusively relied on oral language, had limited options to expand and existed only in small entities and tribes. Compared to this, written communication made a huge difference, since it allowed for structural differentiation and increased complexity. Even if only a tiny

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[2] This understanding sharply contrasts with traditional concepts of communication. *„The common perception thinks just the oposite, since it teleologically interprets communication as being aimed at consensus. From this point of view, oral exchange (dialoge, discourse) naturally appears to be the ideal form, while every technisation of communication by writing or print is regarded as a sign of decline or as a weak compromise."* (Luhmann 1984, p. 224, footnote 48, own translation) The long-lasting resentment against the technisation of communication dates (at least) back to Socrates. However, nobody would know about Socrates' concerns today, had not Platon documented them in writing.

fraction of the entire population had some form of literacy, this already was enough for the emergence of advanced cultures, sufficient to organise more complex and far reaching societies, like states or kingdoms. None of these large social entities would have been possible without forms of written communication, on the basis of personal interaction or oral language only.

PRINT

The invention of the printing press lead to an enormous increase in the amount of available written documents and to an expansion of written communication. This quantitative growth also had qualitative effects.

General public and mass communication

First of all, larger numbers of documents and reduced costs for single copies increased their availability. For larger amounts of the population only now it became attractive to acquire reading skills, and, as a side effect, writing skills as well. Alphabetisation became a mass phenomenon, and, in the longer run, an ubiquitous phenomenon that included the entire adult population in written communication. On this basis, print created publicity via the mass production of written documents, and, for the first time, a general public, accessible via print. It is also fair to say that print was the first mass medium, the first medium for mass communication.

Anonymity and individuality

This increase of possible addressees also had consequences for the production of printed documents. It started to reach out to large numbers of anonymous, unspecified readers. Due to an growing range of supply, readers did not just passively accept, what was given to them, but started to select between different offerings. Therefore, authors and publishers began to produce for what could be expected to be read, and therefore started to orient themselves on the tastes and on the interests for large numbers of readers. While in hand-written manuscripts, the interest of the author (e.g. to instruct and regulate, at least to impart information) was dominant, now the interests of readers became more important. Anonymity of the reader and the option to choose between different printed offerings also sharpened the distance between author and reader.

As a result, traditional forms of authority eroded and societies experienced important structural changes. Authors lost much of their authority qua status or official role. Instead, acceptance and public impact became important. Even if censorship tried to suppress it, critical public evolves.

Since print allowed to easily distribute information, it also fostered differentiation of opinions, knowledge and concepts, which lead to a publicly visible plurality of values and sources for personal orientation. The wide range of choices also became the prerequisite for a broad individualisation in society. Knowledge, models for personal behaviour, and different practices or lifestyles could not exclusively be found in the family or the near social environment, but also be drawn from books. This applies to cooking recipes and scientific concepts, as well as to ideologies and values, or ideas of romantic love.

Standardisation of language and systematisation of knowledge

However, print did not only increase differentiation and variety, it also lead to new forms of centralisation and redundancy. To increase the reach of publications, they had to be cleared from orthographic ambiguities and local expressions. As a result, the need for far reaching, linguistic regulations and standardised national languages evolved.

The improved availability of existing knowledge stocks, caused by their transfer from hand-written manuscripts into print, also created better options for cross-textual comparisons. Now it became apparent, how confusing and inconsistent the wide range of knowledge stocks was. A new demand for overview and simplification, for systematisation and selection of relevant knowledge evolved, which was met with a variety of measurements, like schemes of categories and catalogues, comprehensive encyclopaedias, or the shift in the practice of science from universally interested, sometimes amateurish scholars towards specialised scientific disciplines, which were performed by professional experts. Time, again, had a crucial role in this context. While oral societies had a predominantly circular understanding of time (e.g. the periodic change of day and night, or of the four seasons), the notion of time now became predominantly linear and the most important principle to organise knowledge in historical and/or causal sequences. This met well with the characteristic of script as a linear medium. All together, print had deep impacts on how knowledge was organised and structured.

Self-observation of society

A last consequence of printed communication lies in the fact that it became the main source for description and self-observation of society. On a broad basis, the perception of reality did not only rely on interaction and direct observation any more, but increasingly drew from printed description. This had at least two results. On the one hand, acting (in interaction) and observing (in reading) became stronger separated, which provided more room

for intensified observation. On the other hand, to read also means to shift from direct observation to the observation of other observers, or to second order observation. In other words, modern society began to draw its perception of reality (including society itself) from the variety of printed observations and descriptions, from printed communication.

ELECTRONIC MEDIA

The beginning use of electricity again expanded the range of communicative options and the communicative capacity of society by further reducing physical barriers for communication.

Telecommunication

A first outcome was the evolution of instruments for telecommunication in ‚real time'. The telegraph for the first time transported signals without delay even beyond the reach of sight. By this, the transport of information became independent from and much faster than the transport of physical objects. The telephone hugely expanded the spatial reach of reciprocal perception. Simultaneity over long-distances, at least in point-to-point communication, became possible, which reduced spatial and temporal restrictions.

Recording

In roughly about the same period, recording technologies, like photography and film for optical signs, or like mechanic and magnetic recordings for acoustical signs, were invented. These recordings are images of physical events, taken in real time, e.g. of music or activities, while they were performed. In difference to script and print, which are necessarely subsequent descriptions characterised by their obvious artificiality and difference from physical events, recordings seem to deliver a proof of reality, which can not be denied, but just perceived. To a certain degree, they create an approximation to the original situation, as if the observer would actually participate in the event. Still, there are differences to the original. On the one hand, the observer can not interfere in the actual event. On the other hand, selection takes place on both sides, which again constitutes communication. The sender can choose, what to produce and distribute, the receiver decides, what to perceive.

Broadcasting

In the beginning, these recording technologies were non-electronic. Recordings were distributed much like printed documents, by producing copies and selling them for individual use (e.g. music records) or for playing them back in front of limited audiences (e.g. movies in cinemas).

The use of radio waves for broadcasting opened an additional distribution channel and transferred recordings into an electronic form. This hugely increased the reach of recordings, since it allowed to arrange for the simultaneous perception of the same event by great masses of people. The sender did not only control topics and forms of presentation, but also the timing and length of their distribution. Due to several reasons, terrestrial broadcasting is a very centralised form of one-way communication. Among them are the high costs for the production of content and for broadcasting equipment, but also the limited bandwidth of radio waves for analogous transmission in a given geographic territory, which often made broadcasting an object of state control. Similar to telecommunication, broadcasting still creates a feeling of communicative proximity.

DIGITAL MEDIA

The most recent step in the evolution of information and communication technologies so far can be seen in the development of digital media, like the computer and the internet.

Computer

A first remarkable aspect was the invention of machines and instruments, which did not aim at the transformation and production of physical objects, but which instead processed symbols and information. The capacity of these machines is exponentially growing, a phenomenon first observed by Gordon Moore in 1965. Basically, Moore's Law claims that the size of transistors on integrated circuits is reduced by halve every twenty for month, or in other terms, that the computational power available for the equivalent of $ 1.000 doubles every two years. This observation held true for the last 50 years. Ray Kurzweil expanded Moore's Law in two directions: to the longer past and to the midterm future. Starting with the beginning of the 20th century, he found out that it already applied to earlier computing technologies, e.g. mechanical or electromechanical devices (Kurzweil, 1999). Projecting this law to the future, Kurzweil predicts that for an equivalent of $ 1.000 the computational capability of a human brain could be acquired as soon as in the year 2023, the computational capability

of the entire human race could be available for the same amount in 2049 (Kurzweil, 2001). Even if some observers regard these predictions as too radical, it still is obvious that the information processing capacity of society is growing at rapid pace.

Programmes

Closely linked to the development of computing machines is the emergence of flexible programmes for their instruction, which are distinguishable from rather than ingrained in machines (as it is the case in purely mechanical devices). Programmes are not just documentations, but have a direct operational functionality. Representing working simplifications of procedures that are translated into algorithms and code, they relieve the human brain from repetitive tasks of information processing. Instead, their output and, even more important, programmes and processes themselves come more to the fore as objects of observation. Rather than the final determination of information, the process of generating information gains importance and can be objectified. This contributes to what Herbert (Simon, 1976) called the shift from substantive to procedural rationality, a fundamental change in the organisation of knowledge. In any case, due to their operational functionality, being both descriptive and prescriptive, computer programmes and software constitute an entirely new form of knowledge resource.

Code and convergence

Another characteristic of digital media is their physical convergence, based on their joint rooting in a binary code. While traditional types of analogue media all had their preferred and quite distinct physical materials (print was put on paper, film required photo-mechanical strips and sound was recorded on magnet tapes or vinyl discs), the digitalisation of writing, audio- and video-recordings transferred all of these media products into code and put them on the same physical level as computer programs. By relieving media from most physical limitations of the traditional carrier materials, this convergence creates a range of new creative options. For example, in the case of written text, normally a rather linear medium, it becomes possible to add additional non-linear structures with the help of hypertext, e.g. by creating circular or parallel structures as paths through the text, or by cross-referring to other texts. Convergence allows to easier combine different media formats and to create new formats by merging text, audio and video. By developing interactive applications that build on man-machine interaction, it becomes possible to provide for perception processes in both

linear and non-linear ways and to adapt a single media product to different needs of users.

Apart from this increased functional variety of digital media and their potential for new forms of expression, digitalisation, the shift from analogue to digital representation of information, also enormously increased the efficiency of storage and distribution. With respect to storage, these efficiency gains can be observed in the shifts from magnetic tape to compact or digital versatile discs to flash storage. With respect to distribution, digitalisation allowed to make better use of the bandwidth of traditional distribution channels, like cable, the terrestrial transmission of radio waves or the extra-terrestrial transmission by communication satellites.

Internet

On the basis of the increased distributive capacity, which now includes the transmission of any kind of data in addition to audio and video, the evolution of digital media took its latest major step with the emergence of networked computing and the broad use of the internet. While in the past, computers have been used as tools to support the work of specialists (e.g. mainframes) or as general-purpose tools for the information processing of individuals (e.g. personal computers), they now turn primarily into communication devices to support existing and create new types of social relationships and communicative forms.

New forms of written communication evolve, e.g. email, chat (reciprocal perception focusing on simultaneously produced text messages) and forum (a collaborative form to elaborate thematic threads). The internet allows for synchronous as well as for asynchronous forms of distribution and access, e.g. for broadcasting at a fixed point of time or online archives and downloading on demand. Last, but not least, the internet supports the communication of any type of social system, be it interaction (based on reciprocal perception, e.g. via voice-over-internet or video-conferences) or society (constituted by communicative accessibility, which is largely guaranteed by publishing to unspecified others, now becoming a mass phenomenon of many-to-many instead of staying a centralised phenomenon of a few-to-many, e.g. via bloging or personal homepages), be it social networks (rooted in informal relationships between actors, e.g. via social networking applications) or organisations (built on formal membership and distinct relationships between specified roles, e.g. via intranet and enterprise applications).

	Non-verbal communication	Oral communication	Handwritten communication	Printed communication	Electronic communication	Digital communication
Symbols	• physical gesture	• spoken word	• written word	• printed word	• transmitted image	• code
Necessarely present (temporarely and spatialy)	• Alter/sender • Ego/reciever • object/topic	• Alter/sender • Ego/reciever	• original document • Ego/reciever	• copied document • Ego/reciever	• broadcasted recording • Ego/reciever	• link • Ego/reciever
Possibly absent (temporarely and/or spatially)	• -	• object/topic	• Alter/sender • object/topic	• original document • Alter/sender • object/topic	• original recording • Alter/sender • object/topic	• original application • Alter/sender • object/topic
Layers of reality	• physical reality	• Yes/No-version of reality	• potential reality (maybe)	• differentiated rationalities	• as-if reality	• simulation
Forms of distribution	• synchronous • few-to-few	• synchronous • few-to-few	• asynchronous • few-to-few-among-many	• asynchronous • few-to-many	• asynchronous + simultanous perception • few-to-many	• asynchronous + synchronous • many-to-many
Forms of society	• -	• tribes	• centrally unified states	• functionally differentiated states	• global village	• networked world-society

Figure 1.: Characteristics of information and communication technologies, partly following (Berghaus, 2004) pp.154 and 177.

CONCLUSIONS

Traditional approaches often tried to conceptualise technology as being opposed to nature or human beings, as a quasi-anonymous power put on society and individuals from the outside. However, as the sociology of technology has shown, the development of technology can only be understood in its responsiveness to society, by its occupation and use. One can easily claim that mankind distinguishes itself from other life forms exactly by the use of self-developed technologies, starting from primitive tools to manipulate matter and oral language to communicate until current tools like rockets, quantum mechanics and genetic engineering, of broadcasting and digital media.

Technology does not determine society, rather society makes itself dependent from technology by increasingly building on its reliable use, while becoming prone for failure and unintended side effects (Luhmann, 1997) p. 523). Especially for communication, this holds true. And since individuals develop their self-awareness and their perception of the world through communication, this can be said of human beings as well. Both individual perception and communication always have been mediated. This mediation increases both in variety and in intensity.

Working simplification

Technology can be defined as ‚working simplification' of procedures, by isolating heterogeneous elements from the rest of the world, strictly coupling their connections and thereby creating repeatable, de-randomised effects (Luhmann, 1997) p. 524 ff.). These working simplifications can relieve from repetitive tasks and create new options for subsequent action and observation. Still, it is necessary to see that these working simplification are ingrained in, but not created by technology. It is the social system that decides upon, what simplifications are regarded as necessary to create and to make use of.

The process of isolating and coupling of elements can be found in each of the large communication technologies, by isolating and connecting specific symbols with others of a kind, like spoken words, written letters, printed documents, broadcasted recordings or code. To make sense in practical contexts, the distinctiveness of their respective couplings have to be re-transformed into the ambiguity of communication. Even if certain connections can be strictly coupled and certain procedures can be automated, it still is necessary to select information to feed in, and to understand the output.

Accelerated returns

Analysing the long term development of information and communication technologies, it becomes apparent that each of them contributed to the expansion of the communication capacity of society. This did not lead to a closer adjustment to its environment, but rather allowed to increase the options to unfold the dynamics of society, both with respect to the semantic (the stock of available knowledge, ideas and perspectives) and to the structure (the size, complexity and internal relations) of society.

It is quite interesting to observe the temporal sequence of the development of technologies. While it took ages before oral language was established as the first communication technology, it is only a few thousand years ago from now that scripts emerged. Print on the basis of moveable types was invented in the midst of the 15th century, electronic telecommunication and the prerequisites for broadcasting in the 19th century. Digital computing came up in the midst, while the browser based use of the internet only started in the last decade of the 20th century. Obviously, the speed in the development of communication technologies accelerates. Technologies allow to accumulate effects, which enables society to develop additional technologies. (Kurzweil, 2001) called this the ‚law of accelerating returns'.

Different functionalities

While in short term comparisons, the substitution of technologies by others, functionally equivalent, but more powerful ones, can be observed (e.g. the substitution of analogue records by microelectronic storage), in the long term, epochal comparison does not show full substitutions. This can be explained by the fact that each of the mentioned technological steps was successful in establishing a specific communicative functionality.

Oral language, for example, especially supports synchronous interaction and coordination among present actors, fast turn taking and instant feedback, as well as the feeling of belonging. By allowing for asynchronous communication, script relieves from the pressure to act and to immediately respond, while it gives room to stronger focus on information, for careful reflection of alternatives and for systematic critique. Broadcasting, again an asynchronous medium, but for the centralised distribution of messages and recordings, allows to reach out to large masses of unspecified addressees, providing them with the opportunity to simultaneously perceive images of physical events, which creates a feeling of communicative proximity in the global village. And digital media comprise all previous media, as far as they are transferred into binary code. This hugely increases distributive options and allows for convergence between and for combination of differ-

ent media, as well as for the creation of simulations and alternative procedures of information processing.

Since all of types of communication technologies have their specific functionalities, it does not make sense to think of one technology as a full substitute for another, or to regard one as being generally superior to others. Rather, they all support communication, but do this in very distinct ways.

Cross-fertilisation

The description of epochal communication technologies in sequential steps of their invention should not indicate that the development of older technologies came to a halt. Instead, they continue to unfold in parallel, both with respect to content and to form.

Claiming the distinctiveness of different types does not mean that they do not influence each other. On the contrary, there is rich evidence of cross-fertilisation between different media. As already mentioned, print did not only standardise the orthography of written communication, but also led to the evolvement of unified national languages, which in return influenced the practice of oral communication. The phenomenon of broadcasting does not only provide authors with new topics, but also encourages fictional authors to write novels in a way that qualifies for additional use in film or television. Even if digital media might some day substitute the use of paper (current growth of paper production indicates the opposite), they never will substitute the use of script. As it is observable already, digital media allow for additional forms of written communication (hypertext, email, chat, forum) and for the close combination of script with other media.

Participating in a newer type of mediated communication gives access to additional communicative options, which provides rich communicative (and social) advantages, which is the reason for their rapid development. On the other hand, as (Berghaus, 1999) claims, that any time when communication is expanded by new options, older, more approved technologies are used to steer, select and orient about younger forms. In contrast to what cultural pessimists might think, new technologies do not weaken, but rather confirm the importance of more established forms, especially of personal interaction in oral communication. But to be able to influence developments, established communication technologies have to be used to deal with newer ones, rather than to ignore them.

Social structure

Sociological systems theory describes the structural evolution of society as the shift from segmental (similar units of a kind, e.g. tribes) to stratified (hierarchy, centre/periphery, classes) and further on to functionally differentiated (autonomously acting functional systems with generalised perspective on society, like economy, science, politics or religion) structures of society. With respect to this structuring, (Luhmann, 1997) p. 312 ff.) observes a general trend from hierarchical to heterarchical and a-centric forms, and claims that extended options provided by communication technologies are necessary prerequisites of this development. Similarly, (Castells, 1996) claims the rise of the network society, with increasing importance for the individual, richly connected knowledge worker and diminishing power for centralised structures. But even if these descriptions of long term trends and of predominant structures are accurate, there is no reason to believe that new structures immediately and completely substitute older ones. For example, it might be correct that print has contributed to functional differentiation and broadcasting to the perception of the world as a global village, but it also is true that both technologies have been objects of and tools for centralised control. Even if different communication technologies show preferences for specific structures, the connection between communication technology and social structures leads to a last observation that different communication technologies do not equally support the communication of all types of social systems. This becomes especially apparent with respect to organisations and their use of technologies. Organisations might, for example, become topics of mass media, or even try to contribute by investing in advertisements and promotional materials. However, it is a very seldom phenomenon to see broadcasting being used for their internal communication. Instead, organisations use interaction (both in face-to-face meetings and via telecommunication) to coordinate between positions, and written communication to document, store and distribute decisions to specified addressees. Digital media can raise the efficiency of these forms of communication, objectify procedures and lower the barrier between internal and external communication, e.g. by sharing selected parts of the internally used information via newsletters and public websites.

Therefore, especially with respect to organisations, the impact of digital media is more appropriately compared with the effects of script and print than with those of broadcasting. Digital media constitute a new layer of communication opportunities that especially favours smaller social structures, like individualised interaction, social networks and organisations.

Chapter 3

ICTs and the key functions of the university

„Scholarly communication is the foundation of all academic activities."

California Digital Library

The aim of this chapter[1] is to provide an overview of the variety of information and communication technology (ICT) applications at traditional universities and to integrate them into a holistic picture of the institution. Using the distinction of three key elements of scholarly activity (research, publication, education), it suggests a functional perspective of the organization as a way to raise questions for the assessment of ICT applications in universities. This may lead to a better understanding of the different rationales in research, publication, and education. Acknowledging these differences might enable finding ways for using ICTs to foster academic productivity in each of the different aspects separately and also for contributing to their integration in the organization of the university.

INTRODUCTION

The popular expression ‚virtual university' is widely used for a vast variety of phenomena (Baumgartner, 2000). Some use this label for institutions that merely put their course catalogues online, some for universities that offer online materials for traditional courses or even a few online courses within otherwise traditional curricula. In other cases, the term is used for web-based umbrella organizations that cover online activities of some higher education institutions, for alternative providers of higher education, or even for organizations that merely act as brokers for online courses or curricula. Also a very few institutions have specialized in exclusively providing online distance-learning higher education. This variety of phenom-

[1] An earlier version of this paper has been published under the titel Virtualization of Research Universities: Raising the Right Questions to Adress Key Functions of the Institution. Pfeffer, Thomas (2006).

ena to which the term is applied results in a confusing picture of what a virtual university might be. Additionally, the term is commonly used with a strong bias towards education, often reducing e-learning to web-based education, while simultaneously neglecting other activities of traditional research universities, which go far beyond higher education. And, last but not least, the term suggests something similar to an ultimate state of an ideal organizational form that nobody has yet clearly envisioned, but which all higher education institutions will have to resemble in the near future. As Harley (2002) observes, ICTs are frequently regarded as promising solutions for a triad of pressing issues (costs, increasing access, and quality), while clear reference models are missing.

These limitations are not only unsatisfactory from a theoretical point of view; they also might mislead practical choices for the implementation of ICTs, if education is de-coupled from other activities at the university and designed around technology, while ignoring the possible coherence with other key functions of the university. To avoid some of these limitations, it seems to be more appropriate to speak of a virtualization of universities, indicating that the introduction of ICTs is not a deterministic, but a long lasting, evolutionary process, that meets with the tradition of old institutions. To overcome other definitions, it will be necessary to open the narrow focus and to gain a more holistic view on the use of ICTs in research universities, comprising the relationship between education, publication, and research.

THREE ELEMENTS OF SCHOLARLY ACTIVITY

Noam (1999b) distinguishes three major elements of scholarly activity: the creation of information, the preservation of information, and the transmission of information. Additionally, he claims that the dominant organizational model for universities and their predecessor institutions has been the central storage of information. According to this idea, universities have worked as local accumulations of scholars, books, and students. Noam claims that new ICTs challenge this model, which in the long run could endanger the (monopolistic) status of universities in society and, as a consequence, their funding basis. Therefore he predicts a dim future for the university (Noam, 1995). Others have joined him in this forecast, for example Peter Drucker (quoted in Lenzer and Johnson 1997): *"Thirty years from now the big university campuses will be relics. Universities won't survive."*

Before we discuss the validity of Noam's arguments, we will use his categories to guide our observations. Do we really find ICT in all of the three key elements of scholarly activity, in the:

- *Creation of knowledge* (commonly known as research),
- *Preservation of knowledge* (commonly known as publication and archiving),
- *Transmission of knowledge* (commonly known as education)?

CREATION OF KNOWLEDGE: THE IMPACT OF ICTS ON RESEARCH

According to Noam (1999b), all forms of research activity are affected by ICTs. He distinguishes between the following aspects: data sources, data mining and analysis, data generation, data administration and representation, as well as academic communication and collaboration. We will describe his categories and enrich them with examples:

Data sources

One outcome of the ICT-revolution is the fact that new data sources are made available for researchers, or better, that data sources are given a new form. Data banks for basic materials such as legal materials or statistical data are a prominent example of this. Another is virtual libraries, which in their first step only consist of the metadata from (research) texts, which are made available via an electronic catalogue. In a further stage of development, they also contain full texts. Digitized data sources revolutionize research work in several ways. One major way is in terms of access in that more information becomes available for the single researcher. This tendency is accelerated by intense efforts to standardize digital formats for data sources and to interconnect them.

Data mining and analysis

Another effect, which is closely linked with the digitization of data sources, can be found in new possibilities for data mining and data analysis. Simple search engines increase the speed and extent of investigations into digital data sources. Knowbots (knowledge robots) are little software tools that can be programmed to automatically and periodically search the net. One example for this was the online service Paperball[@1][2], which

[2] Due to potential copyright infringements, the service model in the meantime had to be changed.

automatically delivered individualized newspapers for specifiable profiles of interest, which were composed of articles from online newspapers and archives. While these examples only describe various forms of search functions, data transformation and analysis goes a step further. Simple examples are programs for statistics or text analysis that create new links and correlations. Even more advanced are expert systems that automate complex parts of the process of arriving at conclusions. Maybe the most prominent example from the live sciences is the Human Genome Project [@2], where the analysis of the human genome was made possible through the automation of analyzing routines. Trow (2002) observes that *"[t]he first analysis of ... the human genome is a triumph of computer science, without which these tremendous discoveries could not have been made in our lifetime."*

Data generation

A very diverse type of research activity is data generation, which differs considerably among the disciplines. Pioneers are the natural sciences, which have already been using computers for a long time, e.g., for calculations, modeling, and simulations. In the meantime, some larger research projects (e.g., in mathematics or astronomy) are only possible with the joint use of calculating capacity in *"parallel super computing networks."* During the past decades, all the other disciplines have also been increasingly influenced by ICTs. Economics, for example, uses them for complex model building and the social sciences develop new methods of research such as email surveys and online investigations.

Data administration and representation

Even if the concept of the "paperless office" is far from becoming reality (instead, the use of the computer increases the general consumption of paper), ICTs have also influenced researchers' administration of their own individual data. There are vast qualitative differences between the simple storage of data on a (individual or joint) hard disk and the more complex integration of data into (individual or joint) data banks. Most research data are available in a digital form, which makes it easier to transfer them from one production process to another. Important for this development are changing techniques for representing data and information. A first step in this direction was the use of computers for digital word processing, later for so-called desktop publishing. Both functions still aim at a hard copy as the final product, but greatly alter the method of production and produce a digital form as a by-product. This relationship changes with the introduction of hypertext and multimedia: the digital representation of information

becomes the main product. Hard copies are still possible and necessary, but will soon be reduced to the status of a by-product.

Academic communication and collaboration

Email represents the most common use of the Internet and it is the basis for more complex applications such as mailing lists and newsgroups. It is one of the main motivations enabling asynchronous collaborations (e.g., on joint articles), even across long distances. Synchronous online interaction can take place in chats or online conferences. Academic collaborations can lead to the foundation of virtual groups or virtual organizations and can be supported by the use of small groupware such as Basic Support for Collaborative Work (BSCW[@3]) or by bigger content management systems, which have the potential to construct or rebuild entire organizations electronically. In principle, these systems offer a virtual space in the Internet for the storage of electronic materials and tools for various kinds of interaction in a limited community, both of which can be accessed anytime from any place.

It is possible to complete Nentwich's range of categories by adding the following two types of phenomena:

Integration of formerly distinct research activities

New ICTs not only change single research activities, but based on the isomorphy of a common digital code they also offer new opportunities to rearrange and integrate formerly distinct research activities. An example of this can be found in the convergence between word processing software and reference management tools such as Endnote[@4], where the electronic archive for references can be linked with citations in a document to generate automatically a bibliography. Another example is Cyberlinks[@5], a link management system to create freely accessable, continually improvable link collections. In this application, the collection of data (by asking for contributions), their organisation (in topic areas) and their publication are combined. A scholar can build up a link database as a tool for his own research, and simultaneously contribute to his research community by making it freely available. In return, he not only increases his reputation in his research community, but also receives additional contributions to his database.

Development of academic disciplines

ICTs not only change the form of academic production, they gain increasing influence in research agendas and in the development of academic

disciplines. The pace of technological innovation makes it more necessary than ever before to match the research focus with infrastructure, since the selective use of ICTs can be crucial for the success of any research activity. This puts an enormous strain on the financial resources and, even more so, on the decision making capacities of every academic institution. On the other hand, ICTs themselves become a prominent research topic, which even leads to the development of new sub-disciplines (e.g., Computer Sciences, Economics and Computer Science, Multi Media Art, etc.) and to the foundation of new academic units (e.g. Berkeley Multimedia Research Center[@6]; University for Health Sciences, Medical Informatics and Technology[@7]). Even more interesting is the fusion of a former support unit with an academic department at the University of Graz (the ICT support unit for the Faculty of Humanities was integrated into the Institute for Informatics in the Humanities, a new academic unit, formed as a replacement for the former Institute for Basic Research in History (Höflechner (2002). This unit can serve as an example of the blurring boundaries between technical and academic expertise.

PRESERVATION OF KNOWLEDGE: THE IMPACT OF ICTS ON PUBLISHING AND ARCHIVING

Preservation of knowledge through publishing

Some authors experience extreme costs for producing digital material (especially when multimedia is included), but also have good chances for obtaining enormous profits in the digitization of scholarly publications. For example, according to Noam (1999a), ICTs have the power to push higher education from a handcraft to industrialized production, comparable to the impact the audio-disk had on the music market. Therefore, he sees an ultimate threat to universities coming from commercial publishers, who have experience in the commercial production and distribution of knowledge-based material. They could be able to provide online mass-education for lower per-capita costs, which in the long run would endanger the universities' funding base.

A completely different perspective comes from Harnad (1999), who claims that researchers have always only been paid for their research, but *"never got a penny for the reports of their research findings."* The consumer (e.g., reader, library) of a scholarly publication merely paid for the costs of printing and dissemination. Scholars were interested to reach a big audience, not for direct financial profit, but to increase the impact of their work and to raise their reputation as scholars. Making scholarly informa-

tion available to everybody, who is interested in debates and further developments, is part of the intrinsic logic of academic communication. Therefore, he claims, in principle scholarly publications are *"give-away"* literature, distinguishing it from *"non-give-away"* literature, which is sold to make a financial profit.

This sharp distinction becomes extremely relevant with new technologies, since they reduce the costs of digital reproduction of academic literature to almost nothing. As a consequence, he suggests that all scholarly publications should be stored in de-centralized online archives and made available to everybody for free. *"So authors should transfer to their publishers all the rights to sell their papers, in paper or online, but they should retain the right to self-archive them online for free for all"* (Harnad, 1999, p. 6).

This suggestion sounds a bit idealistic, but it works well with the basic idea of the Internet and the intrinsic motives of the individual scholars as well as of the entire scientific community. More convincing than these theoretical considerations are examples where the concept of the free online archive for scholarly publications has already been realized. One of the largest initiatives in this context is the arXiv.org[@8] (formerly known as Los Alamos Physics Arcive), in which over 100,000 papers in physics have been self-archived by their authors since 1991. But arXiv.org will be surpassed by the Public Library of Science (PloS)[@9]. Founded in 2000, PloS advocates a free online library for research in medicine and the life sciences. Up to now, over 30,000 scholars have signed an open letter stating that from September 2001 onward, *"the signatories will only publish in, edit, or review articles for journals that grant free distribution rights six months after they are published"* (Davis, 2001). Since publishers' reactions fell short of realizing the proposed policies, the initiative started to launch its own online journals and open-access publications.

While Harnad only advocates free access to traditional forms of publication, such as reviewed scientific journals, the last, most thrilling example by far exceeds his comparatively humble suggestion. In April 2001, MIT announced its commitment to invest $100 million during the next 10 years in its OpenCourseWare[@10] initiative, planning to create online material for almost 2,000 courses and to make this material freely available on the World Wide Web for non-commercial use (Goldberg 2001). Very clearly, OpenCourseWare, which acts in line with the principles of the Open Source Initiative[@11], challenges attempts to privatize scholarly knowledge and is a big blow to business models, which are based on expected profits from commercial courseware.

But what is the main rational of MIT's OpenCourseWare, if it is not for direct financial profit? Learning from the computer industry, where closed, proprietary software systems increasingly become a hindrance for further progress, MIT came to the following conclusion: *"Higher education must learn from this. We must create knowledge systems as the new framework for teaching and learning"* (Vest 2001, p. 3). This position is not a sign of mere altruism, but a bold act of leadership, which will strengthen MIT's presence as a global player in the research community. OpenCourseWare, which is more a form of academic publishing than of teaching, makes course material available to a far broader audience than traditional ways of dissemination, something that seems to be widely appreciated by MIT's faculty (MIT News, 2001). In other words, MIT's OpenCourseWare initiative can be seen as a massive investment to attract the scarce resource of attention, an important strategic move in an *"economy of attention"* (Franck, 1999).

Publishing is the academic way to attract attention, not only of an individual, but also at an institutional level. Hunter (2001), who compares the involvement of universities in the current electronic publishing revolution to their role in the publishing revolution of the fifteenth century, therefore argues that since the advent of the Internet Web services have to be understood as the technical and cultural equivalents of publishing houses, and warns universities not to waste as much time for adapting new forms of publishing as they wasted for the institutional use of print, waiting 130 years after the invention of print to introduce the first formal university publishing house in Oxford. Centrally and professionally maintained content management systems could provide a vast variety of publishing services activities that mainly take place at the level of departments and are frequently lacking in professional know-how, e.g., reviewed online magazines, working paper series, conference proceedings, departmental histories, yearbooks, educational materials (textbooks), etc.

PRESERVATION OF KNOWLEDGE BY ARCHIVING

In addition to publishing, archiving is the second aspect of the function of preserving information. Several impacts of ICTs can be observed here as well.

Substitution of physical catalogues

National libraries, large research institutions, and higher education institutions started substituting digitized catalogues for their physical catalogues and were quickly followed by most other institutions that use any form of archive.

Digitization of existing materials and resources

The next step is the digitization of existing materials and resources. An important initiative in this respect is the Journal Storage project JSTOR [@12], that has pioneered in digitizing older issues of scholarly journals in subjects such as history, economics, literature, science, and some fields of engineering.

Creation of online archives

In the World Wide Web, publishing and archiving converge and sometimes even occur simultaneously. The creation of online-archives, e.g., for working paper series or conference proceedings, is a good example of this development. It has become a common pattern for institutes or departments of research universities to provide their own online archives.

Alliances to share and network databases (catalogues, full text)

As soon as they take an electronic form, it becomes (technically) easy to connect catalogues and to share databases. A necessary prerequisite for this is the convertibility or standardization of metadata. "The Dublin Core and Encoded Archival Description (EAD) are examples of metadata formats" ((Drake, 2000)).

Alliances to purchase new materials

To match the power of big publishing companies, libraries are starting to build consortia to get better prices than they would as small, individual market participants. This not only lowers prices for libraries, it also reduces paperwork for publishers and makes it possible to deliver value-added services such as supplying library catalogues with electronic meta-data. As Drake (2000) reports, a consortium for all academic libraries in the United Kingdom has already been formed.

Limit redundancy

Since it is a main task of data management to *"limit or eliminate redundancy"* (Bernbom 1999, p. 79), it is possible that this will lead to a centralization and/or specialization of archives. It is easily imaginable that only one physical place (a web-server) is necessary for one piece of information, e.g., a scholarly paper. This could increase cost efficiency and free resources, but it might also make archives more vulnerable. (It only took a single individual to burn down the library of ancient Alexandria, the central and most outstanding knowledge base of that time.)

Changing role of librarians

Librarians have become increasingly involved in the storage of internal databases and in the organization of access to external electronic databases (e.g., licensing access to online journals). They have become both managers for increasingly complex processes of purchasing, publishing, and archiving, as well as trainers for faculty and students in the use of databases. Their work will become part of more collaborative production processes in their home institutions and in interaction with their environment.

TRANSMISSION OF KNOWLEDGE: THE IMPACT OF ICTS ON EDUCATION

Historically speaking, education might be the last, but, with respect to the resulting impact, it is for sure not the least of the key elements of scholarly activity affected by the cultural changes brought about by ICTs.

Student services and student administration

Normally, universities start to support physical forms of communication by providing additional online information. They begin with distinct tasks such as presenting themselves on a homepage or putting searchable course catalogues online. These features are eventually integrated with one another and supplemented with many other features such as online student registration, assignments, quizzes and certification, course evaluation, etc. Increasingly, university portals are seen as strategic instruments to design the university's communication with their environment ((Olsen, 2002)), which makes it necessary to enhance coordination within the organization. One side effect is the awareness that the educational experience at a university is determined by more aspects than mere student/teacher interaction. Another side effect is enhanced institutional responsiveness, e.g., in the form of a closer link between internal activity and external presentation. This can be observed in the Urban Universities Portfolio Project[@13], which tries to link internal reporting systems with presentations for external assessment.

From product to process

While residential and distance education have been traditionally regarded as two distinct types of education, the introduction of ICTs emphasizes the fact that each of the two types emphasizes different aspects of education. According to Trevitt (2000), traditional residential education is centered on lectures and tutorials, while traditional distance education is centered on a

materials production system. This distinction specifies the functional difference between residential and distance education. Distance education is not just a minor form of provision, as traditional universities would like to believe, but has its strength in the production system for course material. This is a strength most residential universities will have to learn from, while distance providers will have to find more interactive ways to educate. Terms such as ‚flexible learning' (Trevitt) or ‚flexible delivery' (Green and Lamb 2000) reflect this necessity to integrate aspects of both traditions for the successful use of ICTs in higher education. It comes as no surprise, that ‚dual mode' universities (Calvert 2001), which are experienced in providing both residential and distance education, seem to have a certain competitive advantage and are able to take a lead in using ICTs for higher education.

Maybe a more precise way to conceptualize this problem is to differentiate between the process of learning and the products (materials) used for this process. In doing so, it becomes clear that in principle, the one does not come without the other. But with respect to the introduction of e-learning methods into higher education, the emphasis of work in a given institution can shift from product orientation, which focuses on the development of learning resources, to process orientation, which deals with course planning and learning progress (Calvert 2001, p. 16). Johnston and Watson make a similar observation. They suggest an even more detailed sequence in the progressive development of ICT-based pedagogical models.

Content centric	Portal centric	Module centric	Performance centric	Learner centric
Content repositories	Road maps to courses and programmes	Road maps to bite sized learning	Assessment and accreditation	Dynamic customization

Figure 2.: Development of ICT-based pedagogy, adapted from Johnston and Watson (2002)

This model works well to conceptualise variations of human/machine-interaction, but it does not sufficiently comprise web-based forms of human/human-interaction, such as pedagogical models of teamwork, e.g., problem-based learning or project education that can be supported by groupware or learning management systems.

The trade-off between richness and reach

Using Evans's and Wurster's suggestion (2000), Weigel draws the distinction between richness and reach in the following way: "*Richness refers to*

the overall quality of information (for example, currency, accuracy, interactivity, relevance), and reach refers to the number of people involved in the exchange of information" (Weigel 2000, p. 13). In blurring this distinction, higher education institutions may become confused in their strategic focus. The assumption that the use of ICTs necessarily means (at least partially) adopting distance education (e.g., as a business model to reduce costs and increase enrolment) may result in an unclear vision of whom and how many to address, as well as in unwittingly joining markets that focus solely on price competition. This also neglects the potential of ICTs to enhance the richness and quality of the educational experience. At least for traditional, research-based providers of higher education, Weigel therefore suggests using the term ‚eLearning' instead of ‚distance education' to avoid any misconceptions in strategic debates. Additionally, he strongly recommends focusing on the imperative of richness in the curriculum and on the enhancement of academic excellence.

From faculty-centered to student-centered

A qualitative change, which has strong potential to enhance the richness of the learning experience, leads to a new relationship between students and faculty, which frequently is described as a paradigm shift from a more linear to a more circular, feedback-driven form of interaction. Taylor and Eustis (1999, pp. 56-57) make the point that the Internet provides the opportunity for *„on-demand learning through access to a remote resource at the student's convenience"*. In their opinion, this does not only imply a shift from synchronous to more asynchronous forms of learning, but, more importantly, it opens the opportunity to shift the focus from ‚faculty-centered' (Twigg 1994) forms of delivery to more ‚student-centered' forms of delivery. This not only applies to the level of the single course, but also to the level of the entire curriculum that can be customized to the needs of the single individual. The IUPUI Electronic Student Portfolio[@14], a tool for documenting improvement and achievement in student learning, serves as an example of this.

Internal collaborations

Many industries that previously structured production processes sequentially in long chains of fragmented, separately performed tasks, have come under pressure to reengineer this structure in a more concurrent way, e.g., by building interdisciplinary project teams, composed of members of diverse departments, to work jointly on more complex tasks, such as on a new product. (Delhoofen, 2001) compares this pattern of change to similar phenomena in higher education institutions. Here also, he observes a tradi-

tionally fragmented structure, e.g., of academic disciplines or of highly autonomous teachers, and a trend towards rotating this structure and reorganizing it around more complex tasks. Since the efficient use of ICTs in higher education is an extremely complex task, integrative cooperation across the boundaries of distinct departments becomes more necessary than ever before.

> *„The introduction of online facilities into teaching and learning environments requires the filling of multiple roles (e.g., course planning and design, learning facilitation, managing learning environments and teams, managing the development and use of resources, working with clients and collaborators, advising students, managing assessment, and monitoring and evaluation. ... It is neither efficient nor supportive of effective learning to assume that all the roles are filled by a single entity or individual, the teacher.*" (Calvert 2001, pp. 16-17).

This increasing need to link the work of individuals with the goals of the organization leads to major changes in the nature of academic work and the roles of individuals. To design these changes carefully, modern universities will have to find a balance between exaggerated forms of managerialism and the *„wishful thinking to expect that some invisible hand will guide the path of individual academics into a strategic direction*" (Coaldrake and Stedman 1999, p. 13). A more academically driven example of stronger internal collaboration might be the Technology Across the Curriculum [@15] initiative at George Mason University. The goal of this initiative is to incorporate the training of 10 basic IT-skills into regular courses of liberal arts programs as a way to increase computer literacy and to provide graduates with a comprehensive portfolio of marketable technology skills. A more administratively driven example might be the Learn TechNet[@16] at the University of Basel. LearnTechNet is a cooperation of different support units coordinating and bundling their services to support academics and students, aiming at a modernization and improvement of the learning experience at a residential university with the help of ICTs.

External collaborations

The stunning variety of external, inter-institutional collaborations starts with comparatively simple applications such as joint online-catalogues (e.g., Deutscher Bildungsserver[@17] provides searchable online information on existing programs). A bit more advanced are online communities for exchanging and reviewing web-based course materials (e.g., MERLOT[@18]). More complex is, on a small scale, the development of joint study programs (e.g., WINFOLine[@19] is a cooperation of four Ger-

man universities to jointly provide an online master's program), or, on a larger scale, the development of courses under a joint didactical concept (e.g., Western Governors University[@20]). On the level of state systems, one can find specialized initiatives focusing on single functions (e.g., SUNY Learning Network[@21], state-wide coordination of support and infrastructure for web-based instruction), or national portals providing online services for all key functions of their traditional research universities (e.g., Finnish Virtual University[@22]). Universities also form huge international consortia to package and globally distribute their education services (e.g., Universitas 21[@23]). Many new activities in higher education involve private companies, either in collaboration with or in competition with public institutions, sometimes even both. Here again, the less complex initiatives are based on online catalogues and act as brokers for already existing courses (e.g., Mindedge[@24]). Higher education institutions become important customers for software developers, which offer highly specialized solutions such as learning management systems (e.g., Blackboard[@25], WebCT[@26]) or integrated campus solutions (e.g., Campus Pipeline[@27]). In the beginning, some companies offered trial versions of their software for free, using universities as developers and testing sites, and are now starting to charge licensing fees. Even more complex is the bundle of technical, organizational, and didactical products and services provided by companies such as eCollege[@28], which incorporates educational software, academic content, staff training, consultancy in instructional design and course development, sometimes even the re-engineering of the entire higher education institution. Costs and the complexity of their relationship to service providers let many universities therefore face "make-or-buy" decisions, considering which parts of their tasks and support structures might be outsourced efficiently, and which parts have to remain under direct control of the university. But cost efficiency is only one side of the coin; fund raising is the other. Goldstein,)2000, p. 27) made the point that *„technology-mediated learning forces different economic models."* While residential education previously acted in a *„zero-sum world"* of more or less steady markets, successful participation in a web-based distance education market in his opinion requires *„significant capital expenses"* to create courseware, to keep up with technological changes and to invest in the conquest of yet unknown markets. This is the main reason for many new institutional models, such as ventures between public institutions and private companies (e.g., in 1999 the National Technological University[@29] created a for-profit clone, the National Technological University Corporation, which attracted $15 million in venture capital).

Alternative Providers

Ventures such as those described above can be regarded as some kind of hybrid form of traditional higher education institution, maybe even as an alternative provider. Another form of alternative provider can be seen in corporate universities, which start with online training for their own staff and sometimes see the opportunity also to sell these courses to non-employees (e.g., Motorola University[@30]). In a similar, but different way, the Barnes & Noble University[@31] created a new type of service product in addition to, maybe even as a business driver for, the core business of selling books. Although both organizations do not provide accredited courses or programs and therefore are not direct competitors for traditional universities, nonetheless, they "have much to offer the traditional education sector in the professionalism with which they approach their teaching and learning programs, and the funds expended on these activities" (Cunningham et al. 2000, p. 15). Another, more serious class of competitors can be found in virtual, for-profit universities, that offer completely accredited study programs via the Internet (e.g. University of Phoenix Online[@32], which focuses on adult higher education).

THE ORGANIZATIONAL RATIONALE OF THE RESEARCH UNIVERSITY

Noam's categories have been very helpful for organizing our observations and for finding examples for the use of ICTs in all of the key areas of the research university. But what does this mean for the university as an organization? Will the university face as dim a future as Noam says? To answer this question, it is necessary first to take a closer look at his arguments about the threats he sees for traditional institutions of research, learning, and teaching.

With respect to research, Noam observes an exponential growth of most academic disciplines, accompanied by an inevitable trend toward specialization. Both developments, which are not caused, but accelerated by ICTs, lead to an increased interaction among the remote members of a disciplinary community. His main concern is that this trend might weaken the ties among local peers at the cost of the organization. *„Ironically, it is the university that pays for the network connectivity which helps their resident scholars to shift the focus of their attention to the outside...“* (Noam, 1999b, p. 4). While Noam's basic observations may be correct, it is possible to come to different conclusions. At least since the emergence of the modern system of academic disciplines in the eighteenth and nineteenth

centuries, both specialization and interaction with the relevant scientific communities have been prerequisites for innovation and the creation of new knowledge (Stichweh 1984, p. 67 ff.). Therefore, it is no irony, but a crucial necessity for the university to cleverly invest in the connectivity of its resident scholars.

With respect to the preservation of information, Noam observes a trend at universities to *„gradually shift from physical presence of information to electronic access. This will in time transform the system of academic publishing and publishers towards one of deposit of articles by authors at various specialized and interconnected sites"* (Noam 1999b, p. 5). Whether one agrees with this observation or not, the question still remains whether this transformation must necessarily weaken the traditional university. Noam sees an economic advantage in the sharing of hard copies of books in traditional libraries, since the costs for their acquisition are lower than the costs for their use. What he does not see is the fact that the same economic principle applies to commercial online services: for individual scholars, it is still cheaper to obtain access mediated by their university library than to access directly (e.g. ScienceDirect[@33] currently charges $30 for the download of a single article).

Noam sees another aspect of the described transformation in the need for arrangements *„to structure the flow of information, which requires an organizational structure outside the traditional university"* ((Noam, 1999b), p. 5). Again, Noam may be generally right, but those structures do not necessarily endanger the institution. They can also serve the university as a complementary part of its institutional environment, as the following example explains: Stichweh (1984, p. 394 ff.) described the academic journal as an organizational structure outside the university, which uses the university as its institutional background without competing with it. The academic journal organizes highly specialized communication (among scholars, who are mainly located at universities) alongside disciplinary interests and provides sound quality control via peer review (mainly performed by university scholars).

Any university education that continues to be based exclusively on traditional classroom teaching will come under pressure and could possibly be *„provided at dramatically lower costs"*, if *„alternative instructional technologies and credential systems can be devised"* (Noam 1999b, p. 5). But it is difficult to agree with his conclusion that universities are doomed to be defeated by commercial firms, especially when he suggests that publishing companies are the first candidates for becoming the ultimate higher education providers in this future development. It might be true that publishers are more experienced with the technical aspects of media production, but in

the past this was also true for the production of books. Why did publishing companies not already provide credits on the basis of textbooks? Because education is not a commodity (like books or course materials) that can be delivered uni-directionally, but a service that has to be transmitted via the cooperation of the receiver. At least in its ultimate realization, higher education at a research university takes place as participation of the student in the research process (Stichweh 1984, p. 86).

Noam is correct in raising concerns about the economic future of universities. Depending on the evaluation model of the respective governments (Campbell, 2003), it is very plausible that many universities are under pressure to keep pace by raising their productivity with the help of ICTs, which might lead to an increase in economic diversity among institutions of higher education. Less convincing is Noam's concept of the university as an organization. Even if he starts with the most useful distinction of three dynamic functions (production, preservation, and transmission of information) as the key elements of scholarly activity, he suggests an inappropriately static organizational model of the university as a storage of physical entities (scholars, books, students) and therefore ends up with incorrect criteria for the assessment of the university (locality of cooperation, proximity of information, delivery of content).

Contrasting that, Stichweh (1984, p. 83 ff.) suggests a model that is more in line with a functional concept of the university. Guided by the question of why it might be necessary to combine research and education in a specialized type of organization, he arrived at the following conclusions:

- The system of formal education in western societies uses scientific truth (instead of, e.g., professional authority or religious belief) as its communicative medium. Higher education at research universities is the ultimate level in this system of formal education, the form to which all other educational levels refer.
- Science has a structural deficit of legitimacy towards society. One way to compensate for this deficit is by linking research with education. The ultimate form of linkage takes place in higher education, by including students in the process of research, instead of merely confronting them with the outcome of research.
- The organizational link with education provides a broader recruitment base for academic disciplines, compared to non-university research institutions.
- Temporary inclusion of student classes leads to a continuing exchange of people and increases possibilities for innovation.

In other words, universities work well when they successfully organize the integration of research and education in a way that is productive in both directions. Given this perspective, it is clear that the organisational form of the university shapes the composition of scholarly activities, and not the other way around. The creation, preservation, and transmission of information are functions of the university as an organization, rather than of the scholar as an individual.

RAISING THE RIGHT QUESTIONS

As seen above, an activity-based perspective requires an appropriate concept of the university as an organization. Therefore, Noam's elements of scholarly activity should be seen as complex functions of the entire university towards society. Now it is necessary to test whether this activity-based, organizational perspective is helpful for raising practical questions to assess the use of ICTs at universities.

Research attractiveness

Regarding the research function of the university as the task to create new information, it is necessary for the university to enable research innovation and to foster academic interaction.

The introduction of individual PCs, email, and the Internet enormously increased connectivity and interaction among scholars, both remote as well as local. In addition to this basic equipment, an institution must further ask:

- Do ICT services at the university provide an environment that is attractive for researchers?
- Does the ICT infrastructure allow efficient participation in research collaborations and contribution to the scientific community?
- Do the electronic assets of the university (information systems, archives, web-portals, etc.) attract the attention of potential partners?

ICTs in various disciplines

Since research innovation mainly takes place at the level of the discipline, and not (significantly) at the level of the institution, it is necessary to acknowledge differences between the academic disciplines regarding their forms of ICT use and their respective requirements in terms of infrastructure and support. In order to take these differences into account, it is necessary to raise some general questions:

- Are there experts in the faculty dealing with academic issues of ICT in their discipline? Does the university plan to set up academic departments for these fields? (While chairs and departments for business informatics are common phenomena, similar structures are comparatively scarce in the arts and humanities.)
- Are there programs in place to set priorities and to stimulate discipline-oriented research on ICTs? (Higher Education in the Digital Age [@34] might serve as an example for such a program in the field of higher education research.)
- What are the typical electronic materials/documents (text, pictures, videos, simulations, data-sets, etc.) that are produced in a respective discipline or academic department? Are there institutionalized forms to permanently collect and organize scholarly materials (data banks, archives), or are these documents stored individually? Is their use restricted locally, or can they be made available to the research community at large?

Publishing

As suggested earlier, the preservation of information can be divided into two aspects: the publication of information and the organization/maintenance of accessibility. A special characteristic of the scientific publication system is that the distinction between the author and the reader is less asymmetric than in other contexts. In principle, every reader of a scholarly publication is a potential author and quite likely also publishes. Since the system of scholarly publication is gradually shifting from physical to electronic forms of publication, a clear effect is that the work flow from document production to its publication and storage becomes shorter and more integrated.

- Does the university have a policy for intellectual property issues regarding ICTs? (See, for example, a respective framework document of the Association of American Universities 1999).
- Does the university offer guidelines on how to retain the right to self-archive free online versions of articles that have been published elsewhere?
- Does the university offer logistical support (e.g., from the library, for bibliographic issues) to individuals or to departments for creating searchable online archives for electronic papers and documents?

Maintaining accessability

It is easy to argue that the function of traditional libraries was never simply the mere storage of material, even if there might have been some problems with lack of space. The main purpose was to organize existing content, to maintain its availability and to moderate access. Basically, these aspects are still the same. But they are becoming more differentiated and the ways of carrying them out are changing radically. To raise the productivity of a library means to increase the amount of content available, to increase customization in its organization, and to raise selectivity of access opportunities.

- Does the university have a strategy for a hybrid library, blending the use of current physical stock with access to electronic resources?
- Does the university have a strategy towards commercial publishers and information system providers, in terms of cost control and maximizing access opportunities?
- Is there anyone in the organization responsible for screening free online sources and making them available for the appropriate organizational unit (department, school, etc.)?
- Does the university customize information and access opportunities to different user groups, maybe even to individuals?

Linking research and education

Interpreting the function of education as the task of transmitting information to others, a crucial aspect of higher education at traditional universities is to link research and education by involving students in the research process.

- Is there electronic material already available from research activities of the various academic departments that can be re-used in a study program, or do course materials have to be developed from scratch?
- What do the practices of ICT use look like in specific disciplines, and what is the best way to introduce these practices into the curriculum?
- Does the university regard the products of its students (for example, theses, dissertations, etc.) as valuable academic contributions, e.g., by collecting them in free online archives?

Harley (1999) describes the U.C. Berkeley's Humanities and Technology Project as an initiative that circumvents all three of these aspects; it was a discipline-specific project, which involves students in scholarly production by actively stimulating graduate students in their experimentation, and it acknowledges their products by using them in teaching and research.

The learning university

Traditionally, higher education has addressed a local student population in a restricted market. Therefore, it was (and still is) reasonable for most research universities to start their e-learning activities with a focus on their local environment. Collis and van der Wende (2002) observe as a frequent pattern that the respective development takes place in three consecutive steps: First is the institution-wide ICT implementation, followed by a stage of rich pedagogical use of this infrastructure, and in most cases, the strategic use of ICT for addressing new target groups comes last.

- Are the various e-learning activities of the university systematically supervised as a way for the institution to learn by experiment? Are experiences and content collected on an institutional level?
- Do the various e-learning activities aim at enriching the learning experience or at cost reduction?
- In a given local market, does the university want to increase enrollment or to shift towards new target groups?

Different products, different markets

A commonly cited characteristic of ICTs is their potential to exceed the boundaries of restricted, local markets. But it is crucial for the university to clarify exactly what is to be exported. Is it material (e.g., course ware) or services (e.g., a course)? This question seems linked with the distinction between meritocratic and economic dissemination models. Both MIT's OpenCourseWare initiative and the MERLOT project transfer free course material and work under meritocratic conditions, since scholarly reputation is the currency on which they are based. This aspect is especially obvious in the last example, where course material is reviewed according to the criteria of communities of specific disciplines. It can be seen as an attempt to establish electronic courseware as an entirely new medium for scholarly publication, comparable to the reviewed article in academic journals. In contrast, University of Phoenix Online or Universitas 21 are ventures based on economic models; they transfer services to generate revenues. It will be interesting to see the ways in which both the meritocratic as well as the economic transfer model develop in coming years.

- Does the university plan to export material or services?
- Does the university focus on a specific local market, or does it aim at a specific segment of a global market?
- If the university exports materials, what is the best way to generate attention and reputation?
- If the university exports services, what is the business concept for generating revenues?

- Does the university take a single actor approach in its exporting efforts, or does it join forces, e.g., with other universities in a consortium?
- Does the university have a policy for dealing with imported material or services?

SUMMARY AND CONCLUSIONS

This paper began with the assumptions that ICTs affect research universities in more aspects than merely their educational function and that a more holistic picture of the university might lead to a better understanding of the impact and the potential use of ICTs at universities. Noam's distinction of creation, preservation, and transmission of information helps to differentiate and organize a wide variety of the predicted applications.

His approach of re-defining the elements of scholarly activities as different forms for dealing with information has proven to be additionally fruitful as it also offers a pathway for analyzing convergences among them, convergences that might be addressed with the help of ICTs. This becomes especially clear when Noam identifies the preservation of information as a third key element of scholarly activity. Herewith, he raises the awareness of the "material" base for interaction in research and education, the required stability of information, which is created by the publication and maintenance of accessibility to scholarly documents.

Furthermore, we discussed the need for an appropriate organizational concept of the university, a concept that helps to explain, why and how the university as an organization integrates diverse functions and social contexts, such as research and education. This discussion showed that ICTs do not necessarily have to lead to the disintegration of universities (which would be the case if functions were merely accumulated, rather than actively integrated).

In the final section, we tested an activity-based organizational perspective by attempting to develop practical questions for the assessment of the uses of ICTs at universities. This turned out to be a useful tool for focusing primarily on the organizational functions of the university, rather than focusing on technology. It was not difficult to find questions addressing the coherence between different activities. Additionally, we found that research and education at universities not only interact with respect to content and activities, but also with respect to dissemination models.

As shown, ICTs carry a high potential for research innovation and the increase of academic communication. The connectivity of scholars worldwide does not make the university, as an organization, obsolete. On the

contrary, its organization and its infrastructure (server, portals, support units, etc.) are necessary to get connected and to form the background for the development of more complicated applications. Even if neither all universities nor all disciplines act at the forefront of technological developments, experts in the use of ICTs will be necessary in all disciplines.

With respect to publication, it is obvious that scholarly documents were always principally disseminated to a global community of scholars, even if in some cases this community might have been composed of very few scholars. ICTs do not change this, but they change the production processes of scholarly publication. On the one hand, there is a strong concentration process among commercial publishing companies, accompanied by an enrichment of publishing services (e.g., customized user profiles, bibliographic information, etc.). This is followed by the creation of consortia among universities to bundle the market power of the consumers. Additionally, technical and organizational adaptation processes must unfold as a reaction to these developments. On the other hand, there are significant trends towards free publications, which either bypass or complement commercial publishing, a development which is also heavily based on ICTs. In both cases, publication and the storage of information become more integrated than ever before, which strengthens the connection between both activities. The necessary consequence for the university will therefore be that it not only takes on the role of an institutional consumer in the publishing market, but also the role of an institutional provider, by supporting its scholars in their online publishing activities.

With respect to education, it is a paradox that many authors are concerned with the extreme costs of e-content production, while at the same time others observe that „ *[o]f the entire value chain of higher education, content is the least valuable part*" (Wilson 2002). This is not a contradiction, since the costs of production do not necessarily have to reflect the market value of the product. But it raises attention to the distinction between the educational service and the materials used, as well as the difference between the respective dissemination possibilities. It might be the case that e-learning materials cannot be sold for profit, maybe not even for reasonable revenues, even if primary production is expensive. This indicates a strong similarity to scholarly publications. One consequence is that it might be cheaper to promote the systematic collection of electronic content from various other sources in the university (research projects, publications, dissertations, etc.) for use in an educational context, rather than to focus solely on the production of learning materials. Another consequence is to look more closely at the way in which materials are integrated into courses. Traditionally, scholars have used a variety of materials for their lectures and seminars, only some of which they created

lectures and seminars, only some of which they created themselves. Not only would it have been too expensive to write textbooks for each course, but more importantly, the process of higher education at universities is characteristically based on the comparison of ideas (materials) from different authors. If this pattern is still in place, which we do not doubt, course materials tend to be mainly composed of segments from different sources, from both within as well as beyond the university. Under these conditions, it makes more sense to share and exchange e-learning materials, than to restrict their use to the producer. For higher education as a service, this comprises the task of cleverly arranging materials from various sources, organizing access opportunities, and designing interaction with students in a way that they can (at least in the long run) participate in the research process and contribute to research production.

The future of the university as a physical institution (e.g., a brick-and-mortar-building) may be dim, however, it will be dark as a coal mine if it regards itself as a mere warehouse for scholars, books, and students. Instead, more than ever, a need arises for the university to act as an organization that dynamically manages the integration of research, education, and access to information. Therefore, following the rationale of the key functions of the university and using ICTs to support the respective production processes defines a necessity. Otherwise, universities might become lost in the wide variety of options.

Chapter 4

Preservation of academic knowledge resources as public goods

„Long ago we outsourced publishing to publishers. Now we need to take it back."

J. Robert Cook,
Dean of the faculty, Cornell University

This chapter[1] will explain, why electronic knowledge resources in academia cannot exclusively be treated as private commodities, but also can be seen as public goods. After sketching a concept of public goods for a post-national, global society, three types of electronic knowledge resources are distinguished: scholarly publications, course materials and academic software. With the help of practical examples, similarities between these resources are developed. Finally, it will be explained what advantages the status of public good for knowledge resources would have and how it could be achieved by the academic community.

GLOBAL PUBLIC GOODS

„The public/private divide is traditionally understood in terms of state ownership." (Marginson 2004b, p. 1). In this notion, public goods are those owned and/or produced by the state. In contrast to that, private is every social formation apart from the state, e.g. ranging from market-oriented business to NGO, from civil society to family, etc. Private goods, in this understanding, are those produced by these non-state social formations. „However as noted, the equitation of public/private with state/nonstate (or state/market) creates serious difficulties." (Marginson 2004b, p. 3). One problem is that the conception from traditional statist political philosophy focuses mainly on the mode of production (state/non-state), while it „is not sufficient to explain the social character of what is produced." This makes

[1] An earlier version of this text has been published under the title Open knowledge resources for higher education: Scolarly publications. course materials, academic software. (Pfeffer, 2006)

it hard, for example, to describe positive or negative externalities of non-state activities, even if they touch the public interest. Another perhaps even more important problem lies in the fact that a statist approach cannot describe public goods on a global scale, since there is no global state. The concept can capture internationalisation and globalisation only as a phenomenon of private markets and/or private companies. As a result, international higher education is only understood as a commercial activity and treated respectively in the WTO/GATS process.

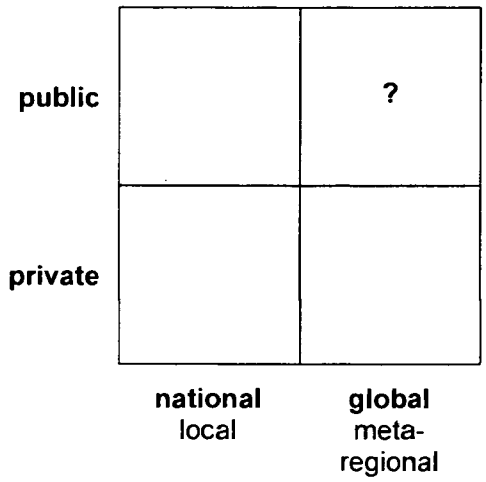

Figure 3.: A lack of concepts for global public goods, based on Marginson 2004a.

To overcome these limitations, Marginson (2004b, p. 5) offers an alternative definition of public/private, which in its core is indifferent to the mode of production, focusing instead on other attributes. He draws from the classic economic concept of public goods, outlined by Samuelson (1954):

> *„I define public goods in higher education as goods that have a significant element of non-rivalry and/or non-excludability and goods that are made broadly available across populations. Goods without these attributes are private goods."* (Marginson, 2004b, p. 5)

Goods (or services) are ‚non-rival', if people can use them without competition or mutual interference. They are non-exclusive, if their use or benefits are not confined to a limited number of people. This definition can be used in different geographic or socio-political dimensions, on a global or a meta-regional level (e.g. EU), on a national or local level, without changing its meaning. However, it might become necessary to specify which level

one refers to, e.g. to a national or global public level, and whether public interest or public good.
In contrast both to the classical economic perspective and the statist perspective, Marginson (2004a, b) sees private/public neither as fixed, natural, nor as essential attributes, which have to exclude each other. Rather, he suggests that higher education produces a complex mix of public and private goods that might vary in time (2004a, p. 7). One can conclude that the specific mix is a matter of political choice and socio-economic convention.

Stiglitz (1999), who also uses non-rivalry and non-excludability as criteria for the definition of public goods, sees knowledge as one of the purest examples to fulfil these characteristics. Additionally, knowledge also most obviously qualifies as global public good, since most knowledge is universal in its nature. One of the few restrictions he makes lies in the fact that the „transmission" of knowledge might be charged for, since significant costs can be associated with this activity. However, in his opinion, these costs for transmission do not affect the public good nature of knowledge.

This is where my main line of argument begins. The transmission of knowledge very much depends on the form of its physical representation. Knowledge is bound in knowledge resources. Does the development of new ICTs and the resulting shift from analogue to digital knowledge resources change the economic nature of these resources?

KNOWLEDGE RESOURCES: PRIVATE COMMODITIES OR PUBLIC GOODS?

Knowledge resources as private commodities

The debate on possible economic models for the distribution of electronic knowledge resources predominantly focuses on revenues. The debate often tries to explore potential, new sources of revenue through commercial distribution of electronic resources, while the potential for cost reductions are neglected. This perspective is based on a misconception of the new economy that the use of ICTs will automatically lead to commercialisation, even at higher education institutions. This assumption was justified with the wrong comparison between education systems and the entertainment industry. Eli Noam (1995, 1999), for example, reasoned that the invention of analogue recording technologies (disc, film, magnetic tape) had led to the industrialisation of the entertainment business, which previously was based on craftsmanship. As a result, huge international enterprises emerged, based on the profitable distribution of physical copies of re-

cordings. This also led to a highly competitive star system, needing only a comparatively small number of prominent and commercially successful artists.

Noam transferred this image to the educational system in the digital age. Quoting from Michael Milken, a former „junk bond king" at Wall Street involved in speculation scandals in the '80s, he stated that: „higher education is a trillion dollar business run by amateurs." No wonder that Noam only saw a „dim future" for universities, which are, in his opinion, still organised like a guild of craftsmen. Instead he predicted good prospects for organisations which try to learn from the procedures and business models of publishers and media companies.

Visions such as these, which are characteristic of the hype of the new economy, were used as an argument that ICT should be viewed as a means of generating profits for higher education institutions, and that only the most profitable higher education institutions would survive. As a result, higher education institutions changed their economic priorities. While in the past, institutions mainly focused on surviving with their budgets, trying to keep purchasing costs as low as possible, now the focus shifted towards profit orientation. If a university was involved in the production of digital knowledge resources, they restricted access to them, hoping that it might be exploitable economically. The misconception that digital knowledge resources in academia might turn into quick profit also led to huge stranded investments. One example for this is the Fathom project at Columbia University, which lost $25m in its attempt to sell learning materials for profit.

Knowledge resources as public goods

The hype of the new economy in the 1990's led many observers to the assumption that ICTs would fundamentally change the business models in research and higher education. They assumed that increased digitisation would automatically lead to commercialisation in academia.

At least with respect to knowledge resources, the business model of research and higher education is considerably different to other industries, e.g. the news and entertainment business, two segments which produce commodities for mass markets. Academic knowledge resources cannot be commercialised in the same way, since the respective clients for individual products are often highly specialised and context specific. Additionally, scholars and higher education institutions are the main producers, as well as the main consumers of academic knowledge resources.

Another characteristic of academic knowledge resources lies in the fact that they are normally not regarded as a direct source of income. This is different to the case of journalists or novelists, for example, who directly

depend on the commercial distribution of their products. Scholars are normally paid for their work, which is teaching and doing research, not for the products they produce. From their perspective, their products are not-for-profit, since they normally do not receive any (or at most, only negligible) direct compensation for these products. Naturally, there exist some scholars, who receive royalties, but only in a few cases does this constitute a significant source of income. Normally, the dominant sources of income are salaries.

Higher education institutions and their members only receive negligible revenues from the commercial distribution of their own knowledge resources. On the other hand, they very much depend on access to other knowledge resources. Therefore, commercial distribution of knowledge resources can become a barrier for academic communication. Taking the systems of education and research as a whole, increased prices do generate more income, but rather higher costs. Prices for knowledge resources transform into costs for higher education institutions and into profits for vendors.

There exist a number of reasons why knowledge resources should be treated as public goods and why to support their free exchange. DiBona et al. (1999), mention two arguments: The free circulation of knowledge (via the free circulation of knowledge resources) can reduce the danger of parallel developments, which reduces the costs for the whole system. Additionally, the free circulation of all components in the development process of research (especially the theory, the research method and the results) is a requirement for the possibility of critique and efficient quality control. This publicity also is in the interest of the individual scholar, since personal performance becomes addressable and increases the reputation of the scholar in the respective scientific/research community. Indirectly, the publication, the dissemination of the results of one's work, is a requirement for the awarding of teaching positions or of the allocation of research funds. As a main indicator for employment and promotion in academic institutions, it also is a core requirement of academic careers.

These arguments for a free distribution apply at least to three types of academic knowledge resources: to scholarly publications, to learning materials and to academic software. For all three types, there exist examples, where the use of ICTs leads to a (re-)definition of knowledge resources as public goods.

SCHOLARLY PUBLICATIONS

The business model for scholarly publications differs considerably from the model for commercial publications. Generally speaking, scholarly publications tend to be operated on a not-for-profit basis, since their producers normally do not receive financial compensation for their texts. The purest form with respect to this characterisation is the paper in a scientific journal. While the creators of for-profit publications (journalists, novelists, etc.) directly depend on the revenues for their texts, scientific authors do not receive any revenues for their papers. The reviewing of scientific journals, which is performed by scholars as well, is not paid either (Harnad 1999).

This business model is based on the institutional arrangement between the complementary parts of public universities and scientific/research journals. For the last few centuries, research has been performed by scholars who are predominantly employed at public universities. Individual scholars publish and review for free. They are paid for their research and their teaching, not for writing. Their motive is to contribute to the scientific debate and to gain reputation from the attention of their audience. Publications are part of their record of achievements and are an essential criterion for career steps like hiring or promotion. University staff are the main producers as well as the main consumers of scientific journals. Specialised journals for scientific communities or academic associations form the backbone of the scientific communication system. Their main function is to enable scientific communication beyond the borders of the local institution and to safeguard scientific quality (Stichweh 1984, p. 394 ff.).

The freedom to openly exchange ideas and knowledge is the basis of scientific communication. To put all parts of scientific knowledge (the hypothesis, the test conditions, the results) in the public domain is a core requirement. Since the use of scientific knowledge represented in a scientific publication is not competitive or „non-rival" (its consumption by one scholar does not limit another scholar's access or benefit), scientific knowledge (and to a certain extent: scientific publication) qualifies as a public good.

Given these normative mechanisms, the system of scholarly communication has been experiencing three economic phases: the original state of greatest possible distance between scholarly publication and the market, the phase of increased commodification and the present counter-movement of de-commodification (Nentwich 2001). The first phase started with the foundation of university presses (e.g. Oxford in the late 15th century) and of academic journals by scholarly associations (e.g. Académie Française, Royal Society in the 17th century). Since market mechanisms did not pro-

vide sufficient profit for commercial publishers, scholarly publications had to be subsidised by universities, associations or governments to advance scientific communication. In those cases where private companies were involved, prices for scientific publications, in principle, covered the transaction costs for printing and distribution of physical copies only.

During the 1960s, scientific publishing companies started to merge on a global scale, to change their pricing policies and to become increasingly restrictive in their copyright management, stripping authors from most of their claims. While the actual transaction costs for print and distribution declined, prices for scholarly publications, especially for journals, escalated. According to statistics from the Association of Research Libraries (ARL) (Kyrillidou und Young 2004), between 1986 and 2001 the average annual increase of journal prices was 8.5%, compared to 3.3% annual increase of the Consumer Price Index (CPI). During this 15-year interval, the overall increase of serial unit costs was 215%, compared to 68% increase of monograph unit costs, or to 62% increase of the CPI. As Edwards and Shulenburger (2003) put it, „there are powerful reasons for believing that high and rising prices are due not to costs, but rather to the combination of highly inelastic demand and suppliers' substantial market power." Scholars who want to keep abreast of the latest developments in their field cannot substitute expensive top-tier journals by lower priced alternatives. The result is a reduced variety of consumed publications. ARL statistics report a decline of 5% in serial subscriptions and of 9% of monograph purchases during the mentioned 15 year period. While this mechanism narrows the focus on established research approaches, the publication of alternative perspectives and innovative approaches becomes more difficult. Since the entry of commercial publishers, universities have spent more money for scholarly publications and have received less intellectual capital, less value for money. Due to this market failure, additional public expenditures for a public good have been absorbed as private profits.

According to Nentwich (2001), the reactions to this general crisis of scholarly journals and book publications have initiated a shift to a third phase, characterised as a de-commodification of scholarly publications. Apart from more traditional strategies, such as forming huge library coalitions to concentrate purchasing power towards commercial publishers, many strategies make innovative use of ICTs. New technologies reduce transaction costs for reproduction and distribution to a minimum. In principle, ICTs offer the opportunity to merge two formerly distinct processes, publishing and archiving, into one integrated activity. To put a document in an online repository is simultaneously a step to publish it. In using this principle, several different approaches try to lever the efficiency gains of

ICTs and to de-commodify scholarly publications. Without covering the full range of possibilities, we discuss three different types: self-archives, online-journals and pre-print-servers.

Many initiatives are experimenting with new opportunities for electronic self-publishing. In a bottom-up movement, individuals set up download pages and research institutes offer collections of their publications or set up electronic „working paper" series. In both cases, self-archives put online are a new tool to organise their own stock of electronic material for further use, a convenient form to raise one's profile and a valuable contribution to the research community. Due to the bottom-up approach, many of these electronic sources are heterogeneously structured, lacking properly coordinated infrastructure, which makes it difficult to access them and act in an unclear legal environment. To overcome these weaknesses, higher education institutions have started to strategically support their faculty and their subunits in their attempts to set up free online archives. For example, as part of its institutional library policy, the University of California set up the eScholarship Repository[@1], a central location for faculty to deposit various forms of scholarly output. This repository also provides assistance in technical, bibliographic and legal issues connected to self-archiving and online publication. Discipline oriented meta-archives, such as Research Papers in Economics[@2] (RePEc), are attempts to connect de-centrally located working paper series and to make them centrally searchable. Networks like the Open Archive Initiative[@3] (OAI) or the Scholarly Publishing and Academic Resource Coalition[@4] (SPARC) try to set common standards for meta-data descriptions of scholarly publications and to distribute free archiving software to increase the inter-operability of institutional online archives.

As a medium of scholarly publication, journals are complementary to institutional archives. They do not collect papers produced at a single institution, but serve the communication in specialised research communities. Many publishers offer online versions of their printed series. Since the online journals have by far lower transaction costs than printed ones, it comes as no surprise that academics quite frequently found electronic-only journals as alternatives to commercial publications. Even if the quality can differ in the vast variety of E-journals, in principle, the same academic control mechanisms can be applied as in commercial print series. For example, the European Integration Online Papers[@5] (EioP) uses the traditional peer review process to safeguard the journals' quality. However, given that ICTs reduce the costs of reproducing and disseminating, there still remain administrative costs, e.g. for managing the review process or for ensuring production standards. Especially for larger series, these costs

cannot be covered by the work of volunteers only. The Public Library of Science[@6] (PLoS), as a coalition of some ten-thousand research scientists in the fields of medicine and the life sciences, therefore developed a new publishing model for its own series. The main idea is to charge fees for publishing, which reflect the actual costs, and to provide open access for prospective readers. A similar approach is taken by BioMed Central[@7], a commercial publisher whose business model is based on an article-processing charge of $525 (US) on all published research articles. In contrast to most other commercial publishers, BioMed Central builds its business model on providing open access publications only, leaving the copyright of all material with the authors. A digital environment was also the pre-requisite for the evolution of a completely new way of publishing. Discipline specific pre-print archives are central servers which offer the opportunity to individually upload papers before they are published formally in a traditional journal. Since regular peer reviews, print and distribution procedures are very time consuming, pre-print archives, which circumvent these procedures, offer the advantage of greater speed in scholarly communication. The oldest and most prominent example is the physics server ArXiv[@8], which first was set up at Los Alamos, but later was moved to Cornell University by its founder Paul Ginsberg. This server started as a tool to share pre-prints in theoretical high-energy physics only, but in the meantime became the principal 'library' for a large fraction of research literature in physics, computer sciences, astronomy and many mathematical specialisms. Today, more than half of all research articles in physics are posted to this server prior to their publication in conventional journals (PLoS 2005). Even if physics is an obvious front runner in the use of ICTs, these developments seem to be significant for other fields as well. Theoretically, some authors are already debating if pre-print archives only will complement the current journal system, or if they will replace it completely in the long run (Nentwich 2001, p. 27-28).

Another more recent, but remarkable, phenomenon is the digitalisation projects of existing scholarly publications, which are not initiated by academic institutions, but driven by industry, like the Google Print[@9] project or the Yahoo Open Content Alliance[@10]. Taking different approaches, both initiatives collaborate with universities in trying to digitise scholarly materials and making them freely available without cost for the user. However, they also raise concerns, e.g. with respect to copyrights, cultural dominance/diversity, or with respect to long term sustainability and dependence. Still, they also carry a huge potential for increasing the accessibility to scholarly publications.

These four types of ICT-based de-commodification of scholarly publications show some similarities. Academics and academic institutions have increasingly become active and are gaining more influence in the publishing process. Even more remarkable, is the general shift in the underlying funding models, from consumer based to producer based funding. Whilst the access to, and the use of, scholarly publications becomes free of charge, producers have to invest additional work and money in their publications. In an ‚economy of attention' (Franck 1999), this is an investment in the visibility and prestige of scholars and their institution. For scholarly communication in general, these models might reduce the costs and/or increase the efficiency of the whole system.

COURSE MATERIALS

Similar economic trends, as in the case of scholarly journals, can also be observed in the case of traditional textbooks and learning materials. As a report of the United States Government Accountability Office discovered, college students at 4-year public institutions spend an estimated average of about US $900 on texts per year, which is about a quarter of the annual costs for tuition and fees. At comparatively cheaper 2-year public institutions, average spending for books represents almost three-quarters of the cost of tuition. Over the last two decades, prices have risen at an average of 6 percent, twice the rate of annual inflation. Additionally, attempts to reduce costs through purchasing used books are undercut by reduced revision cycles, with more frequent newer editions (GAO 2005, p. 3-4).

On the other hand, many traditional higher education institutions make use of ICTs and are increasingly engaged in eLearning projects without aiming at a commodification of their educational services. They have to adapt to technological changes in their socio-economic environment (e.g. schools, employers, etc.) and aim both at efficiency gains and at qualitative improvements in teaching. For most traditional higher education institutions, eLearning does not mean pure distance learning, but a form of flexible or blended learning on the continuum between residential education and distance education.

A main difference between residential and distance education lies in their predominant form of operation. Residential education mainly relies on direct and synchronous interaction, while distance education traditionally is an asynchronous and materials based interaction. Blended learning merges both approaches and helps both residential and distance education to compensate their weaknesses with the help of ICTs. For traditional residential

higher education institutions, it normally will be more important to focus on the provision of electronic course materials than to substitute direct interaction electronically.

The development of electronic course materials is expensive, but necessary, if universities want to make use of ICTs in higher education. And it is a new task many scholars are not used to. In the past, course materials were mainly produced for individual lectures or classes only and not regarded as very important or valuable by scholars. In many cases, course materials consisted of two sheets of paper: a syllabus and a reading list. Only in the case of large introductory classes for undergraduates was it more common to develop textbooks and sell them to students, a warmly welcomed additional (though limited) income for some professors.

Additionally, it makes sense to reflect on the special characteristics of courseware in higher education. Different to fictional books, music or films, where the entire piece of art can be attributed to one artist, course materials deal with scientific/specialist content. Rarely can this content be attributed to a single author. Normally course materials have to work as collections of ideas and resources, only a small part of which are from the lecturer. And, in contrast to a completed entertainment resource, it is comparatively more difficult to disseminate course materials on larger scales, since they always have to be adapted to the specific context of a teaching and grading situation. These are the reasons why it seems to be more appropriate to compare course materials with scholarly publications than with for-profit entertainment resources. This assumption is supported by the fact that there exist several examples of dissemination strategies, which very much resemble strategies for the dissemination of scholarly publications. We distinguish three models for the free distribution of course materials in higher education: institutional archives, discipline driven networks and comprehensive brokerage platforms.

The most prominent example of an institutional online repository for course materials is MIT's Open CourseWare[@11] initiative. In 2001, after a frustrating assessment of the options (there were none) to successfully commodify online courses, MIT promised to publish electronic materials of all its 2,000 courses online until 2007. By summer 2005, electronic materials of 1,250 courses were made available, the rest is to be posted during the coming years. All materials may be used under three conditions, which are regulated under a Creative Commons[@12] license: commercial use without explicit permission is prohibited, formal credit must be given to MIT and the original author, and the distribution of derivative works is permitted only if shared alike, under an identical licence. In supporting its staff in issues of copyright and material production, MIT acts like a pub-

lisher. The materials themselves are not regarded to be fit for a wider audience, due to their often raw condition (e.g. transcripts of notes, basic data, etc.) and complex structure, but they are regarded to be sufficient for teaching qualified students (Drösser 2005). This is a remarkable phenomenon that should be emphasised in this context, because MIT is a private higher education institution, but still takes the lead in several open access initiatives (e.g. the Open Knowledge Initiative[@13], the Sakai Project[@14]), which create new public domains.

Another prominent example is the Multimedia Educational Resource for Learning and Online Teaching[@15] (MERLOT). In organisational terms, MERLOT is a collaborative effort of a consortium of more than 20 higher education systems and institutions. In functional terms, MERLOT provides the infrastructure to contribute, evaluate and freely distribute course materials for higher education. While being funded by the institutional partners, every individual can freely register and contribute. In principle, MERLOT aims at „aggregating and making freely accessible high quality online resources to improve learning and teaching within higher education" (Hanley 2000) and therefore is a free and open resource even if, in practice, limitations or fees may be associated with some course materials. MERLOT stores meta-data (e.g. descriptions, reviews, etc.) only, while the course materials themselves are located de-centrally and are the responsibility of the authors. To be posted at the MERLOT website, course materials have to pass a structured peer reviewing process that comprises three dimensions: quality of content, potential effectiveness as a teaching tool, and ease of use. Peer reviews are conducted by discipline-based editorial boards. Each institutional partner contributes both cash and support to advance the project. Apart from the goals to improve quality assurance of online materials and to increase the speed of development, cost reduction by ‚sharing' costs is one of the main motives for the participation in the consortium.

A completely different approach is taken by Wikibooks[@16], an initiative of the Wikimedia foundation. Similar to the way the famous Wikipedia encyclopedia is written – in a collaborative writing process of voluntary, individual contributors, who also can edit the contributions of others – Wikibooks aims at the production of textbooks for education. As a model, this approach is very different to traditional writing and editing procedures, but it carries much similarity with the collaborative production of code in open source software projects. However, at the present stage the project is too young and immature to assess its viability and potential.

In all these distribution models, course materials are acquiring a new importance unknown in the past. It is striking that making them public (through publishing) increases the value of course materials both for indi-

viduals and for institutions. Publication improves visibility and prestige and, especially when combined with a peer review process, improves the quality of the product as well. Since open educational resources became a trend of increasing significance, the OECD has acknowledged their importance by commissioning a large survey, currently performed by the Centre for Educational Research and Innovation (CERI) (OECD/CERI 2005).

ACADEMIC SOFTWARE

While scholarly publications are a traditional resource of higher education institutions and course materials have recently gained new importance, academic software is a comparatively new resource for higher education. In our understanding, academic software does not only comprise research software (e.g. reference and bibliography tools, statistical software, etc.), but also educational (e.g. learning management and content management systems, collaboration software) and service oriented software (e.g. web-portal, E-portfolios, student registration, etc).

Academic software has become increasingly important for universities, since it accompanies and influences a growing range of individual and institutional activities. Therefore, it is necessary that software reflects both the procedures and the business models of academia. Commercial or proprietary software raise at least two intertwined problems. The first problem is the expenditure for software, costs which are hard to calculate and even more difficult to cover. For example, providers of learning management systems often combine low purchasing prices with licence models which additionally charge per user. Since the fee per user normally is fixed for a short time only, software companies can raise prices in the long run. In principle, they do not ask for a single payment that reflects development costs, but for a permanent fee for usage.

The other problem is the lack of technical transparency combined with strong dependency on the product in use. Private companies often have preferred proprietary data formats to make users dependent on their products. This has proven to be a big handicap for higher education institutions that very much rely on the cross-institutional exchange of scholarly publications, course materials and the related meta-data. In the meantime, several companies have reacted to the respective complaints of higher education institutions and started to increase the interoperability of their products. However, consumers still depend on the vendors, since the knowledge about proprietary software and formats is normally a well protected secret.

Open source software seems to be an answer to many of these problems. The key characteristic of open source products lies in the fact that their source code (an equivalent to a cooking recipe) is made public and freely accessible. Openness of the source code is a prerequisite for the opportunity to publicly test, vary and improve software. This procedure is very similar to the scientific method of knowledge production, where all essential steps (hypothesis, method of observation, results) have to be made transparent and open for critique. Open source software is published and discussed in specialised communities. These documented debates are an efficient tool to safeguard and raise quality. In the long run, they also can lead to the development of open standards, which in return can guide future software developments. Open source products can become public domain without necessarily being for free. In some cases, service providers charge for the dissemination of the software (e.g. via CD) or for its installation and maintenance. However, these charges are supposed to cover the respective costs and are not usage fees.

The open source idea is increasingly becoming popular in higher education. Especially for publicly funded higher education systems, it makes sense to invest in the development of academic software as a public good and as a public infrastructure. We will discuss three examples of major open source initiatives for academic software; one developed by an individual and supported by contributors, one driven by government and the other by a consortium of (partly private) universities.

Moodle[@17] is an example of an open source product, which has been developed in a classical grassroots movement. First released in 2001 by the Australian Martin Dougiamas, it soon became the most popular open source learning management system. According to its own information (Moodle 2006), there exist more than 10,800 installations in 152 countries, as well as language packages for 73 languages. The development of Moodle is based on the voluntary contribution of a worldwide community of developers. While the software is free, the Moodle service network offers commercial services, e.g. consultancy, installations and hosting.

As a contribution to the development of the eLearning infrastructure at schools and higher education institutions in the Federal State of North Rhine-Westphalia (Germany), the responsible ministry of education set up the CampusSource[@18] initiative. The main goals are: to bring together the efforts of single universities, to trigger a cooperative process for the development of software systems and to provide the products freely as open source software for an international audience, regarding this as the appropriate form of scientific publication in this context. On the web-portal of the initiative a wide range of different products is collected, e.g. a learning

management system, tools to produce or to organise learning materials, enterprise software for student administration, a web-base reference management system, etc.

A different approach was taken by the University of Michigan, Indiana University, MIT and Stanford. Together with the uPortal consortium, these universities founded the Sakai Project. They have contributed their already developed eLearning tools and integrated them in a joint technical framework to create a comprehensive, but modularised, software package. The package will contain software for an institutional web-portal, comprising all service and information systems, a complete learning management system, a tool to support research co-operation, a workflow engine and a clear technical framework for the development of additional software in the future. In designing tools for the easy migration of data from commercial learning management systems, such as Blackboard[@19] or WebCT[@20] (the later bought by its competitor in 2005), the Sakai Project not only invests in its own ‚openness', but also aggressively attacks the market position of vendors, which have been very successful so far. The first release of its open source software package took place in June 2004. The four universities in the core of the Sakai Project also agreed to simultaneously implement the software to make coordination easier. Additionally, an Educational Partner Programme was set up to involve further institutions in the project, because a successful and far reaching dissemination is regarded as a crucial factor for the sustainable implementation of technical standards and the long term success of the project.

INTELLECTUAL PROPERTY VS. SERVICE

While in the past, academic knowledge resources have been bound to the medium of their physical representation (mainly paper), and the costs of knowledge resources, therefore, was linked to the costs for reproduction and distribution of physical copies (mainly books and journals), the continuing move towards digital resources loosens this connection. The non-material character of knowledge resources becomes more prominent, while the material part of the physical medium nearly vanishes.

These technological changes are accompanied by severe economic and legal consequences. While in the past, access to physical knowledge resources had to be organised under the premise of scarcity, access to digital resources can be conceptualised as non-rival. In the past, one physical copy of a book could only be used by one person at a given moment. As a result, the quantitative stock of a library was an indicator of the wealth and quality

of the university, defined by the quality of its learning environment. In the meantime, electronic resources can be used by an unlimited number of people, since they do not hinder each other in their use. As a consequence, it is not the ownership of books, but the amount of access options to knowledge resources, or the ‚connectivity' of a university, which became an indicator to assess a higher education institution (Ewalt 2004).

While, in principle, non-material goods could be consumed without rivalry, some actors try to use the term ‚intellectual property' to gain exclusive rights on non-material products to control their use. This is an attempt to transfer the term ‚property", which originally stood for control over ‚concrete' objects, to non-material goods (ideas, information, etc.):

> *„In economics and marketing, a service is the non-material equivalent of a good. Service provision has been defined as an economic activity that does not result in ownership, and this is what differentiates it from providing physical goods."* (Wikipedia, 2005b)

Comparing the three types of academic knowledge resource with an open source status, economically, the tension between service and good becomes obvious. In the case of scholarly publications, the question is whether authors earn their living from salaries for their services, or from royalties from their products. Another question raised was whether the business model of commercial publishers should be based on the support of scientific communication or on the exploitation of property rights. In discussing learning materials, it became clear that higher education should be regarded as a service industry rather than as a goods producing industry. And in the case of academic software, contrasting models can be distinguished by asking whether the production and implementation of software, or the selling of licences for restricted use, should be supported.

CONCLUSIONS

This chapter argues that with the help of ICTs, scholarly publications, course materials and academic software can be made open sources or public goods. This does not mean that they exclusively come as public goods, without leaving room for some private property, nor does it mean that the status as a private good is already well established for these resources. ICTs erode old certainties and make it necessary to develop new concepts and mechanisms.

The use of ICTs makes it necessary to reconsider the status of academic resources. It is important to raise awareness among scholars, academic

leaders and politicians that the status as a public good is a plausible option and a serious alternative to the commodification of these resources. A sound understanding of the markets for academic resources and one's own market position is a prerequisite for making informed decisions, e.g. on issues such as purchasing publications, the assessment of sustainable business models for eLearning, or on the design and the procurement of ICT infrastructure.

What became apparent in many of the described examples is the fact that it is not enough to sympathise with the open source idea or with the status of a public good. The public domain has to be claimed, established and defended, especially in times of transition when the public/private distinction is blurred and needs redefinition. It practice, it is not enough to give away knowledge resources. It is necessary to claim and define a clear legal status with a respective business model and to provide the necessary information for the prospective users (e.g. on how to give credit to the original author, on what conditions for use, etc.). It is necessary to establish infrastructure such as reliable and interoperable repositories, publishing support services and quality control mechanisms, and it will be necessary to defend this public domain against property rights infringements and attempts to devaluate such public goods, either with short sighted profit expectations or due to financial pressures.

Given this list of tasks, it should be clear that the provision of public knowledge resources does not come for free. Where should the required funds come from? Also, in financial terms, it is crucial to address production and consumption of knowledge resources as interrelated academic responsibilities. On the basis of this concept it should become possible to gradually shift expenditure from the consumption of knowledge resources to their production.

Good news for scholars and universities lies in the fact that they do not have to start from scratch. In fact, there already exists a wide range of good examples, business models and practices in the field of academic knowledge resources. It is possible to learn from these examples and to contribute to existing networks and collective initiatives, which try to free academic knowledge from commercial restrictions. This would be the best way to share the costs of development and to improve the status of academic knowledge resources as public goods.

Chapter 5

Preservation and distribution of learning material beyond the boarders of the classroom

„If content is King,
then network connectivity is Queen."

Mike White,
CEO, Multimedia Solutions

The following chapter[1] goes beyond the context of the classroom, trying to examine eLearning not only under the perspective of personal interaction in a course, but also under the perspective of possible effects on larger social communication systems like organisations and society. For this purpose, learning materials and learning interaction will be distinguished as complementary elements of learning arrangements. Both elements carry a very different potential for dissemination. Especially for electronic learning materials, this opens a wider range of possible uses, far beyond the classroom.

LIMITATIONS OF PERSONALISED PERSPECTIVES ON ELEARNING

Following the sociological perspective of Niklas Luhmann (1975), it is possible to distinguish between three basic types of social communication systems:

- *Interaction*, based on mutual perception among present actors,
- *Organisation*, presupposing membership and indirect communication, and
- *Society*, constituted by communicative accessibility

[1] This text is forthcoming in the Zeitschrift für Hochschulentwicklung under the titel Contentmanagement and blended learning: beyond the boarders of the classroom. (Pfeffer 2006)

On basis of this classification many theoretical and practical contributions to the topic eLearning can be regarded as rather person centred. On a theoretical level such a perspective is suitable especially for examining questions of learning psychology and of media didactics (see for instance the distinction of behaviouristic, cognitivistic and constructivistic learning paradigms in Baumgartner und Payr 1994, and the didactical concepts drawn from this distinction). On a practical level, a personalised perspective is often used to deal with perceived problems of the individual teacher, for example how to design interaction in a given electronic environment (e.g. Salmon 2002, Haefele und Maier-Haefele 2004). In both cases, the focus is on the individual person or on a manageable group of people in the context of either a physical or a virtual classroom.

Even if there are clear advantages and indisputable successes of this personalised perspective, this approach inevitably also has its deficits. Practically, a personalised perspective tends to overestimate the potential for direct interaction in educational settings e.g. by idealizing the interactivity of the traditional lectures, which especially in mass situations are often characterised by the verbal, nonetheless unidirectional broadcasting of information rather than by elements of mutual exchange. Therefore, eLearning arrangements in residential education sometimes tend to overestimate the value of communication tools (or use them in ways that compete with non-mediated forms of interaction) and underestimate the potential and need for learning materials. A related problem is the reproduction of the chair holder principle (‚Lehrstuhlprinzip', Kerres 2001), meaning the tendency to take the chair holding professor and his equivalent, the autonomous teacher in the classroom, as the only relevant organisational unit for the production of higher education. As a result, the concept of the classroom as a closed black box and as the only place for learning is not challenged. Rather, organisational decisions on structures and processes are still predominantly built on this concept.

On a theoretical level, a personalised focus limits the ability to observe effects eLearning can have on the organisation of the university, as well as on communication beyond the boarders of the home institution, especially in the functional communication systems science and education. If one tries to overcome these restrictions, it seems to be necessary to take a sociological perspective, or at least a point of view, which enables to go beyond the single classroom (lecture hall, etc.) and to observe phenomena on the level of the organisation and of society as well.

BLENDED LEARNING

For this purpose, it is helpful to contrast traditional residential education and traditional distance education. Trevitt (2000) made the point that the flexible use of ICTs in higher education will blur the traditional distinction between residential and distance education. But what is the basic difference between both concepts? Strongly simplifying Trevitt's idea, one can say that residential education traditionally was based on synchronic and verbal interaction, while distance education was mainly realised in asynchronic and material based interaction. If the assumption is true that the use of ICTs leads to a blurring of residential and distance education into a vast range of blended learning scenarios, then both the providers of residential and of distance education can learn from each other.

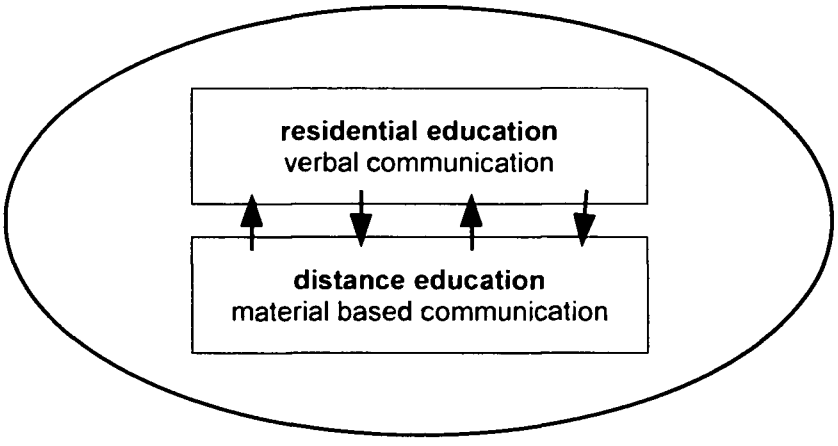

Figure 1.: Blended learning combines two traditional concepts, adapted from Trevitt (2000)

In the past, distance education was based on the production and the asynchronous exchange of materials. The learner was sent written learning materials plus written instructions, and returned his homework in a written form. Today, the use of synchronous forms of communication, like chat, voice-over-internet or the life-broadcasting of lectures and presentations, increasingly gain importance in distance education, which can lead to a transfer of new didactical arrangements (e.g. student-student interaction, group work, etc.).

In contrast to that, residential education can adapt to new forms of material based communication. In the past, most communication was verbal and the reading list often was the only learning material produced by the

teacher himself. However, the educational use of ICTs requires an increased production of electronic materials and of written instructions. Asynchronous forms of communication, e.g. email or discussion forums, gain importance. As a whole, much communication that has been volatile and verbal before, becomes increasingly ‚materialised', fixed in digital form. Examples for that are new forms of written communication (email, chat, forum), the use of PowerPoint instead of blackboard and chalk, the recording of presentations, and the production of more written materials (syllabus, calendar, reading list, lecture notes, etc.)

MATERIAL AND INTERACTION AS COMPLEMENTARY ELEMENTS OF LEARNING ARRANGEMENTS

The use of ICTs in residential education makes it more obvious that education does not only rely on interaction of the involved participants. There exists a material component as well. It is possible to roughly distinguish between two types of materials. One type is the meta information on an educational arrangement, e.g. (commented) course lists, descriptions of courses, syllabi, calendars and announcements. The other type is learning material in a more narrow sense, e.g. lecture notes, literature, assignments, tutorials, self tests, etc.

ICTs in education make it necessary to distinguish different forms of personalised communication more explicitly and to use them more specifically. Different form can, for example, be the presentation of content, discussion with and between students, feedback about how imparted information was understood, consultancy to support individual work of students, and, finally, examination to decide about success or failure.

On the one hand, this distinction between material and interaction as complementary elements of formal learning arrangements makes it obvious that both residential as well as distance education require personal communication. Even if this communication is based on the exchange of materials or if it takes a written form, it still refers to the person of the individual student. His or her personal development is the goal of education and has to be assessed individually. Qualified and qualifying personal communication is a core requirement for formal education. This is the main reason, why education is still performed by education institutions, and not by booksellers or by the entertainment industry.

On the other hand, material and personal communication, the two core components of learning arrangements, differ considerably with respect to

the ease of dissemination and the possibility to lever economies of scale. Even if it can be expected that ICTs will increase the efficiency in personal communication, e.g. by specifying forms of communication and by using them more flexibly, or by the division of labour and maybe even by the outsourcing of certain educational activities, this potential for economies of scale has its clear limits. These limits are set by the capacity for personal communication of individuals: a single teacher can only interact with a limited number of students.

For electronic learning materials, the situation is very much different. In the past, learning materials have been bound to a physical form of representation. Texts were fixed in paper, or in audiovisual recordings to magnet tapes. This made their reproduction and their dissemination logistically and economically expensive. The shift from analog to digital forms of representation and the evolution of the Internet changed this situation radically. The presentation of digital materials in online archives allows to boundlessly increase the number of potential users for neglectable costs per additional user. In contrast to that, analog materials (e.g. lecture notes, books, films) have to be reproduced and each copy only can be used by one person at a moment. Except of problems of bandwidth (which loose importance continually), in principle it is technically possible to make electronic materials available to an unlimited number of people, without significant additional costs for the producer and without users competing for access. The process of digitalisation leads to functionally new forms of redundancy and variety of organisational arrangements. From the perspective of a producer, to put electronic materials in an online archive can be a form of publication. Archiving and publication grow together and change their sequence in the process of production and utilization. Archiving increasingly becomes a task of the producer, while the user is relieved from it. The user does not have to store a copy of a document, neither physically, nor digitally. Rather, she has to organize meta information, e.g. the point of access to the original document. On the other hand, different chances for distribution and economies of scale lead to a stronger distinction between learning materials and personal communication. Both elements of the learning arrangement fall apart. This is especially relevant for learning materials. In the past, they have mainly been produced for the use in a single course, in the context of personal communication in the classroom. Now, new chances for the distribution of learning materials evolve.

CONTEXTS OF USE FOR DIGITAL LEARNING MATERIALS

Refering to the typology of social communication systems introduced before, it is possible to distinguish at least between three different contexts for the use of learning materials: the individual course, the organisation (e.g. the university, or a study programme) and society.

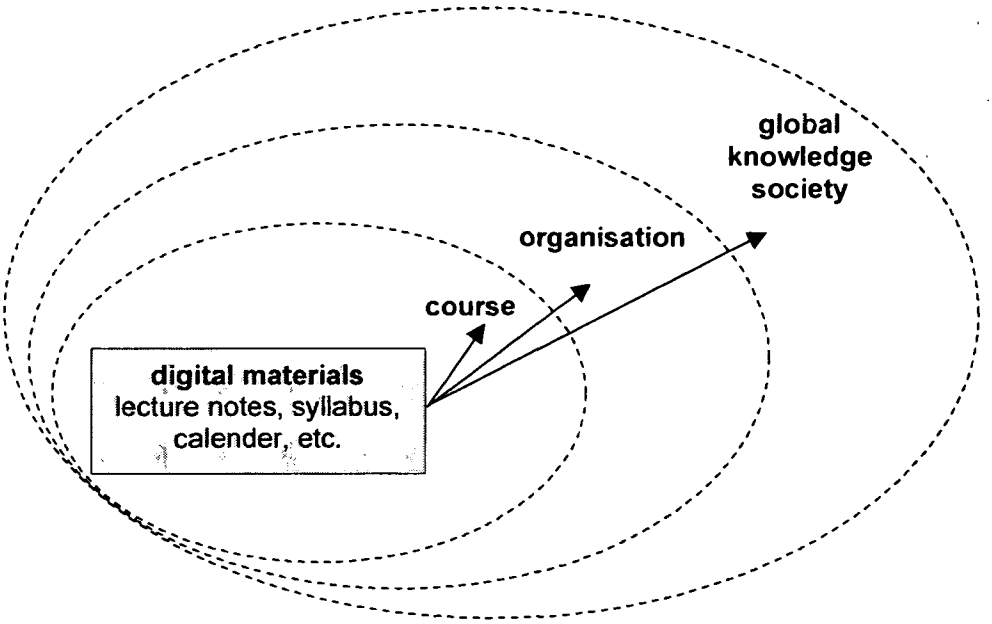

Figure 2.: Potential contexts of use for digital learning materials

The course

In the past, the classroom built the physical, and the course the social boundaries for the personal communication between teachers and students. As far as available, learning materials were exchanged inside these boundaries. Apart from materials produced by the teacher, students sometimes exchanged their own notes, transcripts of lectures, their homework and final papers. Modern learning management systems basically rebuild this arrangement. In their core concept, they aim to support educational arrangements for clearly defined groups. They offer different tools for personal communication (chat, forum, etc.), as well as tools for the exchange of materials, which makes it easier for students to distribute their own products in the group. However, these learning managements systems also virtually reproduce the walls and the boundaries of the physical classroom.

The single course is in-transparent from the outside. A login and the need for authentication guarantees that only enrolled students can see anything. While this restriction of access makes sense to protect the confidentiality of the group, since it provides a secure space for the personal communication between teacher and student, it also avoids access to materials, which not necessarily have to be confidential.

Internationally, the introduction of learning management systems proved to be very popular among higher education institutions. As the OECD found out, the adoption of learning management systems „is clearly one of the most prominent features of e-learning development in tertiary education worldwide." (OECD/CERI 2005, p. 157). However, the same study also finds a limited impact of ICT in the classroom setting and states that „[t]his partly reflects the influence of a 'conventional' course development paradigm." (OECD/CERI 2005, p. 14). Prominent eLearning researchers, like Zemsky and Massy, suspect that this quick uptake of learning management systems might be among the main reasons for the ‚thwarted innovation' in eLearning and the limited effects on learning arrangements (Zemsky und Massy 2004).

The organisation

An alternative approach is to produce electronic learning materials primarily for the use in a specific course, but to make them available to all members of an organisation, e.g. for a study programme or for the entire university.

For students, who want to select courses for enrolment, accessible learning materials give a better impression about the goals and the topics of a course than a title and a short description could give. They also can prepare themselves for a course in advance, or come back to the materials even after they already have passed the exam.

Teachers can learn from each other browsing the materials and didactical concepts of their colleagues, without being indiscreet. They can get ideas for themselves or better coordinate their syllabi in the context of the entire study programme. Teaching itself partly can leave behind the status of a lonesome ranger status activity. Formerly hidden in the classroom and therefore invisible, accessible learning materials can create more visibility, at least for the members of the university, which creates added value. Teaching can become a more collective task than before.

At the organisational level, it becomes easier to increase the consistency of learning programmes and to support teachers in the production of materials and in the logistics of making them available. Quite obviously, it requires special institutional investments to lift teaching on the level of the

organisation. And it can be argued that this new transparency also would lead to increased social control among peers, which might be perceived as pressure by some. However, it also can be seen as a challenge and as a potential to improve the quality of teaching in an academically sound way.

The global knowledge society

Even a step further take approaches, which try to bring digital materials beyond the boarder of the organisation, aiming at their largest possible distribution. In times of the dot-com-boom, many of these attempts had commercial, for-profit goals. Some of them, e.g. Fathom[@1], a commercial venture of Columbia University, attempting to sell electronic learning materials, failed economically.

However, there are also some interesting, not-for-profit projects going on, which distribute learning materials on an open access basis. All of these approaches have one thing in common. They treat learning materials as publications, aiming at maximising communicative accessibility, regardless of the organisational membership of the potential user. While the personal communication necessary for formal education still depends on organisational membership in the respective university, and, even more focused, on registration in a course, the electronic materials produced for the same course gain added value as a medium for publication, which can increase the reputation both of the individual author and of the providing institution.

CHARACTERISTICS OF LEARNING MATERIALS

What exactly are learning materials or educational resources? The materials used in higher education are frequently a conglomerate, composed from different sources, like scholarly publications, empirical data, lecture notes, syllabus, reading list, etc. As already mentioned, the digitization also leads to the production of new types of materials, for example by using PowerPoint, by new possibilities for audiovisual recordings, or by new written forms. Also new is the creation of interactive applications, for example the visualisation of functional relationships in simulations of experiments, or applications to perform self-tests.

Problems in the context of learning materials are on the on hand questions related to their production (for example the decomposition and recombination of their components) and – closely connected – on the other hand questions of distribution beyond the original context of production. The often mentioned goal of interoperability („the ability to cooperate between different systems, technologies or organisations", (Wikipedia,

2005), own translation.) is accompanied by extremely positive economic expectations (Wiley 2002), these expectation have not yet been fulfilled, since a respective economy is still missing (OECD/CERI 2005). However, pragmatically interoperability raises questions of archiving and of the standardisation of metadata.

Currently the debate on electronic learning materials is very much influenced by the idea of electronic learning objects. The idea is based on the concept of object-oriented programming, a paradigm in the computer sciences. „The idea behind object-oriented programming is that a computer program is composed of a collection of individual units, or objects, as opposed to a traditional view in which a program is a list of instructions to the computer." (Wikipedia 2005b). Increasing the modularisation into individual objects makes it easier to address individual modules or to relate several modules to each other. Otherwise, programme code only can be processed in a sequential way.

THREE METAPHORS FOR LEARNING OBJECTS: LEGO METAPHOR, CHEMICAL METAPHOR, ORGANIC METAPHOR

The idea of electronic learning object raises at least three problems: the relationship between learning objects, the question of granularity and the question of reuse. To tackle these questions, researchers used three different metaphors to get a better understanding of learning objects: the Lego metaphor, the chemical metaphor and the organic metaphor (Wiley 2002, Paquette und Rosca 2005).

The Lego metaphor is based on the assumption that learning objects can be compared with Lego bricks, which can be combined with any other brick and in any possible form. Wiley 2002 criticises this assumption as too simplifying und suggests instead, to compare learning objects with atoms, because specific atoms only can be combined with some specific others. Additionally, their form and their ability to connect is determined by their internal structure. Paquette und Rosca 2005, who described Whiley's suggestion as a chemical metaphor, assess it as a necessary step in the debate. Still, they criticise that only the anatomy of aggregated unit is described, but not their internal dynamic. Therefore they introduce an organic metaphor to be able to compare the dynamic interaction between learning objects with biological processes.

From the comparison of these three metaphors Paquette & Rosca develop different analogies for the granularity of learning objects and for the

development of larger units. The Lego metaphor supports the view that bricks can be assembled to components, and these to motors. The chemical metaphor conceptualises granularity differently. Atoms integrate to molecules, a mix of molecules causes a chemical reaction, which again can be arranged to larger, more complex experiments. According to the organic metaphor, cells form tissues, tissues become organs and these are combined to organisms.

The question of how to conceptualise the relationship between learning objects, as well as of granularity and aggregation determines the imagination of how to reuse learning objects. Especially in the case of Lego and of the chemical metaphor, the imagination seems to be that the reuse, at least at the smallest, most basic level (brick or atom) is more or less possible regardless of the context, as soon as their definition and their metadata are established broadly. Reuse in this understanding means that an identical object (or its ‚identical' copy) can seamlessly be integrated in the aggregation of a newly composed, larger unit.

An alternative metaphor: literature

It is really striking, how much this debate on possible characteristics of knowledge resources is determined by physical, chemical and biological metaphors, a far reaching search for comparisons. However, it would be more convincing to compare electronic learning materials with closer relatives like traditional knowledge resources. The use of a literary metaphor, especially referring to the genre of scientific literature, seems to more appropriate as an image to search for possible analogies.

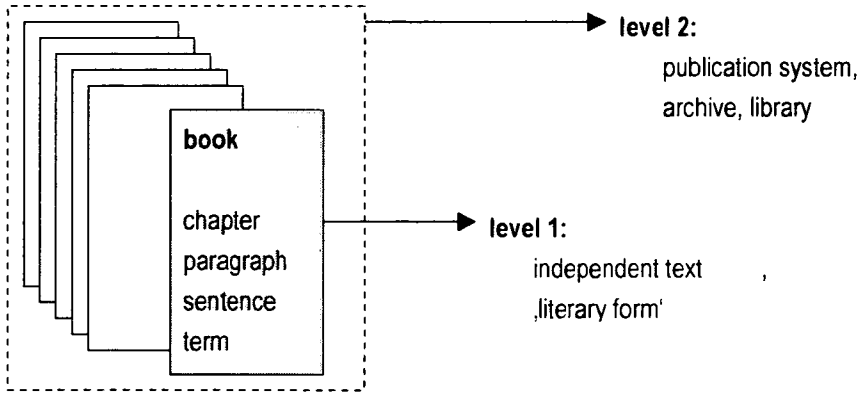

Figure 3.: Different levels for the exchange of text

Internally, scientific documents are structured in chapters, paragraphs, sentences and words. More seldom are units like images, figures and ta-

bles. Similar to the definition of central terms, this formal granularity is very context specific and not easily transferable. The elements and components of a text are produced for the specific context of this text. They receive and produce their effect and meaning in this environment. A direct transfer of identical units (in the sense of a word-to-word quotation or of copy/paste) is normally only possible for very small units, e.g. for a few sentences of single images. To transfer larger aggregations (e.g. larger lines of arguments), this can only be done in an indirect way, at least for respectable scholarly work, e.g. by paraphrasing and referring to the original source, which normally is another document. While in some debates on learning objects nurture the imagination that it would be possible to relief teachers (or authors) from the task to decompose materials into smaller units, and that the exact description of these small sub-units with metadata would lead to an increased interoperability (Wiley 2002), this concept does not seem practical, at least if it is assessed from the perspective of the literary metaphor. Can anybody imagine that each chapter, each paragraph, each word should be described with metadata? And can anybody imagine that a useful text can be composed out of these chunks of material, just by putting them together? These options are inappropriate for most knowledge resources.

However, there is a granularity of scholarly materials, for which a bibliographic treatment has proven to be viable and useful. Independent texts seem to have the right size for this treatment, for example articles in journals or collections, or monographs. Each independent text builds the context for its smaller subunits and components. As (Stichweh, 1984)(1984) explained, after the invention of print it took quite a while, till literary forms and formats have been developed. This literary standardisation of document formats and text forms was a prerequisite for efficient forms of text distribution, of archiving, but also of quoting and systematically referring. For authors, it is easier to produce towards a given format. Standardised text formats make it easier for publishers and librarians to manage larger quantities of similar texts. And for the reader, standardised formats make it easier to navigate and locate specific information.

TYPES OF REPOSITORIES

These standardisations are only to a lesser extent a technical issue. To a much larger extent, they represent literary conventions that had to be developed and naturally can change throughout time. Aiming at a wider distribution of electronic educational resources, there exist similar problems

and needs. It is still undecided yet, which size of materials will become common standards. However, based on existing examples I try to distinguish some possible types of repositories and respective literary formats.

Learning object collections

Specialised learning object repositories typically collect multimedia resources, which are each produced for a single learning objective, which can be regarded as self-contained and stand alone, like animations or applets. Similar to libraries for films or pictures, these repositories show a preference for a limited number of media formats, like for applets or for animations. Since these materials are very expensive, collaborative production and re-use are even more necessary than with other types of resources.

One example of a learning objects repository is provided by UCEL (Universities' Collaboration in eLearning)[@2], which was founded by six universities in the UK. UCEL is focusing on reusable multimedia resources (mainly interactive animations) for health-professional education, which contain presentations, activities, self-assessments and further links. Another example is Mathe Online[@3] at University of Vienna, which started as a collection of interactive applets for education in mathematics, e.g. dynamic diagrams, puzzles, tests and other interactive online tools.

Course collections

Another literary form is the course as an independent entity for publication and reuse. A course normally can have more than one learning objective and can comprise a variety of smaller object and of various media formats. Courses should contain syllabus, calendar, materials and reading lists, as well as instructions, assignments and tests.

Maybe the most prominent example for a course collection is MIT's OpenCourseWare initiative[@4]. Having started in 2001, MIT in the meantime has published materials from more than 1.250 courses. These materials can be regarded as post-teaching publications, since they are extended descriptions and enriched by-products of their regular courses, which are published after the courses were finished. Different to that, Learn@WU[@5], a project at the Vienna University of Economics, provides a course repository directly aiming to support residential education of their students. This repository is accessible for all members of the university, but not open to the general public. Yet another approach is taken by the Open Learning Initiative[@6] at Carnegie Mellon, creating materials for full online courses, which even could substitute residential teaching.

Generic collections

Generic collections try to cover different literary formats of learning materials in one repository. To a certain extent, they can be regarded as a mixture or learning object repositories and course repositories.

A very ambitious example for this is the Connexions[@7] project, which defines two different types of formats, modules and courses. Modules can be regarded as small ‚knowledge chunks', which are produced with a special authoring tool and stored in a common repository. With the help of a course composer, these modules can be assembled to entire courses.

Another type of generic collection are brokerage platforms, like Merlot[@8] or Educanext[@9]. In both cases, these brokerage platforms collect (meta-descriptions of) learning materials from various sites. Due to their basic concept, they have to cover materials of different technical, didactical and literary formats, which results in very complex typologies.

Lexicons

As lexicons I here refer to educational resources, which are composed of large numbers of very small text parts, which are highly integrated and interconnected, similar to the small text units of a lexicon or an encyclopaedia. Hypertext networks could be another way to name these resources, since their individual texts can not be regarded as independent. They can not only be used in one, linear, but in a variety of different ways.

Examples for this are Pastperfect[@10] and Geschichte Online[@11], both produced at the University of Vienna. Pastperfect is focusing on the Renaissance and the Reformation period in Europe, while Geschichte Online deals with questions of scientific work, literature research and didactics in the field of history.

Collections of scholarly publications

Last but not least it is necessary to mention collections of scholarly publications as crucial educational resources. These can be university libraries, but also online journals, working paper series or electronic collections of monographs. In most of the mentioned cases, literary formats and the respective types of collections already are well established.

ORGANISATIONAL ARRANGEMENTS FOR DISTRIBUTION

What can educators and universities practically do to open access to their resources? We have not only seen differences with respect to literary forms of materials and their respective repositories, but also with respect to the sophistication of materials and to the related amount of editorial investments. Especially cases like UCEL or the Open Learning Initiative represent expensive, high end developments, which are very impressive, but neither necessary nor feasible for most educators and universities. To create a common sense of sharing, it seems rather more appropriate to develop options, which have a lower entrance level for a broader community of producers, who in most cases still are individual educators. Logistically, there are different ways imaginable to achieve this goal.

Open course

Technically the simplest way is to make course descriptions and all materials used for a course public. This can be done by setting up individual course homepages or by opening courses in learning management systems to the public. A problem might be that this concept does not allow to share sensitive (e.g. licensed, premature of confidential) materials or to protect sensitive interaction among the participants of a course.

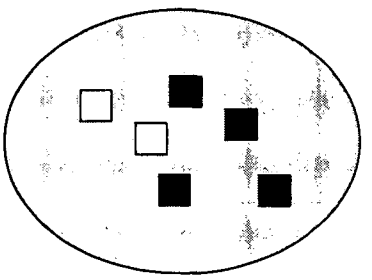

Figure 4.: Open course

Partly open course

A different way to organise the publication on an individual level is to discriminate between publishable and restricted or confidential materials within one course by creating a public and a restricted view on a course. Technically this requires scalable access-rights and/or the potential to create different views.

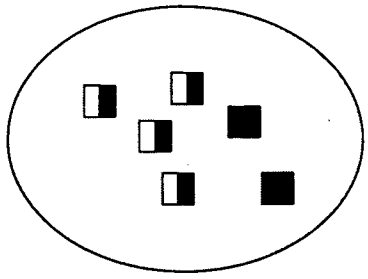

Figure 5.: Partly open course

Institutional archive

A third option can be the foundation of institutional archives to share and/or publish educational materials. This can provide a bigger, more prominent stage for the distribution of materials than individual courses or homepages. However, institutional archives need centralised (technical, editorial, meta-data) maintenance and may require a duplication of materials (from the individual course into the institutional archive).

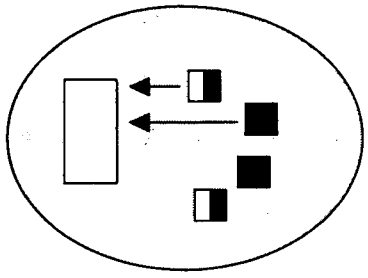

Figure 6.: Institutional archive

External archive

It is also possible to set up external archives, which are used for the exchange of materials from different institutions. On top of the need for centralised maintenance, cross-institutional agreements and standards become necessary.

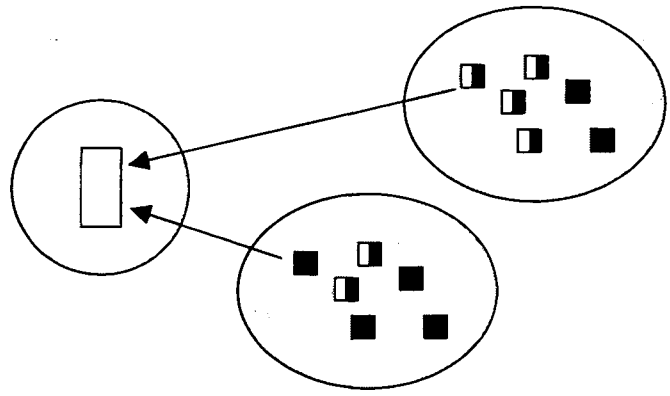

Figure 7.: External archive

Connecting of or harvesting across institutional archives

Yet another option for the distribution of educational materials is to connect the archives of different institutions. This could be done either by simple mutual references or, more advanced, by harvesting across various sites. Practically, it makes most sense to connect archives of the same or at least similar kind, e.g. similar OpenCourseWare sites or similar learning object repositories.

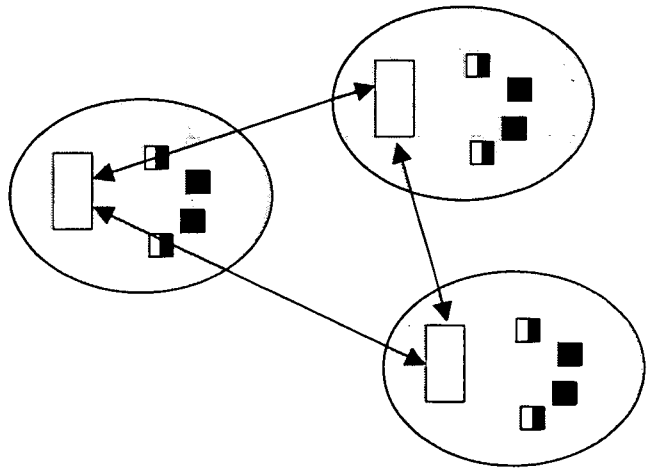

Figure 8.: Harvesting across institutional archives

CONCLUSIONS

It is obvious that learning materials and personalised interaction are complementary elements of educational arrangements. Learning materials will never substitute interaction in formal education. However, the use of ICTs is changing the shape of learning arrangements and increases the need to produce learning materials.

The conceptual distinction between courses, organisations and society helps to understand that there are several options for the distribution of electronic materials beyond the single classroom. Expanding the reach of learning materials can add value and contain costs for higher education. Additionally, this can lead to more transparency and innovation. Different contexts do not necessarily compete with each other, but also can complement each other, since they offer different levels of control and participation. Technically and logistically the scalability of access rights (both for users and producers) become necessary.

The increased distribution of learning materials reconfirms the role of educators as authors and the role of universities as publishers. It is necessary to understand that this creates a variety of new challenges. To a lesser extent, these challenges are technical ones, even if technical competences clearly help. To a larger extent, these challenges are conceptual ones, which have to do with the nature of academic knowledge resources. It seems to be most appropriate apply metaphors and comparisons with academic literature and related repositories to deal with these questions.

Given the considerations on the variety of literary formats and types of collections mentioned above, it seems to be more plausible to expect a consolidated range of literary formats than to expect a single standardised definition that comprises all forms of learning materials. As a consequence, it also seems to make more sense to plan for a consolidated range of types of repositories rather than to wait for one single universal archive.

Universities as organisations will become responsible to create and maintain institutional archives as a way to foster the distribution of electronic materials. Apart from technical requirements, they will have to provide logistical and editorial support. Instead of creating everything from the scratch, they will be well advised to join forces with peer institutions to exchange experiences and to create joint models for publication.

Last, but not least, it will be necessary to create a common sense of sharing and to educators serious as producers and consumers of educational resources. Especially, if these resources are published, they should be seen as relevant contributions to the academic portfolio of scholars. Only, if the production and publication of learning materials is addressed by academic

mechanisms of acknowledgement and promotion, the provision and distribution of electronic learning materials can be sustained.

Chapter 6

Education as an institutional achievement: Six organisational dimensions for the use of ICTs

„We already do distance learning at Stanford. It's called the lecture."

Donald Kennedy,
President Emeritus, Stanford University

The following chapter[1] describes the educational use of new information and communication technologies as an institutional achievement of the entire university, rather than as a task of individual teachers or of specialised service units. To organise observations from an institutional perspective, a theoretical framework is suggested that distinguishes between three external (product, content, market) and three internal dimensions (personnel, organisation, technology) of the organisation. The purpose of this holistic concept is to provide instruments for the analysis and the comparison of a vast variety of eLearning projects and technology-related initiatives at higher education institutions.

EDUCATION AS AN INSTITUTIONAL ACHIEVEMENT

Handicraft educational paradigm

The general perception of teaching and learning is still largely dominated by the most common mode of production in European higher education, which (Kerres, 2005) appropriately named the ‚principle of the chair-holding professor' (‚Lehrstuhlprinzip' in German). For the American context, (Massy and Zemsky, 1995) named this phenomenon the ‚handcraft educational paradigm'. In its purest version, it takes the individual teacher as the only authority to autonomously determine access of students to classes, define contents, deliver instruction and assess learning outcomes. Frequently, this perception of higher education results in study pro-

[1] An earlier version of this text has been published under the titel eLearning als Leistung der Hochschule: Sechs Aufgaben der Organisation (Pfeffer et al., 2005).

grammes, which are composed as a loose collection of hardly connected courses.

Even if the focus on the chair-holding professor or the individual instructor still is an accurate description of the current situation in many European higher education institutions and essential for the self-perception of educators, it also neglects crucial aspects of the educational environment. Admittedly, teaching and learning in classes is crucial. However, other activities, such as admission and enrolment, student administration, the organisation and provision of knowledge resources (e.g. in libraries), various service and consultancy tasks also contribute to the educational experience of students, even at the most traditional institutions. Limited forms of division of labour already exist, but are neglected by exclusively focusing on the individual teacher and on the classroom as the only educational setting.

The situation changes with the growing use of new communication technologies in education. As (Kerres, 2001) accurately notes, increased division of labour is an essential characteristic of mediated education. To get this in focus, it is essential to go beyond a teacher-centred concept of higher education, and to take a position that allows to perceive education as a task of the entire institution rather than as the responsibility of the sum of individual teachers.

Organising eLearning vs. the organisational use of ICTs

Authors who deal with educational technologies in higher education, therefore often address organisational questions. Khan (2001), for example, developed a ‚framework for eLearning', which has eight dimensions: institutional, pedagogical, technological, interface design, evaluation, management, technological and ethical. Similarly, Kerres (2001) suggested a ‚quadrangle for innovation through media didactics', which again comprises eight dimensions: educational contents, educational methods, production, distribution, organisation, personnel, support and infrastructure.

Even if both concepts are very comprehensive and succeed in covering many aspects of educational technologies, they also have some shortcomings. Both put technology mediated education in the centre of their observation and separate it from other forms of education, paying little attention to given educational arrangements and organisational missions. Being highly integrated and comprehensive, both concepts tend to set eLearning as an independent phenomenon, as if education has to be organised around the use of technology, as if eLearning itself would be a single, clear cut concept, which in practice could suggest highly standardised technology, a single organisational model and similar educational processes.

In other words, these concepts deal with organisational problems, but tend to ask „what has to be done to organise eLearning?", instead of posing questions, like „how can we use ICTs to serve the mission of the organisation?", „which areas of the university are affected by the use of a specific technology?", or „how to compare different technology-related initiatives from an institutional perspective?"

To allow for answers to this second set of questions and to avoid the danger to unintendedly apply the traditional handcraft paradigm to technology-mediated forms of education, it is necessary to shift the focus of observation from the organisation of eLearning to the organisational use information and communication technologies by higher education institutions. Only this shift in focus to the university as an organisation makes it possible to get a comprehensive impression for the potential of technological innovation. (Evans and Wurster, 2000) convincingly claimed that the use of new information and communication technologies can lead to the decomposition of existing, and to the creation of new organisational structures, workflows and business models. This opinion is supported by findings of the innovation researcher (Brynjolfsson, 2003), showing that innovation only takes place, if the introduction of digital technologies is accompanied by organisational change.

These considerations also apply to higher education. Even if technology initiatives intend to focus on a single task, they often effect wider parts of the institution and can lead to a re-arrangement of multiple aspects of the university. This already can be demonstrated with the example of the individual course. Trying to use digital media in a course often raises questions of admission, the control of membership and group size, the production and dissemination of learning materials, or access to support services and infrastructures. While traditional settings provide implicit solutions to these questions, which in the past have been taken for granted, the use of new information and communication technologies asks for reformulations of these questions, new, explicit solutions and re-arrangements of educational settings.

Actually, there already exists a vast number and confusing variety of technology-related initiatives at higher education institutions. This confusion is caused by the fact that traditional, seemingly homogenous educational arrangements are challenged by an enormous range of new and unknown structures and educational arrangements. Therefore it does not make sense to expect a single, ideal technological and organisational form of eLearning.

A conceptual framework to describe the organisational use of ICTs

Aiming at orientation in this confusing situation and to allow for comparisons between different initiatives, the following grid distinguishes six dimensions for the use of information and communication technologies at higher education institutions. Taking the perspective of the single institution, three dimensions deal with external relationships, three with internal relationships of the university. In all of these six dimension, technical and organisational changes are possible.

External relations (products, performances, tasks, goals, etc.)	**Products** materials, teaching, services
	Content discipline, topic, competences
	Market target group, benefit, distribution, funding
Internal relations (means of production, processes, instruments, means, etc.)	**Personnel** competences, training, rewards
	Organisation strategies, structures, support
	Technology hardware, software, licences

Figure 9.: Six organisational dimensions to describe the use of ICTs at universities

The rough distinction between internal and external relations follows the theoretical assumption that organisations, like all social systems, distinguish themselves from their environment by their own communications (Luhmann, 2000). Alternatively, other dichotomies, like product/means of production, performance/process, task/instrument, goal/mean, etc.) could be used as well. Since both sides of each dichotomy are in close relationship, the goal of these distinctions is not to rigidly attribute observations to either the one or the other side, but rather to observe the dynamic relationship between both sides of each distinction.

In principle, this conceptual framework already can be used to analyse traditional educational settings. For example, with respect to internal relations, one could claim that traditional universities are frequently organised according to the principle of the chair-holding professor, their personnel being largely composed of autonomous teachers with functionally equiva-

lent job descriptions, and their most commonly used technologies being chalk and blackboard, as well as the spoken word. With respect to external relations, traditional courses are frequently regarded as the main product, dealing with disciplinary organised content. The predominant market for most European universities is still the target group of full time students from a regional/national catchment area.

Every university that deals with digital media in education, will have to consider each of these six dimension. But the challenges and options will differ considerably, depending on the organisational level, from which these dimensions are analysed, e.g.:

- The institutional level
  (comprising all subunits and study programmes)
- The level of the study programme
  (or, alternatively: faculty, department, organisational subunit)
- The level of the course
  (or, alternatively: the individual teacher or position)

Each organisational unit that makes use of digital media in education should consider, which product and which content it wants to distribute to which market. It also will have to know, if its personnel has the necessary skills and motivation, if the organisational unit itself is ready for the initiative, and which technology it aims to use.

PRODUCTS

Those objects and services, which are directly aiming at the clients, target groups and audiences of the university, can be defined as the 'products' of the university. In the case of the research function of a university, these are the research activities and publications, in the case of the educational function, these are mainly study programmes. With respect to the later, it is possible to distinguish various elements, which differ in the way they can how they can be influenced by the use of digital media. Important elements of the educational arrangement in study programmes are materials or knowledge resources, teaching activities and student services.

Materials

Most universities already have more digital materials in stock than they are aware of. Among them are electronic versions of scholarly publications or scientific data repositories. materials, which partly can be used for education as well. As has been mentioned above (chapter 5), technically there is

no big difference between the archiving and the publishing of these materials to a larger audience. While hardcopies of knowledge resources (e.g. learning materials, textbooks, journal articles) have to be reproduced, and each copy only can be used by one reader at the same time, digital materials can be offered to large numbers of recipients for simultaneous use without significant rivalry among them.

Due to the same limitations of hardcopies, materials, which have been self-produced by educators, predominantly have been circulated within classrooms only. The digitalisation of learning materials relieves from these physical restrictions and increase the options for distribution. Learning materials, which have been produced for classroom use, now can be shared with larger audiences, e.g. with all participants of a study programme, with all members of the institution, or even with an unspecified, global public. Instead of the traditional distribution of hardcopies, now the opening or restriction of electronic access become an issue.

Higher education institutions increasingly become aware of their digital assets, which can be used in different ways. A first step in this direction is to foster the archiving of digital materials and/or to create institutional archives. There exist many reasons (e.g. copyrights, confidentiality, profit expectations) to apply differentiated digital rights management and to differentiate access for specific target groups. But there also exist examples of institutional archives, which provide free access to knowledge resources and which therefore can be regarded as new forms of publication in their own right.

Intranet for learning materials

Learn@WU[@1], an institution-wide project at Vienna University of Economics, started by providing learning materials for 18 large enrolment courses (more than 400 students each). This initiative was part of a comprehensive reform of all undergraduate study programmes, aiming at increased efficiency and improved quality, while reducing the drawbacks of mass education. These learning materials built the basis of a common body of knowledge, which is growing ever since. Students now have easy access to the required resources any time they whish. For faculty, it became easier to compare the content of different courses, which reduced redundancies and allowed to relate to courses of others. Access is restricted to members of the institution.

Open archive for learning materials

In 2001, the Massachusetts Institute of Technology launched its OpenCourseWare[@2] Initiative, promising to make self produced learning materials of all of their 2000 courses freely available by 2007. Learning materials are organised in courses, but put online only as post-teaching publications after having been edited and scrutinised for copyright clearance. As an

elite institution, MIT does not want to increase enrolment, but to set an example for academia and innovate the global distribution of knowledge resources in higher education. By now, about 1.500 courses were made available.

Scholarly publications
The eScholarship Repository[@3] was founded by the California Digital Library. As a member of the Open Archive Initiative, the eScholarship Repository is an open online archive for scholarly publications (including prepublication materials, journals and peer-reviewed series, postprints, and seminar papers), which have been produced by faculty of the University of California. Academic departments and research groups can create and design their own, subject-specific archives in the framework of the central infrastructure. This allows for efficient archiving and smooth connections to library catalogues.

Digitalisation of historic books
In 1997, the library of Graz University started a project for the digitalisation of its full stock of historic books and manuscripts, mainly from the middle ages. These documents need to be carefully handled, due to their age and their historic value. The Centre for Digitalisation[@4] has specialised in the creation of electronic copies of old books and manuscripts, which allows for their wider distribution and use.

Recorded lectures
The project Stanford on iTunes U[@5] provides access to a wide range of university-related digital audio content, such as faculty lectures, campus events, performances or book readings via Apples iTunes music store. Parts of these contents are freely available to the public, other parts are restricted for Stanford faculty and students only.

Both Learn@WU and MIT OpenCourseWare are examples, how the distribution of learning materials can go beyond the boarders of the classroom. In both cases, learning materials are produced for use in specific, local courses and clearly attributed to them. Still they are made available to larger audiences as well. In the case of the Vienna University of Economics, this increased internal coordination and made the management of study programmes for large student populations easier. MIT used its free online archive as new form of publication, which largely raised its reputation in academia and in the general public.

The other examples serve as illustration for the term ‚digital material' as a product of the university. All of them carry the potential to be used for education, be it scholarly publications, like in the case of the eScholarship Repository, or be it basic scientific sources, like the digital images of ancient documents in the case of the Centre for Digitalisation Graz. Audio or

video recordings of lectures, like in the case of Stanford on iTunes U, are by-products of the original lecture in the first place, but can create added value by being later used for additional educational purposes and for public relations.

Teaching activities

To define teaching activities as a ‚product' of universities should neither reduce the value of teaching, nor the necessary participation of students in education. Naturally, education relies to a large extent on the personal relationship between teachers and students. To speak of teaching as a product should only help to clarify, what the specific contribution and quality of teaching might be in difference to other activities.

Didactics can be seen as the form in which teaching is conducted. A traditional distinction in this respect is the differentiation between residential and distance education. While teaching in residential education was predominantly characterised by verbal communication in lectures and seminars, distance education was based on written communication and the exchange of documents. It is a frequent misconception that the use of digital media only makes sense in distance education, since there exist many examples for the successful use of information and communication technologies in residential settings as well. Therefore, it is more appropriate to assume that the use of digital media will lead to blurring boundaries between residential and distance learning arrangements. (See chapter 5 as well.) Terms like ‚flexible' or ‚blended' learning refer to didactical forms, which combine elements of face-to-face with remote teaching and learning.

It is necessary to emphasise that the mere distribution of learning materials does not substitute the need for teaching activities and personalised communication. Even if distance education put more emphasis on the provision and circulation of learning materials, it was necessary to instruct students, to give individual consultation, feedback and examination. The main difference to residential education was that it made more intense use of written communication for this purpose.

While the evolution of digital media lead to a nearly endless scalability of distributive options for knowledge materials, it would be wrong to assume the same of teaching activities. These are clearly limited by the capacity of individual teachers and of higher education institutions for personalised communication, a capacity that might also be expanded by digital media, but to a much smaller extent.

Didactical forms for flexible or blended learning can be analysed in at least three dimensions: with respect to the intensity in the use of digital

media, with respect to course size and with respect to the question, if individual and/or collaborative are to be supported.

Intensity in the use of digital media

An important criterion for the distinction of didactical forms in blended learning is the intensity in the use of digital media. Drawing from the Program in Course Redesign[@6] that focused on large-enrolment, introductory courses in multiple disciplines, Carol (Twigg, 2003) provided a typology of five different models that covers a long continuum of gradually increasing intensity. These five types are: the supplemental model, the replacement model, the emporium model, the fully online mode and the buffet model.

The supplemental model

The supplemental model can be characterised as leaving a given course structure (e.g. frequency of meetings) intact, while providing additional digital resources and technology-based out-of-class activities. In case A, the classroom activity was left unchanged, while in case B, classroom activities responded to out-of-class activities.

A. The course on General Psychology at the University of New Mexico[@7] encourages students to take online quizzes and to study additional learning materials as a way to prepare for in-class exams.
B. At the University of Colorado at Boulder, the course Introductory Astronomy[@8] posts about a dozen discussion questions per week, which have to be answered by small learning teams out of class. The instructor can review the answers on the Web and decide, which topics to elaborate or skip for the next discussion session.

The replacement model

In difference to the supplemental model, the replacement model substitutes part of the class meetings by online activities. In case A, the remaining classes keep their traditional structure, while in case B significant changes also occur in class meetings.

A. In the course Elementary Statistics at Pennsylvania State University[@9], the number of traditional lectures per week was reduced from three to one. The traditional two recitation sessions were changed into two weekly meetings at the computer lab, where students worked individually and collaboratively worked on prepared activities. Regular tests probe students' conceptual understanding and study progress.
B. For the course Intermediate Spanish Transition at the University of Tennessee, Knoxville[@10], the number of weekly classroom meetings was reduced from three to two. Online activities of this introductory language course are focusing on grammar, vocabulary and listening exercises, providing immediate feedback to students. Relieved from these repetitive tasks, meetings in class can focus on practicing the expressive skills of speaking and writing and on collaboration.

The emporium model

The emporium model substitutes all class meetings with a learning resource centre featuring all materials and personalised assistance online. It can be applied either A in an open attendance or B in an required attendance mode.

A. At Virginia Tech, the course Linear Algebra[@11] is based on idea to provide students with the opportunity to learn mathematics at the time and pace they individually prefer. While previously the course was organised in 38 sections à 40 students, it now is combined in 1 section à 1.500 students. This allowed to pool instructional person-power, to reduce repetitive tasks, but also to significantly increase the time span in which personal assistance for students is available. Staff for this course is a combination of faculty, technical assistants and peer tutors.

B. The course Pre-Calculus at the University of Idaho[@12] also built up a learning centre and combined the previously existing sections into one large course. In difference to the example mentioned above, it assigned students to focus groups for weekly meetings, to coordinate activities, discuss experiences and build up community among students.

The fully online model

While in the emporium model learning partly takes place at a local resource centre, the fully online model moves all learning experiences to the Web.

The World Literature course at the University of Southern Mississippi[@13] applies a fully online model. Again, a larger number of parallel sections (16-20 à 60 students) have been combined to one large section (à 800). The course is taught by a team of four faculty members, each one responsible for a module in their area of expertise, four graduate assistants, who help students with writing and grade their essays, and a course coordinator, managing the team. The course provides consistent content coverage of all necessary materials fully online, which gives all students the same learning experiences and improves course coherence and quality control.

The buffet model

While the models discussed above treat all students as if they were more or less the same, the buffet model customises the learning environment for each student based on background and learning preference, offering a range of individualised learning paths to reach the same learning outcomes.

Ohio State University's Introductory Statistics[@14] course enrols about 3.250 students each year. It offers a wide range of learning opportunities, including lectures (on- and offline), individual and group discovery laboratories, training modules, homework assignments, as well as individual and group projects. After initial orientation on course content and learning options, students complete an online inquiry to assess their personal learning style and study skills, receiving a report on their results and recommendations for their individual learning path and study options. Student's choice results in a personal learning contract, which details what needs to be accomplished and when each part of the assignment must be completed. This contract also serves as an instrument to monitor study progress on an indi-

vidual basis. The student may decide to change the contract, if feeling that an alternative learning strategy would be more appropriate.

Large enrolment vs. small courses

Given the background and the results of the Program in Course Redesign, it becomes apparent that the use of digital media allow to lever economies of scale, both with respect to the cost and to the quality of teaching activities. (Twigg, 2003) observed reduced costs by about 40 percent on average across all of the 30 involved courses, while at the same time increased course completion rates, improved retention and deeper student satisfaction could be achieved. Introductory courses, which are often characterised by large enrolment and many repetitive tasks, are an obvious environment for the automation of some procedures, for coherent content coverage, for the exchange of teaching practices between faculty members and even for team work and a new division of labour in teaching teams. Some of the mentioned teaching activities and models seem to be viable only, if they are used for serving large audiences. The provision of different learning paths and their customisation in a buffet model would be among them.

However, the continuum of intensity in the use of digital media also applies to smaller courses, which are the majority in current higher education. By tendency, smaller courses will rather apply supplemental or replacement models than the emporium or the buffet model. In any case, group size plays an important role in the choice of didactical models and the respective teaching activities.

Individual vs. collaborative learning

A frequent misconception about the educational use of digital technologies is the assumption that digital media favour individual learning. It is true that there exist many digital applications, which support individual learning, for example the delivery of digital materials, which can be retrieved independent from time and place, interactive tutorials and quizzes, which are based on person-machine interaction and provide immediate feedback, or the individualised assessment of skills and tracking of learning activities for the purpose of personalised assistance and grading.

Still, digital media offer at least as many opportunities for collaborative learning arrangements as well. Online workspace for study groups to exchange materials, chat for networking and forum for group discussions, as well as tools for collaborative writing and peer reviewing among students are only some possibilities. As the examples mentioned above demonstrate, both individual and collaborative learning arrangements can be combined within a single course.

Student services

Debates on the educational use of technologies often neglect the area of student services outside of course settings, which also form an important part of the institutional learning environment. Here are a few examples for the application of digital media in this field.

Administration

Apart from a large number of other administrative services (e.g. course enrolment, credit information, etc.), the Vienna University of Economics technically enhanced the process of matriculation. Freshmen, who never have not yet been enlisted at the university, are offered an online tool to fill in all required personal data on the Web. Digital cameras in front of the enrolment office produce passport photographs, which are automatically included in the personal file of the prospective student. The online tool suggests dates for physical appointments with the enrolment office, which are necessary only to sign and pick up the personal student card. The amount of time required for the whole procedure has been reduced from several hours, sometimes even days, to a few minutes.

Counselling

4students is an initiative to support student counselling at Graz University. The respective service unit serves as a contact for general study affairs. It collects information on all general aspects that might be relevant for prospective students or students, e.g. choice of study program, study administration, campus information, and maintains the respective Web site with answers to the most common questions. In parallel, the service unit provides counselling to individual questions, mainly via email and telephone.

Individual planning and presentation

Electronic student portfolios have gained increase attention during the last years. The (IMS Global Learning Consortium, 2005) developed a set of eight major types of ePortfolios. The following three are the most important for higher education institutions: assessment, presentation and learning portfolios.

Assessment portfolios can be used to formally certify and accredit individual achievements of a student by an educational institution. Presentation portfolios organise individual achievements in a less formalised way, e.g. by collecting overviews on interests, education and acquired skills, documenting study career, work and experiences abroad, as well as providing the opportunity to present own products, like the best essays written during the course of studies. Learning portfolios can be used to document, plan and guide learning during the course of study.

As (Young, 2002) explains, one of the largest advantages especially of learning portfolios can be to create a ‚big picture' of individual study experiences. By comprising all of a student's academic activities and achievements, which are often disperse over different courses, they support the creation a holistic picture for academic monitoring, reflection, and

counselling. Apart from this purposes as an accompanying instrument during the course of studies, ePortfolios later also can be used for presenting experiences and achievements, e.g. toward a prospective employer.

The tool for matriculation at Vienna's University of Economics is an example for improvements of purely administrative processes, while 4students is more an example for new ways to distribute institutional information to students and to provide orientation on regulations. Electronic student portfolios are even more interesting, because they provide an example for a possible teaching activity that can take place outside the traditional course format and that can help students to integrate otherwise fragmented educational experiences.

CONTENTS

While the dimension ‚product' deals more with the external form of what is presented in education and how activities might look like, the dimension ‚content' refers to the topics, issues and themes of education.

Since the content of education has a large impact on the possible forms of delivery, it is crucial to consider the content before choosing the adequate arrangement for presentation, instruction and assessment. In addition to providing possible tools for education, digital media also become an issue in two other ways: either as a theme for academic debate, or as a question of literacy and personal skills.

Disciplinary differences

There exists a strong relationship between the contents of education and the form of possible teaching/learning activities. Many topics in the natural sciences qualify for graphical presentation, picture recognition and simulations, language studies can rely often rely on audiovisual recordings and interactive training, while the humanities and social sciences especially depend on text. The following examples illustrate these differences between disciplines.

Natural sciences

Math online[@15] is a collection of digital learning materials. To improve the understanding of abstract geometrical concepts, the materials provide dynamic simulations and interactive construction kids for mathematical formulas, providing immediate feedback to learners.

Language training
The commercial training provider hueber.de[@16] offers a variety of test courses on its website. Test courses comprise various activities, giving examples of dialogues, listening and speaking exercises, overviews and multiple choice tests for vocabulary and exercises, roll games, and tutored exercises.

Social sciences
The Internet Sociologist[@17] is a tutorial for self-learners, which is maintained by the Social Science Information Gateway. The goal is to train the use of discipline specific online resources, like full text repositories, catalogues and bibliographies, search engines, original basic data archives, learning materials and discussion lists.

Digital media as a topic of education

Information and communication technologies can be a topic of education as well. While digital media are an obvious issue in technical disciplines, like engineering or computer sciences, they also become topics for theoretical considerations in other disciplines, like economics, social sciences, arts and humanities, or medicine.

Political communication
The course New Forum Internet is part of the study programme political communication[@18] at the Danube University Krems. Topics of this course are the acceleration of political communication via email, newsletter or SMS-campaigns, democratisation of communication via homepages and web logs, or new prognostic instruments, like ‚electoral stock exchanges' (in German ‚Wahlbörse'), which simulate chances of political parties with playfully buying or selling ‚shares' and deliver astonishingly accurate results.

Medical informatics
The private University for Health Sciences, Medical Informatics and Technology (UMIT)[@19] offers study programmes for medical informatics. Topics are for example information systems in health services, medical documentation, visualisation technologies and signal recognition, diagnostics and therapies, as well as knowledge management in medicine.

Humanities
The lecture series called The Digital Challenge: Social Aspects of Information and Communication Technologies[@20] at Klagenfurt University covers a wide range of different topics, like ICTs and society, the economy of knowledge and copyrights, the knowledge society and changes in work, technology and gender, person-machine interaction, naturalised technology

in smart environments, as well as identity and community in digital networks.

Examples like these illustrate the increased importance of digital media in various academic disciplines, which as a consequence has to be reflected in higher education. This does not necessarily mean that every single scholar equally has to be interested in information and communication technologies. But examples like these demonstrate that information technologies can become a relevant subject for research and education in every academic discipline.

ICT competences and information literacy

For being able to competently investigate digital media as a subject, a certain amount of proficiency in using them is a prerequisite. The training of ICT skills therefore becomes a topic of general importance for higher education institutions.

Juridical informatics

The course Introduction in Juridical Informatics at Graz University provides an overview of the technical infrastructure of the university, training in the use of local library resources and computer facilities, as well as an introduction in the use of web based legal information systems and resources.

Technology Across Curriculum

The College of Arts and Sciences at the George Mason University aims at preparing their students with basic skills that are necessary to successfully perform at the labour market. In cooperation with employers from the regional environment, the college set up a list of 10 ICT-skills:

1. communication	email and electronic collaboration in groups
2. documentation	word processing and websites
3. presentation	use of presentation technologies
4. investigation	critical use of Web resources
5. data banks	feeding and retrieving data banks
6. spread sheets	calculation and diagrams
7. statistics	descriptive statistical applications
8. graphic and multimedia	handling of graphic and multimedia files
9. law, ethics, security	copyrights, privacy, firewall, etc.
10. hard- and software	personal computer/local network, operation system/application software, document management, etc.

For each of these skills, basic and advanced skills were defined. Rather than to expand the curriculum by setting up separate courses for training these skills, the list was held against the given curriculum, trying to identify, which of the existing courses would be most appropriate to train which of the skills. This approach guaranteed both a close connection of skills train-

ing with work in the discipline as well as a commitment of the entire faculty with the programme Technology Across Curriculum.

While the first of the two examples deals with introductions in the local technical infrastructure and specific learning environment, as well as with disciplinary resources, the second approach has a broader goal: to treat the ability to deal with ICTs as general cultural skills which have to be provided by higher education. In other words, one could say that the programme Technology Across Curriculum provides information literacy on an academic, literacy that has to comprise the critical use of digital media.

MARKET

Even if universities normally have very comprehensive missions in research and education, in practice they can not equally and simultaneously deal with all parts of society. Therefore each institutions and each organisational subunit has to define its profile, describing its target groups, geographical catchment area, thematic focus (contents and topics), as well as its products. This definition, which fraction of the world is regarded as its own relevant environment has to be done by the institution itself. It can be termed as the ‚market' of the university, which should not suggest a specific economic model of how to deal with it. Rather, the term should help to focus on the relevant environment of an institution, and to grasp changes in this environment. Generally speaking, expansion of higher education, internationalisation, increased autonomy, competition and demands for accountability are trends, which lead to an erosion of national boundaries and traditional monopolies, as well as to increased heterogeneity in student population. Information and communication technologies contribute to these trends.

For the strategic use of digital media in the market dimension, it is necessary to distinguish target groups, competitive arguments, and distribution channels.

Target groups

To avoid confusing assumptions for the institution (e.g. ‚digital media necessarily lead to distance education', ‚digital media necessarily lead to for-profit business models or additional revenue streams'), universities have to consider, which target groups they are aiming at. It makes a big difference, if educational offerings are aiming at traditional full time students or at adult learners, if they are publicly funded or if they rely on pri-

vate contributions. Another criterion can be, if it the offering is provided for a regional environment or if it reaches out for larger catchment area.

Traditional residential students
The Wharton School at the University of Pennsylvania is one of the most prestigious business schools worldwide. It offers residential education for traditional full time students, but is highly selective and tries to attract talents internationally, without wanting to expand its student body of about 4.000. Digital media are used as an enrichment of its educational environment. Home grown developments, like the school's free online business journal Knowledge@Wharton[@21] or the award-winning intranet SPIKE contribute and stabilise the high academic status of the institution, making it an „Alma Mater Multimedialis" (Brockhaus et al., 2003).

Adult learners
The University of Phoenix is a distance learning institution for adult learners, providing a small number of study programmes for economics, engineering, education and nursery. In recent years, it has successfully established an online branch, the University of Phoenix Online, serving about 60.000 students in a more than 25 states in the United States. Being profit-oriented, this branch actively tries to expand enrolments. Digital media are used for the efficient circulation of learning materials and to provide learning arrangements like group work or improved assistance, which previously were not available for distance learners.

Continuing education
In 2002, three higher education institutions (Graz University, Graz Technical University and Fachhochschule Johanneum) jointly performed a feasibility study for a regional distance learning centre[@22], which should serve the catchment area of Styra, a region in Austria. The motivation for such a centre was a lack of regionally available offerings paired with increased demand for qualification. Additionally, access of adult learners to tertiary education should be enhanced with the help of eLearning courses. Based on an analysis of existing offerings and of demands in the regions, the study developed of how to jointly organise a regional distance learning centre.

These examples illustrate different business models for the use of information and communication technologies in higher education. In the case of the Wharton School, digital media are used to strengthen the competitive advantage of a competitive, highly selective institution for traditional students. Phoenix University uses technologies to expand its share of the market in for-profit distance education for degree programmes aiming at adult learners. And the case of the suggested Regional Distance Learning Centre Graz is an example for the attempt of public higher education institutions

to set up a branch of continuing education activities in addition to serving traditional full time students in degree awarding programmes.

Competitive advantage

The use of digital media promises two different competitive advantages: improved quality of education and/or reduced costs of delivery. However, many comparative studies on the use of technologies in higher education rather indicate the opposite: increasing additional expenses without delivering improved quality. (Russel, 1999) referred to this as the 'no significant difference phenomenon'[@23].

(Twigg, 2003) argues that many universities have not yet realised the promises of technology, since they merely add digital media to existing structures, without changing organisational arrangements and teaching practices. In reporting about the Program in Course Redesign, she demonstrated that both educational improvements and cost savings can be achieved, if learning outcomes and costs are continually monitored, and if these analyses are related with purposeful steps for improvements. Measuring quality by criteria, like course completion rates, retention and average grades per cohort, two thirds of the involved courses improved student learning, while one third showed no significant difference. Based on detailed cost analyses of both the traditional and the redesigned arrangements, all of the thirty courses could achieve savings of about 40 percent on average.

The introduction of digital media will not automatically lead to improvements, if quality or costs are not targeted explicitly, or if existing structures and processes are kept as they are. Both is easier to be realised, or, at least, easier to be observed in large enrolment courses, which are staffed with teams of instructors. If efficiently organised, costs can be contained by shifting more repetitive parts of the workload from faculty members to technology, as well as to tutors and study assistants. This is also possible, but harder to achieve in courses with one instructor only.

Distribution channels

The Web offers new opportunities for self-presentation and for reaching out to target groups and the general public. From this perspective, the portal of a university or the homepage of a department can be regarded as crucial communication tools for institutions and organisational sub-units. The functionality of these addresses in the Web contribute to communication of universities with their environments.

While the portal of a university can be seen as a general address or platform for self-presentation, there exist additional distribution channels for

specific types of products or information of the university. The impact of information can be hugely increased, if they are not 'hidden' in separate homepages of individuals or organisational units, but if they are also presented at prominent platforms and feed in efficient distribution channels.

Course catalogue
Electronic course catalogues allow for the comfortable use for individual courses at an institution. The individual data sets can be combined with information on lecturers, departments and study programmes.

Study guide
The higher education study guide for the region of Lake of Constance[@24] is maintained by a cross-national consortium of higher education institutions on the boarder between Austria, Germany and Switzerland. It provides information about all higher education study programmes in the region of Lake Constance.

Brokerage platform for learning materials
The portal of MERLOT (Multimedia Educational Resource for Learning and Online-Teaching)[@25] is a brokerage platform digital learning materials. Funded by a consortium of about 20 higher education institutions and systems in the US, peer reviewed learning materials are made freely accessible. The goal of the involved institutions is to foster eLearning and the community building among interested scholars.

Joint editorial concept for learning materials
The international OpenCourseWare Consortium[@26] is a collaboration of more than 100 higher education institutions and related organisations. It also provides free online materials. But in difference to MERLOT, which comprises a large range of materials with different granularity and size, the OpenCourseWare Consortium only accepts entire courses for publication, which meet certain agreed-upon criteria. The idea is to promote the OpenCourseWare concept and establish it as a broadly applied standard for the production and distribution of learning materials.

Funding

Even if there exist clear expectations about the use of digital media in higher education (which normally can not be taken for granted), the are in any case related with costs. For newly developed, large eLearning initiatives, like the Finnisch Virtual University, (Kess, 2002) suggested to consider at least the following types of institutional costs:

- Specification (definition of functionality)
- Development (design and programming)
- Implementation (introduction in social settings)
- Maintenance (permanent use und update)

Claiming that especially the last two types of costs are frequently hugely underestimated, which then can result in applications that are badly implemented or not sustainably used, he proposed as a rule of thumb to calculate the proportion of 1 : 3 : 9 : 27. Every step multiplies the costs by three. Even if there can be variations from this maybe extreme calculation key, it has to be clear that institutional eLearning initiatives are never completed with the mere set up of the technological infrastructure. The more significant costs evolve with the implementation and the permanent maintenance of the initiative, especially with respect to editorial services, community management, training and update. These costs come on top of the costs for regular academic activities and require long term commitment.

These costs have a direct relationship to the market situation of a university and to the question, where the funding for institutional eLearning initiatives might come from. Common sources are grants and public agencies, new revenue streams, reallocation of investments, or cost sharing between institutions.

Grants and public agencies

One source of funding for eLearning initiatives are grant programmes by governments or, in mainly in Anglo Saxon Countries, also by foundations. These programmes are characterised their timely limitation, and often by their competitive approach to award funding. They serve well to trigger innovation, to raise attention for the issue eLearning and for the initial funding of projects. But grants can not guarantee the long term existence of eLearning activities.

A more sustainable approach is to set up public agencies to provide support for eLearning, like JISC (The Joint Information Systems Committee)[@27] in the UK, or the Swiss Virtual Campus[@28]. These agencies can accumulate expertise, support permanent communication platforms (journals, conferences, etc.) and provide consultancy to higher education institutions, valuable and deeply needed activities. However, they also can not fund institutional eLearning on a permanent basis.

New revenue streams

Partly due to the expenses which are necessary for technology initiatives, universities also started to search for new revenue streams. Especially during the times of the dot-com-bubble, some institutions in the US expected to conquest yet unknown markets and raised venture capital to fund their initiatives. The equivalent in Europe are attempts to expand activities into the field of continuing education as a potentially new market. Even if it is legitimate for universities to diversify their funding basis and to search for

additional revenue streams, the options should be examined realistically. In practice, the core market for public universities is highly regulated and dependent on public funding. Commonly, universities are not free to raise prices for undergraduate and graduate studies as they like. And they might be able to generate additional revenues, but they can not completely shift to new markets without loosing their core mission as public higher education institutions. It does not seem realistic to expect that funding for eLearning initiatives at universities can solely come from new revenue streams.

Reallocation of investments

Frequently, one can observe the emergence of additional or parallel structures during the early phases of technology implementations, which necessarily leads to increased costs. Additionally, especially in the case of collaborative environments, like online communities or archives, the costs for their social moderation and management (functionally new activities, which come on top of the sum of individual contributions) are often hugely underrated.

Since neither grants nor new revenue streams will lead to a sustainable funding for technological investments at traditional public universities, one answer has to be found in the reallocation of investments. Institutions therefore have to search for cost savings and a gradual reallocation of investments. Examples for these can be the substitution of physical documents (e.g. course catalogues), reduction of routine activities, or new arrangements in the division of labour.

Cost sharing

Last, but not least, the economic use of funds and avoiding of unnecessary expenses can be resource as well. E.g., to invest in the efficient distribution and sharing of knowledge in the organisation is a good way to reduce the costs for the individual teacher in learning how to use digital media in education. But it also between institutions, there exists the danger of parallel developments or of following unsustainable trends, which can lead to an unnecessary waste of resources. Cost sharing via cooperation and the investment in a joint infrastructure can be an answer to this danger. Many developments (e.g. strategic orientation, accumulation of specialised know-how, standardisation, specialised services, archives and/or distribution channels) are extremely expensive and risky for the individual university, while institutional collaborations can reduce the respective costs for the individual member, increase the quality of service, and distribute risks. The example of the Finnish Virtual University illustrates, how costs can be shared on a national level.

Finnish Virtual University

The Finnish Virtual University (FVU)[@29] is no independent higher education institution, but rather a joint service infrastructure for all Finnish universities. Steered by the consortium of universities, the FVU has the following tasks:

- *Harmonising academic information system* (e.g. to foster the transfer of digital certificates and grades.)
- *Development of compatible practices* (e.g. metadata to describe courses or learning materials)
- *Joint service and marketing* (e.g. the portal of FVU, with a comprehensive catalogue of all online courses; technical and didactical support; student services; etc.)
- *Fostering the cooperation between universities* (e.g. by providing logistical support for disciplinary and interdisciplinary networks)
- *Establishing models and services*, which become part of the permanent academic activities at universities.

In performing its task, the FVU creates a joint, national infrastructure, but also a joint platform and common marketplace for the exchange of know-how and of educational offerings. By participating, the individual universities are easier found in the Web and can increase their visibility.

The FVU is embedded in an institutional arrangement that is characterised by a clear division of responsibilities. The FVU itself is responsible for the described tasks, the dissemination of results and for marketing. It receives its terms of reference from the consortium of universities, which ensures both FVU's mission to serve the needs of the universities, as well as the commitment of the universities for the success of this initiative. To increase this commitment, FVU is jointly funded by the ministry of education and by the consortium of universities.

PERSONNEL

Being expert organisations, universities rely more on their ‚personnel' than most other institutions. Faculty and other staff members are the most important asset of each higher education institution. Institutional strategies for the use of information and communication technologies have to be based on the competences and the commitment of the personnel of a university. It does not make sense to create highflying eLearning concepts, if given staff members are either not able to translate them into their daily work or if they are seriously convinced about the desirability to use digital media in education.

From staff development's perspective, at least the following aspects are relevant: the inquiry of current competences, their strategic development

and incentive mechanisms for the use of information and communication technologies in higher education.

Inquiry of current competences

An investigation of current competences and motivations among faculty members can be a starting point for an institutional initiative, if the results are used to inform about policy options for the institution and to design further staff development measurements. It is useful to distinguish between different competence levels and to quantify their appearance in relation to each other.

Engaging faculty ‚types'

In preparing for the broad introduction of digital media in teaching activities at University of Hartford, US, a newly appointed expert for learning technologies at the learning support unit performed an inquiry among faculty members about their readiness to participate in this initiative (Hagner, 2001). The inquiry used the following scheme of faculty types:

1. early adopters:	intrinsically motivated (being convinced about the usefulness in education), willing to experiment, self-confidently using ICTs
2. second wave:	intrinsically motivated, apply tested practices, avoid risks of new developments and additional efforts
3. reward seekers:	extrinsically motivated, if personal advantage is obvious or expectable
4. reluctants:	due to unease in using digital media, and/or being convinced about the superiority of traditional teaching methods

Equipped with this conceptual framework, the specialist for learning technologies visited all faculty members for individual interviews. He asked his respondents for current and potential future uses of digital media in their courses. Additionally, he presented learning materials from other higher education institutions, but always in the disciplinary field of his interview partner, asking if he or she would be interested to use or even develop similar materials. The answers allowed to assign the respondent to one of the four types, which generated a good overview of the general needs, interests and readiness of the whole faculty.

Unexpectedly, the investigation showed two other results beyond the mere generation of data. On the one hand, the presentation of different opportunities during the interview already increased the interest for eLearning. Being performed in intense personal interaction and in a highly individualised way, the survey on the other hand contributed to an improved relationship between the learning support unit and the faculty.

Staff training

Generally speaking, media literacy and competences in the use of information and communication technologies is not only an issue in the education of students, but also in the training of teachers. Staff training can be either organised internally or by using external supply.

Internal staff training

The staff training course Interactive Distributed Learning for Technology-Mediated Course Delivery[@30] at the University of Central Florida is provided by the local support unit for course development and web services. Being organised in a combination of online and face-to-face elements, the course gives an introduction in the local eLearning environment and related administrative processes, as well as in the basics of media didactics. Calculating a time exposure of 70 hours in total, participants acquire the following competences:

- Designing of own courses in the local learning management system.
- Comprehensive didactical strategies for blended learning scenarios.
- Course administration in the local learning management system.
- General strategies for establishing online courses at the University of Central Florida, including strategies for the use of local support units.

External staff training

Several Austrian higher education institutions joined forces to provide Zertifikat eLearning[@31], a certified staff training programme, which is open for teachers from non-member institutions as well. The programme consists of three modules/courses, each of which has a duration between 20 and 30 hours:

- Media didactics for online education
- Media production
- Media organisation and teaching strategies

It is obvious that neither of both examples is only about pushing the right buttons or about training software skills, since they both include media didactics and teaching skills, which are fundamentally academic competences. Each of the two models has its advantages. External training has offers the possibility to acquire know how that is not always kept ready or up to date inside an institution. Internal training can be better adapted to the local infrastructure and closer related to the practices and conventions of a given institution.

Rewarding systems

Even if faculty members have the competences to adequately use information technologies in their teaching, it is not always obvious, what their reasons for doing it should be.

Financial incentives

Experimenting with digital media can cause additional costs also for individual teachers. Some universities provide financial incentives and supplemental funding for their faculty members. This is especially helpful in the early phase of technology initiatives, as a means to find the early adopters of an institution, to raise the interest in eLearning and to establish the issue at an institution.

However, for most universities this approach is not sustainable in the long run. If the institution wants to make the use of digital media in education a mainstream activity, it can not pay extra money to every teacher, who uses technology in his or her teaching activities.

Academic reputation

The last one and halve decades brought about eLearning as a new, or at least hugely expanding, interdisciplinary field for academic debate. Scholars from more or less all disciplines contributed their visions and insights, their research and eLearning projects. Very interestingly, academia treated the topic eLearning in common scientific forms of communication, by organising research projects and sharing knowledge in workshops and conferences, something scholars never would have done with their traditional teaching practices.

Similar mechanisms are used by universities to promote eLearning and the use of digital media in their organisation. Local workshops, seminars and communities of practice are organised to foster the exchange among peers. This type of events is familiar to scholars and highly popular, since they offer an opportunity for the free exchange of ideas and for generating academic reputation.

Institutional acknowledgement

Even if conferences, workshops and communities of practice are good instruments to learn among peers, they are mainly attractive for early adopters, maybe even for the early majority, but they will not be enough to make eLearning a broad mainstream activity at a university. There also exist some hindrances, which can make the use of digital media an additional burden for teachers.

One of these obstacles can be the lack of institutional acknowledgement for eLearning, treating respective engagements of individual teachers more or less as their personal affair. To overcome this barrier, the use of information technologies in study programmes should be discussed, their status in curricula should be formally stated in official documents. For staff development, it also would be helpful to state specified media didactical

competences as requirements for appointments and obligatory for promotion.

An even bigger obstacle is the missing flexibility of universities in their salary structures. Frequently, teachers are still rigidly paid per contact hours, but not, if they invest time in the preparation of learning materials. This impedes more fundamental changes of workloads and work organisation, which could be achieved through technology. Here, universities have to find new salary structures, which allow to invest in innovation, but also save costs, when workloads were reduced or processes became more efficient.

ORGANISATION

The dimension of the ‚organisation' at a university here refers to the strategies, structures and the internal support units for the use of information and communication technologies at a university.

Strategies

If the use of digital media in education is regarded as an institutional achievement rather than as a task of the individual teacher, then it has be established as a common, strategic goal of the entire organisation. General missions for the direction to go to and strategic goals to set milestones are necessary to provide orientation for daily operative decisions. Two types of strategies can be roughly distinguished: task related strategies, which deal more with the external relationships (e.g. product, content, market, or: ‚what' should be be achieved?), or instrumental strategies, which are more focused on the internal relationships of the organisation (e.g. personnel, organisation, technology, or: ‚how' should it be done?).

Task related strategies

For a university it is useful to formulate common strategic goals and challenges as concrete as possible, which can be understood as integrated achievements of the entire institution or of specific organisational units, rather than as the sum of individual efforts or as vague declaration of intent.

Increased efficiency in the first year of study

The background for the initiative Learn@WU at Vienna University of Economics and Business Administration was characterised by the following situation: For a couple of years, it has faced increased enrolments, which put enormous stress on its capacities and lead to the danger of bottlenecks

especially in introductory courses. As a response, the university planned to increase its efficiency by reforming its undergraduate curricula, organising a joint introductory phase for all of its six study programmes (Alberer et al., 2003). Based on these clear goals, the university received funding from the ministry of education.
Starting in 2001, the project was designed by two senior professors, one from business informatics, the other from pedagogy of economics. Both their high rank and their background in different disciplines contributed to the broad acceptance of the project. To maximise the impact, the project focused on 18 large enrolment courses. Staff for material production supported participating faculty members.

IT skills in the curriculum
In 1998 the College of Arts and Sciences at George Mason University set up its Technology Across the Curriculum initiative ((Agee and Holisky, 2000). The university already had experiences with the experimental use of technologies in education. Additional motivation came from the government of Virginia that offered initial funding for projects which focused on implementing IT skills in study programs for the arts and sciences. Jointly, the vice rector for information infrastructure and the dean of the college designed the initiative. A project team had internal planning sessions and additionally consulted employers from the regional business community for advice about their own demands for their future work force. As a result, the team drafted a list of 10 basic IT skills, which are now cultivated in normal courses throughout the entire curriculum and assessed on a regular basis.

Instrumental strategies

Frequently, the increased virtualisation of universities takes place in processes of research, education and administration without much comprehensive planning or strategic vision. As a result, universities sometimes are passively driven by technology towards organisational change, which influences internal structures, processes and workflows. To regain room to manoeuvre and the ability to take proactive choices, it is necessary to make technologies a subject for official institutional debates and policies, to establish a joint institutional understanding and to reorganise internal structures.

ICTs as a strategic subject
During the process of developing a general mission statement for Graz University, the use of information and communication technologies in education was made an important strategic subject (Pellert et al., 2005). Background for this decision was the experience that the technological infrastructure evolved in an self-determined and uncoordinated way. Additionally, the management recognised the potential of learning technologies for qualitative improvements of teaching activities. The mission statement

clarified the strategic institutional priority (teaching quality rather than cost savings or new revenue streams) and the responsibilities of different units (academic vs. service) with respect to decisions upon digital media.

Establishment
In 2001, the newly appointed management at Stuttgart set up a strategic initiative for the foundation of Uni Online[@32], a supplemental online infrastructure for its residential study programmes. The initiative was structured in three phases:

1. *Raise attention*: To raise the attention among faculty members for eLearning, the university set up the 100-online grant programme, awarding 5.000 € each for 100 applicants, who used digital media in their courses.
2. *Professionalise and integrate activities*: The programme self-study-online aimed at the development of materials for self-learners. This programme was targeted at academic departments and/or study programmes.
3. *Commercialisation*: The third phase foresaw the development of plans for the commercialisation of its products at the market for continuing education.

All three phases were accompanied by structural measurements, like the development of internal services (e.g. for didactical consultancy and material production) and the necessary technical infrastructure.

Reorganisation
To meet the challenges of increasingly digitised processes in research, education and administration, Karlsruhe University recognised the need to reorganise the structure of its service units. It merged several of its central support units and created the position of a chief information officer, who should be responsible to take a comprehensive institutional supervision on all information related processes, searching for underserved or missing functions as well as for overlaps and parallel structures (Juling, 2003).

It is obvious that task related and instrumental strategies should be related and coordinated, at least in the long run, and that their distinction not always it clear. However, it also is necessary to observe that it sometimes is useful to strategically focus on its internal structures and processes. Especially with respect to new information and communication technologies in education, it seems to be adequat for universities to gain experiences and to build up a joint understanding among its members before they can proceed and turn to more specific plans on what to do and how to deal with digital media in a way that they can have an impact on external environments.

Structures

If the assumption holds true that the tendency towards an increased division of labour is a characteristic of mediated education, it is necessary to conceptualise ways in which this division of labour can take place. An obvious way for observing this division is the distinction between academic and service structures, and the emergence of new service activities. Additionally, it can be helpful to analyse different ways in which teaching itself can take place. In any case, universities find different structural answers to the challenges information and communication technologies create for their organisation.

Academic structures

There exist several types of specialised academic structures that deal with the use of information and communication technologies in education, at least the following three: commissions, communities of practice, and specialised academic departments.

Commissions

Academic commissions can either be used as representative bodies to coordinate the interests of different academic units (e.g. departments, faculties). Or they can serve as temporary task groups to develop expertise or strategic advice, e.g. for selecting applicants for internal grants or for elaborating an institutional vision for the use of educational technologies.

Communities of practice

In the context of eLearning the evolvement of internal peer-networks or communities of practice are frequently observable. Often, these communities evolved spontaneously by the networking of early adopters, as a means to share eLearning experiences among peers, to give advice and to learn from each other. These communities need a forum for communication (often a virtual one), continuous contributions and reliable moderation to steer the process. Participation normally is on a voluntary basis, driven by personal interest for information, feedback and advice.

Specialised experts and departments

Another very typical academic form to react to new challenges and phenomena is the specialisation of experts and the foundation of specialised research groups or academic departments. This is also the case in the field of eLearning, where departments like the Stanford Center for Innovations in Learning (SCIL)[@33], or The Center for Open and Sustainable Learning (COSL)[@34] at Utah State University have been set up.

As valuable as these academic structures are, they also have their clear limitations. Since faculty members are predominantly engaged in their research and teaching, they only can afford to participate in commissions either on a short term basis or, if it is a permanent commission, with a very reduced amount of their time. Communities of practice can foster the subjected related debate and exchange among peers, but even the most enthusiastic early adopter will not be able to give advice to every newcomer in the field. And specialised academic departments are valuable pockets of expertise, which are established on a permanent basis for continuous, in-depth research. But their focus normally is rather on their disciplinary community, then on their home institution. Academic structures therefore can not fully substitute the need for reliable internal service structures, since they can not provide reliable and permanent support for all staff members.

Service structures

The use of new information and communication technologies at universities also led to a differentiation and expansion of service structures. The most basic of these are IT departments, which are often followed by supplemental service units for instructional services and media production. These units can either exist more or less separately from each other, or integrated in a more comprehensive infrastructure.

IT departments

Historically, IT departments often evolved from centralised computer centres to comprehensive service units with responsibility for the technical infrastructure of the university. Driven permanent technological development, their tasks expanded both quantitatively and qualitatively, e.g. from providing computers for a few administrative purposes, to comprehensive supply for all staff members, from maintaining individual desktop computers to building up computer networks and implementing large enterprise applications.

Instructional services and media production

While IT departments are mainly responsible for the maintenance of general hard- and software, they are normally overcharged with the responsibility of proliferating and consulting academic practices, especially in teaching. As a result, newer technologies, like learning management systems often lack the necessary uptake, or are used incompetently, if no systematic support for academics is available.

Universities can react to this problem by creating specialised positions or service units for instructional support and media production. An example for this is the Center for Flexible Learning[@35] (Zentrum für Flexibles Lernen, ZFL) at Salzburg University. It supports the community building

among teachers, trains in the use of the institutional learning management system, gives consultancy for media didactics, media production and also provides regular assessments of the quality of eLearning activities.

Integrated service units

A step beyond the foundation of supplemental service units is their comprehensive integration and coordination with other information-intensive units, like the IT department or the library.

In 1999, Basel University started a long term organisational development process to build up its LearnTechNet. The planning was based on:

1. *Needs analysis* (examining existing project and analysing additional needs)
2. *Analysis of best practices* (strategies and structures of three American universities)
3. *Analysis of existing structures* (definition of necessary support and comparison with the profile of existing support units)

As a result of this planning phase, it was possible to acknowledge those activities, which were already working well. Missing services were not provided through a new, additional competence centre. Instead, existing service units partly expanded their portfolio, if necessary and were better coordinated by the vice rector for education (Bachmann and Dittler, 2005).

Teaching structures

Traditionally, teaching at universities has been, and still often is, a highly individualised activity, single-handedly performed by the lonesome teacher. Technology and the evolvement of instructional support units do not necessarily change much of this situation, if they exclusively support the individual teacher and the single course. Therefore it is necessary to think in alternative teaching structures, like the course, the study programme and collaborative teaching.

Course

As mentioned above, the handcraft educational paradigm is characterised by a high autonomy, but also a comprehensive responsibility of the individual teacher for all activities in the teaching process, like the selection of contents, their presentation, instruction and supervision, as well as grading and some administrative activities. This activities are performed in the closed context of the individual course.

Study programme

The coordination at the level of the study programme can take place in different ways. Traditional study commissions mainly performed input control by deciding about the composition of study programmes by defining types of courses and about the selection of potential lecturers.

More advanced forms of coordination define measurable learning outcomes for the study programme and monitor results (e.g. completion rate), which are used as feedback for continuous work. The position of a study coordinator can be an indicator for this form of coordination, but also frequent meetings between the responsible lecturers, if they discuss content and didactical affairs of their study programme rather than administrative issues only.

Collaborative teaching

Collaborative teaching takes place, when teaching is regarded as a collaborative activity, when teams jointly decide on topics and content, when they collaboratively design didactical concepts and coordinate them among each other, when comprehensive study outcomes and success criteria are developed.

Team work like this allows to deal with different tasks in a more complex and differentiated way. Teams can be arranged according to different criteria, depending on the structure and the aim of a study programme. Organisational forms can be:

- Disciplinary groups (responsible for an academic discipline)
- Segment of the study programme (e.g. first year, second year)
- Cohort (e.g. accompanying one cohort throughout the entire study programme)
- Learning arrangement (e.g. distance vs. residential)
- Functionally differentiated (e.g. lecturer, tutor, technical assistant)

All of these forms to compose teams for collaborative teaching can be mixed and combined as well (Delhoofen, 2001).

TECHNOLOGY

The dimension of ‚technology' in this framework refers to the provision and maintenance of a stable technological infrastructure as a task of the university. This infrastructure has to developed according to academic and didactical goals, rather than adapting the organisation to technologies. Important aspects to consider are hardware, educational software and licence models.

Hardware

When digital media are going to be used in education, the technical infrastructure and the terminal equipment are important framework conditions. This applies both to the institution (e.g. servers, networks) and to end users, like teachers and students (e.g. personal computers, personal digital assistants, internet connection). The university has to know about the technical equipment of its students to design adequate learning environments and to make complementary investments.

Notebook and Wireless LAN

In 2000, the postgraduate study programme Telematik-Management at Danube University Krems for the first time was organised as a notebook-class. Each of the 25 students was equipped with a portable notebook computer. In parallel, the university set up a Wireless LAN (local area network) for all of its buildings, which allowed for wireless access to all local resources and to the internet (Günther, 2002).

This new infrastructure had two economic advantages for the university. The investment in notebooks paid back in two years, since the computers allowed to substitute the reproduction and distribution of hardcopies of learning materials. Additionally, the new infrastructure relieved from some spatial problems. Previously, it had been necessary to book special computer classes in addition to regular lecture halls and seminar rooms. Now, notebooks could be used everywhere on campus.

In addition to cost savings, the new infrastructure also had didactical consequences. Being relieved from hindering cables, it now became possible to use notebooks in different learning arrangements, e.g. during the lecture as well as for working in small groups. Permanent availability of internet connection also allowed to participate in classes, while working on other subjects or keeping contact to the outside world, without disturbing teaching. This proved to be especially helpful to increase participation in classes, since students of this study programme are adult learners, which have to stay in frequent contact to their regular work. Instead of moving in and out of classes to call their work place, they now easily could answer short requests via email.

Educational software

The main purpose of educational software is to support teaching and learning activities. There exist different types of educational software, like comprehensive learning managements systems, content management systems and assemblies of specific tools. Decisions on educational software should not only focus on functionality, but also consider different licence models, since they do have serious implications for the costs and academic freedom of higher education.

Learning management systems

Most products, which run under the title of learning management systems or virtual learning environments, should be more accurately termed course management systems, since they basically focus on supporting course arrangements. Normally, they show the following functionality:

- Web based course space for exchange of materials and communication
- Access is reserved for enrolled course participants only
- Differentiated roles (e.g. instructor, student, tutor), which allows to assign role-specific rights/options for the use of materials and activities
- Instructors can create materials, tests and assignments
- Students can edit at least some documents (e.g. homework submissions) and create responses (e.g. answers to test questions)
- Announcements and calendar
- Forum or discussion board
- Chat
- Etc.

In the past, the market for course management systems has been immature, which was reflected by a huge number of available products. As late as 2002, the Austrian ministry of education commissioned an evaluation to provide orientation for educational institutions. The study screened 90 software packages, which met a basic definition of learning management, and selected 16 for recommendation (Baumgartner et al., 2002).

Only in recent years, the market started to show signs of consolidation. In the meantime, Blackboard[@36] and WebCT[@37] (bought by Blackboard in 2005) became commercial brands with by far the biggest market shares, strongly challenged by the most popular open source products Moodle and Sakai.

Content management systems

As a critique on learning management systems, one can claim that course management systems digitally re-establish the walls of the classroom (and the handcraft educational paradigm), since they organise participants in courses of registered students. While this rigid demarcation obviously is necessary to protect the confidentiality of personal interaction (e.g. feedback, consultation, grading) in small groups, it hinders the exchange of other elements of the learning arrangement, especially of learning materials.

As a result, universities increasingly start to search for ways to foster the exchange of learning materials, and often implement content management systems as tools to serve this purpose. Additionally, providers (or local IT departments) try to connect both types of currently separate software packages. The problem of this arrangement is that it requires to move materials from one system to another, rather then to assign different access rights to materials within one system. However, it is predictable that course and content management will merge in the long run, since both the confidentiality of course interaction and the sharing of learning materials beyond individual classes are essential activities at higher education institutions, which are strongly interrelated.

Licence models

Software as a commodity differs in many respects from physical goods, e.g. with respect to its durability, its high dependence on environmental factors (e.g. standards and compatibility) and the necessity of organisational implementation. This also reflects in the economic rationale of software procurement and use, as well as in the way it is traded. (See also chapter 4.) Software can not be purchased, owned and managed in the same way, as one would do with a house or a car.

Universities have different options to acquire educational software. They can invest in home grown solutions, purchase commercial packages or make use of open source products. Each of these models has severe economic, but also long term organisational and political consequences.

Home grown solutions

In the late 1990s, several universities invested in the development of home grown virtual learning environments. This approach has the advantage, that software can be developed for the specific needs of the institution.

The problem of this approach lies in the long term perspective. Since virtual learning environments, like all software, tend to undergo continuous growth in functionality and have to be adapted to permanently changing technical environments, home grown solutions either have to be continuously updated or they become outdated. Additionally, they frequently lack compatibility with other systems, which hinders the exchange of data. From a managerial perspective, the dependency on a small group of developers is another problem. Most universities therefore stepped back from investing in the development of large and comprehensive applications.

Proprietary software

Proprietary software is a product that has been developed under commercial, profit oriented aspects. To protect these commercial interests, the source code (or: the ‚cooking recipe') is a secret only accessible to the vendor.

As a customer, the university does not acquire ownership over proprietary software, but only the licence for a defined number of users and for a limited time span. On top of the licence come cost for implementation, adaptation or extensions, as well as for upgrades. Especially multi-user applications, like course management systems, raise additional costs for organisational change and for staff training, which easily make a university dependent on a product.

Still, many universities decided for proprietary educational software, since it also offers a range of advantages for them. In difference to home grown solutions, large commercial brands promise to last for longer and to invest in the further development of their products. Additionally, commercial providers offer good documentation and manuals, as well as reliable (but costly) support. The university does not need to have all the expertise itself. But at least it should have some expertise to make informed decisions as a customer.

Open source software

Open source software combines some characteristics of home grown and proprietary approaches. In difference to proprietary products, open source software projects share their source code for free and make it open for critique and change. Any user with development skills has the opportunity to analyse, customise and improve the software. In difference to home grown solutions, open source projects care about the dissemination of their products via brokerage platforms like Sourceforge[@38], and try to build up communities of users and of voluntary software developers, who care enough about the product to contribute additional code. The essence of the open source development model is the attempt to create solutions within an open, collaborative environment, which promotes higher quality and long term viability of applications.

To a certain degree, the communication in the open source community resembles scientific communication (see chapter 4), e.g. with respect to the open exchange of ideas, the encouragement of critique as a mean for quality improvement. The rewarding system is meritocratic and based on the accumulation of prestige. To be successful, open source projects have to raise attention and significant uptake of their products, since this is the only way to establish sustainability and continuous development. Even if their

viability depends on the size of their community an on multiple contributions from various actors, successful open source projects are not organised in a basic-democratic way. Rather, small groups of core developers evaluate contributions from the community and centrally control, which functionalities and code elements are implemented in the standard versions of the product to guarantee consistency and avoid forking of developments.

Increasingly, the open source model gains momentum in academia as well. There are several approaches observable: the governmental programme, the grass root initiative and the institutional consortium.

Governmental programme
To set up the infrastructure for eLearning at schools and universities, the government of the German state Northrhein-Westfalia funded the CampusSource[@39] programme to foster the development of educational software. In the context of this framework, a number of different software products has been developed, ranging from web based literature management for workgroups, to learning management systems and student administration.

Free software project
The learning management system Moodle[@40] is an example for an international grass root project for the development of open source software. Founded by Martin Dougiamas and first released in 2001, this software became hugely successful in the recent years. According to its own Moodle statistics, there exist more than 14.500 registered sites in 158 countries. About 150 of these sites cater for more than 5.000 students each (as of August 2006). Given these market share, Moodle is the second largest brand for learning management systems.
While Moodle remains a free software project, steered and controlled by a group of core developers, higher education institutions and companies get involved in the development as well. E.g. the Open University currently works on the establishment of the largest Moodle installation for its more than 200.000 students and will contribute its own innovations to the software project. Commercial Moodle partners provide a range of optional services, like hosting, technical support and consulting.

Institutional consortium
In 2004, University of Michigan, Indiana University, MIT, Stanford and uPortal joined forces to collaborate on software development in the Sakai Project[@41]. They decided to integrate their separate products (portal software, learning management system, student administration, workflow management, etc.) to a comprehensive system for higher education institutions and to disseminate this package as open source. Several aspects of this project are remarkable:

- The four universities committed themselves to simultaneously implement the software, which guaranteed its actual uptake and usage. Technical and organisational developments are closely linked.

- The project specified clear technical standards for the future development of the software, which provides guidance for individual adaptations.
- The project also set up an educational partners programme. Rather then just making the software available, the project actively approached other institutions to make use of the software, further develop it and contribute their experiences to the community.

Since higher education institutions have similar problems with finding and integrating software for various purposes, the rationale of this initiative is to share costs and risks, as well as to establish general standards for the academic community. The larger the community of users (currently about 80 institutions) becomes, the better the chances for viability of the product are.

It is important for universities to be aware of open source as a possible alternative to proprietary software, an alternative many will find more cost effective and supportive to academic values. This alternative also has to be defended: In Summer 2006, Blackboard sued a commercial competitor, claiming to hold patent rights for the broad idea of course management systems. Even if the company denies to have plans for approaching Moodle and Sakai on the same issue, the open source community for educational software is furious, since it is afraid the lawsuit might establish a precedence for attacking academic open source developments as well (Pope, 2006).

CONCLUSIONS

This chapter started from the assumption that education can be regarded as an achievement of the entire university as an organisation. To observe effects of information and communication technologies on the organisation, three dimensions of external relations (product, content, market) and three dimensions of internal relations (personnel, organisation, technology) of the institution have been distinguished. This allows to formulate six decisive tasks for the university in dealing with digital media.

Definition of products

New information technologies change the products of universities and the way they can be interrelated. Distinguishing the products material, teaching activity and student services, one can observe that digital materials offer global options of use, while services and teaching activities can not be expanded in the same way, since they are still limited by the capacity of individuals to interact.

Apart from learning materials, scholarly publications and primary sources are the most important academic materials. The digitalisation of all these materials facilitate archiving, which allows for new forms of dissemination and publishing.

In the near future, traditional residential study provision will not be substituted by distance study programmes. Rather, it can be expected that the distinction between residential and distance learning arrangement blurs, and that blended learning scenarios will gain importance.

In addition to the provision of materials and teaching activities, student services can be facilitated with the help of technologies. They can facilitate the study career of students and also evolve forms of academic guidance outside the regular course setting.

For universities, it is important to define, which of their products they want to innovate with the help of digital media. The distinction between different types of products allows to observe or create new forms of interdependences between them.

Distinction of content

Information and communication technologies do not only influence the external form of products, but also the contents and subjects universities deal with. Therefore it is necessary to distinguish disciplinary differences, information technologies as a topic for analysis, and IT competences and information literacy as an educational goal.

Due to their different contents, academic disciplines vary much in their practice of instruction. Mathematics deal with formulas and geometric symbols, language studies with acoustical examples and their repetition, while humanities and social sciences strongly rely on the research of primary data and the interpretation of text.

Information and communication technology become a research subject, not only in computer sciences, but also all other disciplines, like humanities, law, medicine or the social sciences, a fact that has to be reflected in education, courses and study programmes.

Since digital media also become part of the research practice and the way different disciplines are performed, the training of IT skills becomes an important issue for higher education. The progress of the digital revolution is accompanied by an increasing demand for information literacy on an academic level.

Universities have to specify, which contents they want to disseminate with digital media and adapt their strategy to them. E.g. many cases it can make more sense to flexibly orient on the specific teaching practices of a discipline rather than to standardise didactics within an institution.

Positioning at the market

Universities have to adapt their use of digital media to their actual market position or to the position they want to achieve. Relevant for the analysis of the market situation are target groups, the competitive advantage they want to achieve, distribution channels and funding.

Especially for traditional universities it is necessary to see that digital media will not immediately change their target groups an the related business models. Digital media will not automatically change residential into distance education and public funding into for-profit revenues. Keeping this in mind, information and communication technologies can offer ways to explore new markets and potential additional revenue streams.

To increase the impact of investments and efforts, universities should specify their expectations, e.g. if they aim at achieving cost savings or quality improvements. The institutional debate on goals and the specification of expected outcomes will help to assess success and failure of technology driven initiatives.

Institutional portals are important tools for universities to present themselves and their products on the market. Additional, they can also use other repositories and distribution channels, like brokerage platforms and specialised search engines to raise their profile.

Universities have to position themselves on markets, which increasingly communicate on the basis of digital technologies. Accurate knowledge about these structures and a clear assessment of the own potential how and where to participate are prerequisites for institutional success.

Support of personnel

To establish the use of information and communication technologies throughout the university, it is necessary to involve faculty members and to take care of their capacities and needs. From a staff development perspective, it is necessary to inquire existing competences, to invest in training and to create rewarding systems.

Normally, competences to deal with digital media are unevenly distributed. It is necessary to assess the distribution of competence levels and different motivation, before one can develop adequate support measurements.

Staff training can be offered either internally or by external providers. In any case, training has to go beyond the mere introduction in technical functionalities and also contain didactical training as well as the familiarity with organisational procedures and practices.

To raise the motivation of teachers for the use of digital media, rewarding systems like supplemental funding, academic reputation and institu-

tional acknowledgement (e.g. competences as a career requirement, responsive salary structures) are necessary.

Universities have to invest in the support of their personnel, if the broad uptake of digital media should become a success.

Developing the organisation

Organisational development is a prerequisite for the effective use of educational technologies. Main aspects are institutional strategies and internal structures.

Some institutional strategies are more task related and focus on the outside of the university, while others are more instrumentally oriented and deal with structures, processes and staff development. Even if in the long run universities should try to combine both aspects, it sometimes can be adequate for a while to focus on one side of the distinction specifically. E.g. it can be useful to set a short term priority in the dissemination of educational technologies as a mean for the institution to become more familiar with its possibilities, before focusing on possible product innovations or new target groups.

Structurally, universities develop a variety of different academic forms to investigate, discuss and decide upon educational technologies. However, it is evident that these academic structures can not substitute support units and services. Additionally, it is helpful to consider different forms of teaching structures, which can be supported, like the individual course, the study programme or collaborative teaching.

Generally speaking, universities should regard their increasing use of information and communication technologies as a learning process with the need and opportunity for constant organisational development.

Providing technology

A reliable technological infrastructure is another prerequisite for the effective use of digital media in higher education. Important aspects of this infrastructure are hardware, educational software and licence models.

Universities have to consider both their own hardware as well as the terminal equipment and the internet connection of their students to be able for complementary investments and for adapting their educational arrangements.

Even if learning management and content management systems are not the only options, they still are the most common types of educational software and therefore are essential for academic computing. Learning management systems are more focused on educational activities in courses,

while content management systems can support the exchange of materials beyond the classroom.

Since software constitutes both costs and considerable predefinitions for academic activities, the economic and logistic implications of different purchasing options are of crucial importance for universities. While home grown software applications promise flexibility, their long term viability is questionable. Proprietary software does not award ownership, but only the right to use for a limited number of users. Open source software (sometimes) offers cost savings for purchase, more viability via international groups of developers and options for flexible self-adaptation via its open source code. Additionally, its development resembles in many aspects that of scientific innovation.

The provision of the technological infrastructure is more complex than and different from the provision of the physical infrastructure, like buildings or lecture halls. Since it has many implications on academic activities and high costs, it should be regarded as a crucial task of the central management of a university.

The conceptual framework of six organisational dimensions for the use of ICTs at universities, which has been elaborated in this text, is intended as an instrument to analyse and compare eLearning initiatives and technology related projects at higher education institutions. Individual initiatives and projects in practice never can be exclusively attributed to only one of the provided dimensions and aspects, since they are analytic categories. Rather, initiatives will be characterised by their specific combination of these dimensions.

Chapter 7

The development of an eLearning strategy at Klagenfurt University

„Klagenfurt University's goal is to to overcome ‚borders of the mind'."

Günther Hödl,
late rector of Klagenfurt University

The following text uses the conceptual framework of ‚six organisational dimension for the use of ICTs' as an instrument to describe an institutional case study at Klagenfurt University. It shortly sketches the national context for eLearning initiatives in Austria and the definition of institutional case studies on organisational development in relation to the implementation of information and communication technologies at universities. The main part describes the author's involvement in the process to develop an institutional eLearning strategy and a to set up comprehensive eLearning project at Klagenfurt University.

ICTs IN THE AUSTRIAN HIGHER EDUCATION SYSTEM

Early funding policies for eLearning

Apart from investments into basic infrastructures, the first reaction of Austria's higher education policy to the growing importance of eLearning was to contribute to international awards, like the *European Academic Software Award* (since 1994, in collaboration with Germany, France, the Netherlands, Norway, Sweden and the UK) or the *Medidaprix* (since 2000, in collaboration with Germany and Switzerland). In addition, grant programmes for the development of learning materials were established. In 1998 and 1999 the programme for multimedia teaching material (*Multimediale Bildungsmaterialien*) spent €1.5 million in two consecutive calls. From a total of 91 applications, an expert jury selected 19 projects for funding (bm:bwk, 2000).

New media in teaching

At the beginning of the new millennium, the Ministry of Education set up a larger grant programme for new media in teaching at universities and Fachhochschulen *(Neue Medien in der Lehre an Universitäten und Fachhochschulen, NML* [@1]*)*, providing a total budget of € 8 Mio. for three years from 2000-2003. The programme was part of the broader eFit platform[@2], where the Ministry aimed at coordinating projects in all education, science and culture sectors. eFit was one of Austria's responses to eEurope, the respective initiative of the European Commission, which was presented to the Council at the Lisbon summit in 2000.

Compared to other European countries, the Austrian programme new media in teaching came comparatively late, but this made it possible to draw from the experiences of other countries. As a result, the initiative did not invest in mere infrastructure. Instead, it focused on the community building with respect to eLearning in the national higher education system, supporting the networking of key actors as well as issues of organisational development (Ecker, 2003).

In the context of rather tense relations between the Ministry and the higher education institutions, especially in the university sector, the programme also marked a policy shift, from a traditional administrative, top-down towards an innovative, more participatory approach, that combined project management with network development. With the help of two consultants for organisational development, the Ministry created a complex framework concept to shape the process of cooperation between institutions. Moderated by the consultants, an expert workshop was used to develop a strategy paper (bm:bwk, 2000) as the guiding document, defining the goals, the structures and the instruments for the programme (Grossmann and Lobnig, 2004).

Taking the network as constituting principle, the Ministry invited the management of universities, faculties and the Fachhochschulen to nominate delegates, which were both competent in the subject of ICTs/eLearning and integrated in key positions of their organisation. These delegates formed the core of the forum new media (*Forum Neue Medien, FNM*), a network organisation formally established in a first kick-off meeting. One of the first tasks of the forum was the election of 6 of its members as delegates, representing the forum in the steering group for the programme new media in teaching. The steering group consisted of 15 members, composed out of 6 delegates from the forum, 6 national and international eLearning experts as well as 3 representatives from the Ministry as the sponsor of the programme (Grossmann and Lobnig, 2004).

For the entire duration of the project, the steering group became the main decision making body. Providing the formal frame for joint decisions of the Ministry and the higher education institutions, the steering group developed the criteria for two consecutive calls for proposals and selected 25 projects for funding. Apart from the emphasis on didactical concept, the main criteria for successful proposals were the need to join forces in consortia with other institutions and the need to demonstrate sustainable implementation in the organisation of the applying institutions (Grossmann and Lobnig, 2004).

After the end of the funding periode in 2003, the forum new media was encouraged to sustain the established network, which had become the central platform for the exchange of information, debate and cooperation on eLearning in Austria. The delegates decided to set up an association, called forum new media – Austria (*Forum Neue Medien Austria, FNM-A*), which was funded by its member institutions. Since the steering group did not exist any more, a presiding committee was elected.

As Grossmann and Lobnig (2004) explained, the combination of project management and network development has been crucial for the success of this initiative. Networks of this size do not spontaneously evolve, but have to be carefully structured and designed to provide an adequate setting for cooperation. This design and the advocacy for the new structure were the main tasks of the involved consultants. Clear leadership, as it was performed by the steering group, did not contradict, but rather was a prerequisite for effective network cooperation. It was possible to establish the steering group not just as a mere advisory board for the ministry, but as a decision making entity, jointly carrying the responsibility for the entire project. On the other hand, the design also established productive links between the project and the routine organisation of the Ministry. Members of the Ministry participated and chaired the steering group, and the Minister committed herself to support the decisions of the group.

Apart from the strategic steering and management of the initiative, the actual cooperation in the network had to be structured as well. The forum new media *(FNM)* was designed as a network of individuals and organisations. To guarantee the involvement of higher education institutions (rather than only individuals), the management of higher education institutions was asked to nominate delegates, which were both in decision making positions and interested in the issue. The establishment of a support structure (called *Serverprojekt*) was essential to facilitate community building by organising biannual business meetings of the forum, providing monthly newsletters and maintaining a central website.

eLearning/eTeaching strategies

After the successful completion of the programme new media in teaching, the outcome and the effect on the Austrian higher education system was evaluated. Several universities and Fachhochschulen had recognised the need for institutional strategies and started to work on respective developments. The management of higher education institutions began to identify the strategic orientation for eLearning as part of their core responsibility, and the need to set up specialised support structures for eLearning (Baumgartner, 2003). The programme new media in teaching had been successfully raising the awareness of the higher education system for eLearning and in putting the topic on the agenda of the institutions. But now it had become necessary to develop adequate decision making structures, and to invest in organisational and in staff development (Pellert, 2003).

Responding to the feedback from the community and to the clear request for initial funding for strategic developments, the Ministry set up a consecutive grant programme for eLearning/eTeaching strategies at higher education institutions *(Entwicklung und Umsetzung von e-Learning/e-Teaching-Strategien an Universitäten und Fachhochschulen*[@3]*)*. In contrast to the prior programme, it was more focused on the development of priorities for the individual institutions.

On a general level, the grant programme wanted to lever the potential for the innovation of products and processes, to improve access to education and to contribute to gender mainstreaming by developing the organisational framework conditions for eLearning. In directly addressing the management of higher education institutions, the call aimed specifically at

- the development of institutional eLearning/eTeaching strategies, that were rooted in the central institutional management,
- the support for organisational development and staff development measurements,
- the sustainable continuation of existing activities,
- safeguarding the participation in the institutional network, that was represented by the association forum new media.

With a total budget of € 3 Mio. for about 40 eligible higher education institutions, funding had to be allocated on a competitive basis. Grant recipients would be selected by an international jury. Successful projects would receive co-funding of 60% of the total project costs for the first twelve month after its start. The call for proposals was published in November 2004 and anticipated the actual start of the co-funding period by late autumn 2005.

INSTITUTIONAL CASE STUDY ON ORGANISATIONAL DEVELOPMENT WITH ICTS

Defining criteria for potential cases

After having done much desktop research on the impact of ICTs on the organisation of higher education institutions, I found it useful to enrich my studies with fieldwork as well. I wanted to investigate a case of organisational development that was linked to the use of ICT in the key functions of a university. Due to practical considerations (prior knowledge of the field, personal contacts to possible actors, etc.), this case should be located in the Austrian higher education system. I already had participated in several ICT projects, but they did not qualify for the purpose of my study.

Even if this definition of the prospective research object seems to be very broad and general, it served as a very selective filter. It excluded ICT projects that lasted only for a short period of time, without showing a clear impact on the organisation, e.g. by generating or changing sustainable organisational structures or by being implemented in the permanent processes and workflows of the institution. (In this respect, many ICT projects at universities resemble traditional research projects: After the funding period is over and the participating researchers have lost their interest, the only remainings are knowledge resources, like publications, learning materials, software, and contacts among researchers.) The filter excluded small scale projects, which might have had some organisational impact, but only for a single course, a small department or a study programme, since I was interested in the developments of larger organisational units, like a faculty or an entire institution. And it excluded those universities, which did not have significant ICT developments on an institutional level, or only for administrative purposes, since I wanted to observe more than deficits or missing phenomena.

Another pre-condition not mentioned yet was my goal to participate in a case of ongoing organisational development. I did not want to only take an historic perspective, listening to the war stories of some veterans in the field. My ambition was to observe the process of organisational development in the making. I wanted to contribute my findings to this process and learn from the reactions of the various actors.

Being rejected by prospective case study institutions

Given this set of pre-conditions, it turned out to be more difficult to find potential cases than to select from them. Having had the comparison of many international examples, my expectations might have been a little bit too high, therefore it took me some time to find possible candidates in

Austria that met my criteria. With the help of my PhD-supervisor Prof. Pellert, who supported me with her well known name and reputation, I started to approach the management of the selected institutions. I proposed to investigate existing ICT applications of the university in the areas of education, the web-portal and the presentation of scholarly knowledge resources. Systematically using an institutional perspective, I suggested to work out options for the further organisational development of the respective university.

What I regarded as a very good offer of free work and valuable expertise, customized to the needs of an institution lucky enough to be selected by me, was not received in the expected way. In the case of University A, the head of the central eLearning support unit was very much in favour of my proposal. However, my contact person convinced me that the responsible vice-rector would never approve of such a project, if it was carried out by an outside researcher. In the case of University B, the responsible vice-rector already had consented to my proposal, but only to withdraw his approval two weeks after, since the suggestion was met with unexpected resistance from internal actors.

Even if these rejections were frustrating for me personally and led to a delay in my work, they still carried a lot of useful information. Given my experience as a higher education researcher, who frequently approaches higher education institutions in Austria for similar requests, I supposed a variety of possible reasons for these rejections. In the past, potential interview partners have mentioned a lack of time and a general annoyance for being interviewed too frequently as explanations for their reluctance. Others showed concerns that research might find embarrassing details about internal conflicts or organisational weaknesses. In a few cases, people also wanted to avoid the revelation of strategic business information to their competitors. In most of these cases, I succeeded to convince my potential respondents that I would not unnecessarily waste their time, that I would not make any information public without their consent, and that instead I would provide them with opportunities for positive publicity and with valuable input for reflection.

This time, the explanations have been different and left me with no option to negotiate. Even more striking was the similarity of the feedback I received from my informal sources. In both cases, the reason for the rejection of external research was motivated by the internal research interest of the institution. As an informal contact person in case B put it: *„Since we had the gruelling work to develop our institutional ICT projects, we also want to exploit them in terms of research.“* The contact person in case A used much the same argument, stating that the responsible vice-rector

wanted to reserve the right to present and publish on central ICTs projects for members of the institution.

Out of two reasons, these responses were still fruitful for me. First, they supplied me with excellent evidence for the hypothesis of modern systems theory that academic institutions relate easier to academic than to economic mechanisms. In both cases, the universities were concerned about academic currencies like scholarly publication and academic prestige, not about money. Second, these responses demonstrated the significance of ICTs at universities exactly with respect to these academic currencies, an assessment coming from the institutions themselves. Quite obviously, both institutions saw their organisational ICT developments as valuable sources for research, with high potential for academic prestige. For me, it was the first time to observe that universities regarded any of their organisational developments as interesting research objects. Both institutions found it necessary to protect the prior access to these research objects, a clear sign of the high esteem they attributed to these developments in terms of research assets.

Admittedly, the rejections might partly have been caused by my humble experience with organisational development. Even if I proposed to coordinate my research with the management of the respective institutions and to provide them with feedback and recommendations, intending to contribute to their organisational development in a collaborative way, it seems as if I was perceived as an external investigator, mainly serving my own agenda. Maybe more experienced consultants for organisational development would have been more successful in convincing the responsible decision makers that the proposed project could improve the internal potential of the institution, e.g. by proposing to strengthen the organisational potential to research and develop the own institution. Being interested in the active development of institutions as part of my work as a higher education researcher, I clearly have to improve my competencies in approaching institutions and designing working relationships that allow for research driven organisational development.

As a consequence of these two rejections and especially due to the first part of the explanations, I turned to my own institution, Klagenfurt University.

THE DEVELOPMENT OF AN ELEARNING STRATEGY AT KLAGENFURT UNIVERSITY

Approaching my Klagenfurt University

The Alpen-Adria University of Klagenfurt is a regional university, located in the south of Austria. It is subdivided into three faculties (Economics and Informatics, Humanities, and Interdisciplinary Studies) and has about 8.000 students enrolled.

As a member of the former Institute for Interdisciplinary Studies (IFF), I am connected with this university both through long-term and loose, as well as through short-term and close contacts. In the past, IFF had been affiliated with universities in four different cities (Klagenfurt, Vienna, Graz and Innsbruck). The institute therefore had had inter-universitary status, it was loosely controlled by a board formed out of delegates from four universities. The new University Act 2002 (Universitätsgesetz (UG) 2002) increased the organisational autonomy of the Austrian universities. IFF lost its inter-universitary status and became a faculty and full part of the University of Klagenfurt by January 2004. Due to this historic development, about 40% of the IFF faculty, including the office of my department (IFF Higher Education Research), were still located in Vienna, while the main campus of the university is in Klagenfurt, in about four hours travel distance. I became a new member of the university, both historically and geographically located at the periphery of the institution.

Similar to my previous attempts, I contacted the central management of the university (rector plus his two vice-rectors) via eMail. I proposed to investigate existing ICT applications and services of the institution, and to work out perspectives for the further organisational development. I attached an extended version of this proposal (3 pages A4), which contained my theoretical framework model (six dimensions to analyse the ICT applications and structures at a university, see chapter 6). As a prerequisite for my work, I asked for an official order by the central management, for the nomination of a responsible contact person with decision making competencies, for a member of staff to deal with operative questions and for support in specifying my research objects and agenda. Doing this, I tried to gain the commitment of the management team, to co-create a kind of official client-consultant relationship with the institution and to involve representatives of management in the development of the project objectives.

This time, I was luckier than in the previous cases. The management team agreed to my proposal and decided to make the vice-rector for research my contract partner for this project. In a first phone call, he made it clear that there was no coherent institutional strategy in place for the issues

I had mentioned in my proposal, especially no eLearning strategy. Even if several faculty members were involved in eLearning activities or projects on an individual level, there was neither a policy, nor a budget or a member of staff to coordinate eLearning at the institutional level. However, the management team saw my project as a possible contribution to a debate on these issues, a debate that should lead to a clear institutional decision for or against specific policies and the accumulation of respective resources.

One week later, we met in Klagenfurt. To my surprise, I was faced with a larger group of people, e.g. both the vice-rector for research and the vice-rector for education, representatives of the units responsible for the web-portal and for the IT infrastructure, as well as two of the most experiences faculty members in eLearning. In composing this group, the vice-rector for research partly reacted to the scope of my proposal, but also to his own interest to coordinate people, who work on the same topics, trying to avoid parallel developments inside the institution. I improvised a small presentation of my research goals and collected reactions and additional ideas from the group. The vice-rector for research asked the group to identify hot spots of ICT applications and of prospective interview partners. For me, this first meeting was very successful, since I was introduced to a larger group of key actors, received the official backing from the management team and quickly gained information about the institution.

Doing interviews

By October, I started with a series of interviews by contacting people which have been named to me. Providing them with a written description of my research topic and of key issues I was interested in, I asked them from the perspective of their organisational unit and working context, which forms for the use of new media in research and education they observed, and which were the anticipated effects for internal and for external relations for their organisational unit. I also invited them to speculate about possible future uses of ICTs they would either see as attractive or as problematic.

Very soon I realized, that the use of ICTs still was a very fragmented activity at the university. It was hard to get an overview, since people did not know much about each other. Some had even been wrongly percieved to be interested in eLearning, others had not been known yet. I learned about a vast variety of practices, tools and ways to use these tools.

„No, this is not proper eLearning, it's only ...“ Frequently, respondents did not regard their practices as very special or remarkable, either because they regarded technology only as a minor aspect of a more general teaching activity or because it was so self-evidently integrated in their everyday life,

that they had not been aware of the specific use of ICTs any more. On the other hand, their own expectations on eLearning and the use of ICTs seemed to be too big to keep up with and made it difficult to appreciate smaller gains. This conceptual reservation was especially to find in non-technical studies, which were less confident in attributing significance to their, often very interesting, uses of ICT.

These very personalised views on eLearning, focusing on own experiences and practices, also seemed to make it difficult to take the position of an organisational unit, and to imagine possible demands for and effects of ICTs on a larger scale. For me, it became obvious, that it would not be possible to develop a general picture of the institution just by aggregating individual views in a bottom up approach. However, I also observed a certain interest in reflecting on the use of ICTs in research and teaching, as well as in getting specific information and orientation. In the interviews, I shared some of my own experiences and information about resources, which could be of relevance for a specific respondent. In most cases, this was received with interest.

Appart from these valuable insights in many different activities, the interviews were also a good opportunity to get familiar with (for me) remote parts of the university.

Getting involved in the development of an eLearning strategy

By the beginning of November, the two vice-rectors sent out an invitation to set up a group for the development of an institutional strategy for eLearning and the use of ICTs at the university. For the first meeting, they invited ten people, both faculty and support staff, whom they assumed to be interested to contribute. Most of the addressed actors followed the invitation, but a few also stayed away, indicating to either be misinterpreted or to have lost their previous interest in eLearning.

The first meeting was organised under the title "Quo vadis E-Learning?" The vice-rector for research had prepared an agenda to discuss the general motivation for an institutional eLearning strategy, the goals and the composition of the workgroup, as well as the timeframe and organisational issues.

With respect to the general motivation for this strategic work group, the vice-rector for research wanted to prepare the basis for a debate in the extended rectors team (*Erweitertes RekoratsKollegium (ERK)*, a group composed out of the rector, both vice-rectors and the deans of the three faculties). He planned to bring about a formal decision, if the university should set up an institutional eLearning policy and implement it in its development plan. This motivation was increased by the announcement of the min-

istry of education to set up a competitive funding programme for institutional eLearning strategies by February 2005. Additionally, there have been some minor operational questions to deal with, which created a need for institutional responses as well.

Soon the need for orientation about the status, the goals and the understanding of eLearning at the university became apparent. We would have to differentiate between heterogeneous external conditions, various technologies and services, as well as between procedural questions to achieve possible institutional goals.

In its composition, the workgroup tried to reasonably reflect the diversity of the university with representatives from all three faculties. To achieve this, we decided to search for possible members from the underrepresented Faculty of Humanities. The responsible units for IT infrastructure and for staff development have been fix starters, other support units should be asked optionally.

Given the composition of the workgroup and the timeframe, we agreed to meet three times before the next session of the extended rectors team, which would take place by the end of December. My suggestion to have a more complex design, e.g. with two subgroups (support and faculty). and a longer development process to involve more people, was rejected. All members of the workgroup participated on a voluntary basis, basically. There also was a lack of resources to steer such a process. No staff member was specifically responsible to coordinate eLearning or related issues on an institutional level. In practice, it was the vice-rector for research, who organised meetings of the workgroup and centrally steered the communication. Therefore it was seen as imperative to make cautious and efficient use of the group, without wasting anybodies time, an assessment I soon had to agree.

Vision for 2008

The vice-rector for research invited me to join him in the preparation for the next meeting of the workgroup. He asked the group to envision the state of eLearning at the University of Klagenfurt in 2008, which directed our thinking towards the pro-active development of a desirable future. To thematically structure our debate, I suggested to distinguish between external relations (e.g. the market situation with supply and demand for eLearning) and internal relations (e.g. the organisational structures, support activities and technical instruments). Using the affiliation to organisational units as the distinctive criterion, we split up in four small subgroups: management. Faculty for Economics and Informatics, Faculty for Humanities together with the Faculty for Interdisciplinary Studies, and a joint subgroup

for the support units. These specific subgroups proved to be efficient for the development of ideas, which later were collected in the plenary session. During this process of collection, the vice-rector for research documented the contributions visibly for all, using a software for mind maps. After the meeting, I tried to integrate the contributions and to develop substantial categories out of them. As always, the report was returned to the group.

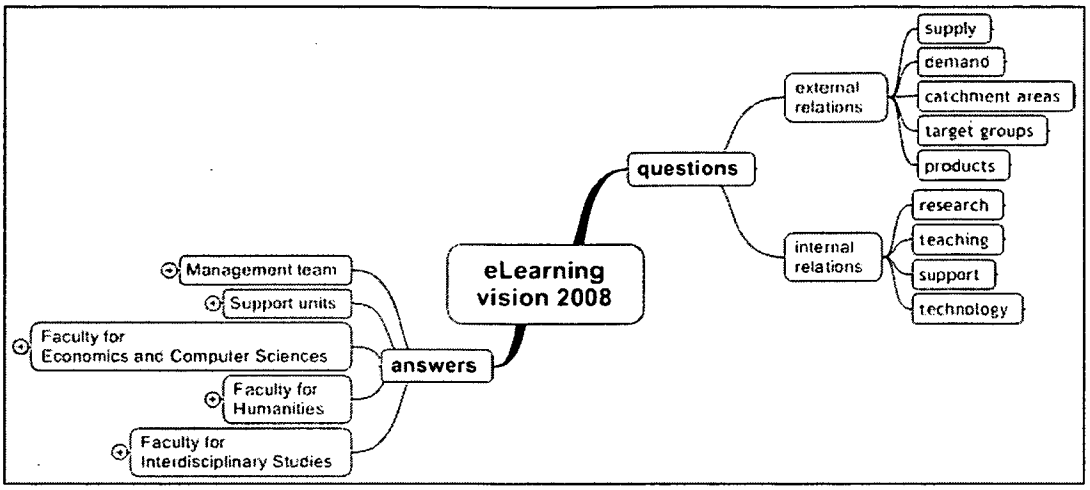

Figure 1.: Example of a mind map, used for the development and the documentation of a joint perspectives

Defining external priorities

Since the vice-rector for research has defined the formulation of priorities and the sketching of steps for their realisation as his two main concerns, I thought this would fit well to the distinction between internal and external relations of the organisation. I proposed to use the next two meetings to work on these aspects, using the first one to focus on defining external priorities.

As an input, we provided them with the condensed categories, which were derived from the report of the last meeting:

- Competition: how should the university position itself?
- Cooperation: how should the university cooperate?
- Catchment areas: Which are the relevant?
- Target groups: Which are the relevant?
- Product 1: traditional study programmes (bachelor/master).
- Product 2: international study programmes.
- Product 3: continuing education.
- Product 4: other products.

We asked the same subgroups to agree on one statement per category, which of the collected goals in this category would be the one of special importance, and which would be the easiest one to realise from the perspective of their organisational unit. The debate was very good for deepening the joint understanding of the external situation. However, I was a little bit disappointed with the not-too-selective effect of the voting system, which also turned out to be quite complicated to handle during the session. As a result, I had a hard time to summarize all responses to a condensed picture.

Sketching steps for the realisation

In analysing the responses for the next meeting, I found it useful to distinguish between more general, strategic goals (e.g. the institutional position, catchment areas and target groups) and more specific, operational goals (e.g. different products or types of products). The discussion on the strategic goals has been useful to establish a differentiated picture of the specific environment of the Alpen-Adria University Klagenfurt for possible eLearning scenarios. Now we could take this point as settled and focus on the question of how to realise the following operational goals:

- eLearning in traditional study programmes
- eLearning in international study programmes
- eLearning in continuing education
- EduTech Modul for teacher training
- eLearning content pool
- eLearning competence centre

Given the reduced number of participants in our work group, we split up in three subgroups, each one discussion two of the mentioned products. Searching plausible steps for the realisation, we provided a written template, asking the subgroups to answer the following questions:

- Specify your (sub)goals.
- What is already there?
- What is missing?
- Who should be responsible for the realisation?
- Estimate the required resources.

The time reserved for the session proved to be too short to answer the full range of questions. The most difficult one was the question on resources, since it would have required more elaboration and agreement on the previous questions. However, we collected a good sketch of the complexity of tasks to be realised for any of the mentioned goals.

Discussing a draft report of the work group

Since we wanted to present the findings of our workgroup to the extended rectors team, I immediately started to prepare a draft of a strategy paper on the basis of our documented debates. Time was pressing, since the next meeting was only 1 ½ weeks, and the deadline for our report only 3 weeks away. The vice-rector for research did some editing and forwarded it to all participants. He also proposed the name GELSE *(Gruppe E-Learning StrategieEntwicklung)* for our workgroup. The acronym is the German word for mosquito and should be a picture for our willingness to show constructive persistence in the future.

The name was better received than the paper. While joking about different unpleasant implications of the word, we easily accepted GELSE as a catchy name for our group that worked better than any full title. The paper was a different case. What took me by surprise was the level, where the critique was developed. I had expected to discuss on the detailed level of specific chapters and paragraphs, but the disagreement was more fundamental, aiming at the whole paper.

Part of the group perceived the paper as too general, as kind of naïve and as far from being ready for decision. Among some of the more experienced members, it rouse memories about annoying episodes of similar ventures, when workgroups like ours had extensively worked out reports preparing institutional strategies in several time consuming steps, reports that only gained *"first class funerals"* by the rector. The lack of concrete numbers would make the paper vulnerable and would lead to a similar fate.

For me, the critique was confusing and hard to take. In the beginning, I mainly saw my own problem, of how to translate the responses into changes in the text. The need for changes seemed to be substantial. My understanding of our work was that we had explored and prepared the field of policy options to start a debate on possible institutional strategies, not that we had already aimed on delivering final solutions. To go more into detail would have overstretched our resources as a workgroup, or at least my own ability as the author of the draft.

After a while, the focus of the debate shifted from a general critique of the text towards the question of how to gain the commitment of the central management. Even if we did not fully agree in this point, it became apparent that we could not produce much more concreteness and security in our proposal, although it would have been helpful for reducing some anxieties. In this situation, the head of the IT support unit came up with the suggestion to ask for experimental money. The university should set up a special budget for eLearning, which should be continuously expanded by 30% every year, for a period of four years, to create a middle range development

perspective. Our set of policy options could be a possible framework for the use of this money without too rigidly determining every single expense.

After having incorporated these responses and suggestions, I circulated the paper in the workgroup with a request for written responses. Both structurally and in content, the text tried to reflected as many elements of our ongoing debate as possible. E.g. for each policy option or product group, a visionary goal for 2008 was formulated, the current situation was described and possible steps for the realisation of the goal were sketched.

Apart from many responses on details, which hugely improved the text, the most important structural contribution was the request for a description of eLearning options. A professor for informatics with much experience in eLearning projects said, we should not assume that decision makers would be aware of the full scope of eLearning options and therefore we should provide them with an short overview on the variety of options and applications to avoid wrong decisions. Interestingly, this short overview about two paragraphs caused some questions of understanding in our group already, since several of the mentioned options have been unknown to some members. This sequence in our debate is a sign for the complexity of the topic, for the lack of common understanding of eLearning even among interested actors and pioneers in the field, and for the resulting need for orientation.

Report of the strategy work group

In the preamble, the final text was framed as a desirable scenario of eLearning at the Alpen-Adria University Klagenfurt in 2008. It was stated that an elaboration of an institutional strategy could only be elaborated with the commitment of the extended rectors team and with clarity about the available funds. A paragraph on eLearning options described eLearning as a generic term to cover a variety of ICT applications in educational activities. Given this broad definition, it was made clear that eLearning is a complex, ongoing development in which a modern university has to participate, or it will risk to loose its contact to parallel social and technical developments in society. To keep up with these changes is more than a task of individuals. It is also the task of the institution, which has to develop organisational structures and processes to observe these changes and to translate them into necessary consequences for the organisation.

Based on the traditional strengths of the University of Klagenfurt in educational sciences, media studies and informatics, for 2008 the paper envisioned an institutional priority on media didactics, which should be established as an unique selling proposition among the higher education institutions in the region. As a public university, it should have established itself as an open institution, open for the exchange of learning materials and

scholarly publications, open for institutional cooperations and joint studies, open for the needs of its clients. This openness should also reflect in decisions on technical infrastructures and logistic standards.

Strategically, the paper defined three goals for eLearning. It should mainly be used to improve the attractivity of the educational services for the main target group, which are students from a regional catchment area in traditional campus based study programmes. eLearning should also be used to attract new target groups (e.g. non-traditional students, adult learners or people with reduced mobility) and to reach out to new catchment areas. Last but not least, eLearning should be regarded as an important research topic.

Given these general goals, the paper identified several products or product groups for eLearning:

- Traditional study programmes
- EduTech Modul
- International Master of Informatics
- Adult education and university training programmes
- Research on eLearning

Traditional study programmes should be enriched with a good mix between face-to-face and blended learning arrangements. Since it is save to predict that ICT skills will become more important for teachers in secondary and post-secondary education, the vice-rector for education has suggested to develop an EduTech Modul, a set of courses especially designed for teacher training study programmes, but which also could be offered to other disciplines, or to the internal staff development programme. Representatives from the computer sciences suggested an international master programme to be developed with partner institutions in the Alpen-Adria region. Since the university provides a large number of university training programmes, the special needs of these programmes should be investigated. E.g. distance learning elements could make it easier for adults to participate. Interdisciplinary research on eLearning could become a unique selling proposition of the university. A necessary step into this direction would be to document already existing research on eLearning and increase its visibility.

Parallel to these new or changed products, the paper suggested organisational measurements as well:

- eLearning support centre
- eLearning research centre
- Content pools
- Implementation of eLearning in curricula
- Staff development and reward systems

To build up an eLearning support centre, it would be necessary to include and coordinate existing resources and services that relate to eLearning. Similarly, existing research activities on eLearning should be documented by a research centre, active actors in the field should be coordinated and others should be invited to participate. Content pools should collect existing electronic documents and materials, which were produced by members of the university, and make them publicly available in open archives. To transform eLearning from an individual to an institutional task, eLearning should not only dealt with at the level of the single course, but also on the level of the curriculum of entire study programmes. Parallel to that, it will be necessary to elaborate staff development programmes to raise the ICT skills of teachers and related reward systems to encourage faculty to apply eTeaching and eLearning.

Given these policy options, the paper identified the key requirements to realise any of them. On the one hand, it would be a priority to create an organisational unit or at least a staff position for coordinating and supporting eLearning activities on an institutional level. On the other hand, it would be helpful to have a specific budget for eLearning, that can be expected to be continuously expanded for the next four years.

Presentation to the extended rectors team

After having done the final editing, the vice-rector for research sent this report to the members of the extended rectors team. In the formal meeting of this group, he gave a short presentation and asked for a clear decision either in favour or against our proposal. The group unanimously agreed with the goal to develop an institutional eLearning policy and to provide funding for it. eLearning became part of the strategic development plan of the university. To allocate the required resources was more complicated, because the budget for the next year was negotiated already. However, the rector promised to be creative in finding the necessary funds.

DEVELOPING THE CONCEPT FOR AN INSTITUTIONAL ELEARNING PROJECT

Commissioned to draft a proposal

After having achieved this favourable decision shortly before Christmas, there was a break in our activities for several weeks, both due to holidays and to the following closing of the winter term. In February, the management team decided to participate in the competitive grant programme eLearning/eTeaching strategies at universities and Fachhochschulen.

The vice-rector for research asked me to develop a draft proposal for the University of Klagenfurt on the basis of the report of our work group, which I gladly agreed to do. Given the experience of the last months, when most of the activity in the strategy group had to be organised and arranged by the two vice-rectors themselves, the management team had decided to focus the proposal on the foundation of a twin competence centre for eLearning, which should be built out of two complementary research and support units around the position of an eLearning manager. Very clearly the grant was seen as an possible, additional lever to build up missing managerial capacity for the support and the organisation of eLearning on an institutional level.

In parallel to the proposal I was responsible for, the university also participated in proposing a joint project of four institutions, which was developed in the name of the association forum new media. The professor of informatics, who also was member of our strategy group, was the president of the association and the responsible spokesperson for this project at our institution. The plan was twofold. On the one hand, these two proposals should work independently, and - with respect to the available funds - even competitively. On the other hand, it was necessary to demonstrate the awareness of each other and to develop options for collaboration.

Call for proposals

The competitive grant programme on institutional eLearning/eTeaching strategies offered successful proposals co-funding for 60% of their total project costs for one year. These framework conditions asked for a clear concept both in content and in organisational terms, a plan for the realisation and a calculation. The call for proposal also contained a long list of criteria:

- priority in the profile and the educational mission of the institution,
- location of eLearning responsibility both in terms of organisational structure and of personell, to be demonstrated in an organigramm,
- synergetic use both of internal units and of potential external partners,

- provision to raise the eCompetence of teachers,
- reward systems for eTeaching and improved eCompetence.
- consideration of standards, both with respect to didactical concepts and to technology,
- efficiency with respect to the number of involved staff and students,
- added value in qualitative terms,
- timeframe and work plan,
- calculation of the venture, both with respect to own contribution and to required additional funding,
- controlling measurements and indicators to assess the performance of the project,
- size and organisation of the project team.

Each of these criteria would be assessed by the international jury. The list of criteria also was suggested to be taken as the basic list of content to structure the proposal, which had to meet a maximum length of 15 pages.

Developing and deciding on the proposal

These framework conditions and the full list of criteria proved to be very demanding. They asked for a different type of text than the report of our strategy work group had been. While it was sufficient for our report to create a list of unconnected policy options, the proposal had to be more specific and more integrated. A lot of issues had to be covered, specific information had to be interrelated and to be provided in a very condensed way. Every piece of information had to be checked for its consequences on the rest of the text.

After having read the details of this call, I found it necessary to expand the scope of the proposal. To exclusively focus on a twin competence centre would have made it difficult to explain anticipated effects on output criteria like added value in qualitative terms or the efficiency in quantitative terms. Therefore, in addition to the development of internal structures and processes of the institution, I also felt the need to propose that effected the products and services the university provides to its social environment.

On the other hand, the need for a project plan also made it necessary to be selective. While the workgroup report listed policy options and left wide space for future decisions, the project proposal had to be plausibly calculated for more specified goals. If we did not want to overstretch the available resources by promising too much, we had to focus on a few measurements with the best input/output ratio, measurements with the broadest possible dissemination in the institution and/or the clearest qualitative difference to current practices. Given these impressions, it is fair to say that

the call for proposals worked well in establishing an strategic, institutional perspective on eLearning and in guiding towards a stronger output orientation.

The most difficult part of the proposal was the development of a project organisation, the division of workload in separate work packages, designing the structure of the process and the calculation of related costs. Even if there existed some basic cornerstones, like the basic willingness to participate from the members of our workgroup, the deadline for the proposal was too short to come to detailed agreements. Basically it was necessary to centrally and unilaterally sketch the architecture for the project and even to name people outside of the workgroup, who did not yet know about their luck to be considered for participation.

It would have been too much to say that the circulated draft was received with enthusiasm by the strategy group. However, there was less conflict than with the work group report, which may be due to the history of the group and its latest success to receive the commitment of the extended rectors team. Realistically speaking, people were glad that somebody had done the main work and willingly helped to fill the gaps. Even if there had been some regrets about dropped policy options, the draft proposal seemed to cover enough of our previous debate. In the only meeting we had prior to submission, the votes on a few issues were controversial, but evenly balanced. Since I had drafted the proposal, I found myself in the position to defend it, which made it difficult to steer the process. The vice-rector for research economically invested his authority by mainly using it in undecided questions to shift the balance to one or the other direction, while still sustaining his credibility to be impartial.

After integrating the feedback of the group, especially with respect to the budget calculation, and after the final editorial agreement of the vice-rector for research, I electronically submitted the proposal.

THE ELEARNING PROJECT OPEN ALPEN-ADRIA UNIVERSITY KLAGENFURT

Strategic goals

Located in Klagenfurt, the capital of Carinthia, the most southern province of Austria, the university already had set the goal in its development plan to expand its catchment area beyond its home province into the Alpen-Adria region. This awareness of a dense cultural environment also reflected in the ambition of the university to be addressable in four different languages: German, Slovenian, Italian and English, the lingua franca of cur-

rent scientific communication. It therefore was a natural claim, that the Alpen-Adria University of Klagenfurt set the goal to be the main higher education institution for this region in the context of a global digital knowledge society as well.

Corresponding with its mission as a federally funded, public institution, the university wanted to position itself as an open institution, open with respect to sharing scholarly publications and learning materials, open for the joint development of study programmes and the acknowledgement of individual courses, open for the needs of its target groups and its client organisations. Promoting openness also required the participation in the development of joint infrastructures and the orientation on open technical standards.

Another aspect of the eLearning strategy related to its mission as a public institution was the newly defined goal of the university to tackle the dangers of a digital divide. To overcome the digital devide, it was necessary to open access not only to electronic knowledge resources as products of ICTs, but also to ICTs as electronic means to produce knowledge resources. Therefore it was seen as necessary to raise the competences of students and of scholars both in producing and in using electronic knowledge resources. In this context, the university wanted to use its eLearning strategy to support the empowerment of females and as a gender mainstreaming measurement as well.

> *„On a global scale, women ... are underrepresented among the users of the internet ... Simultaneously it becomes clear that the virtual space turns into a central mechanism of socialization that determines chances for occupation, education, participation and power. Exclusion from the virtual space not only means partial discrimination; rather the distinction between inclusion and exclusion determines decision about participation or non-participation in the modern age."* (Schachtner and Winker 2005, p. 10, own translation.)

This statement makes clear that an institutional eLearning strategy also has to consider gender mainstreaming measurements to avoid a naïve transfer or reproduction of gender imbalances in the virtual space.

Operational goals and project structure

These strategic goals were translated to into two sets of operational goals. One set dealt with structural measurements, mainly with the development of a twin competence centre composed out of two complementary units, an eLearning support centre and an eLearning research centre. These two units should be built up around the position of an institutional eLearning man-

ager, a staff position that was to be established in close connection to the vice-rector for education. The other set of goals dealt with potential outputs, which mainly were an OpenCourseWare initiative, a project for student portfolios and accompanying measurements, such as related research and development (R&D) projects, staff development, an eLearning portal and various others. All together, these goals were reflected in the following organigramm of the planned project structure.

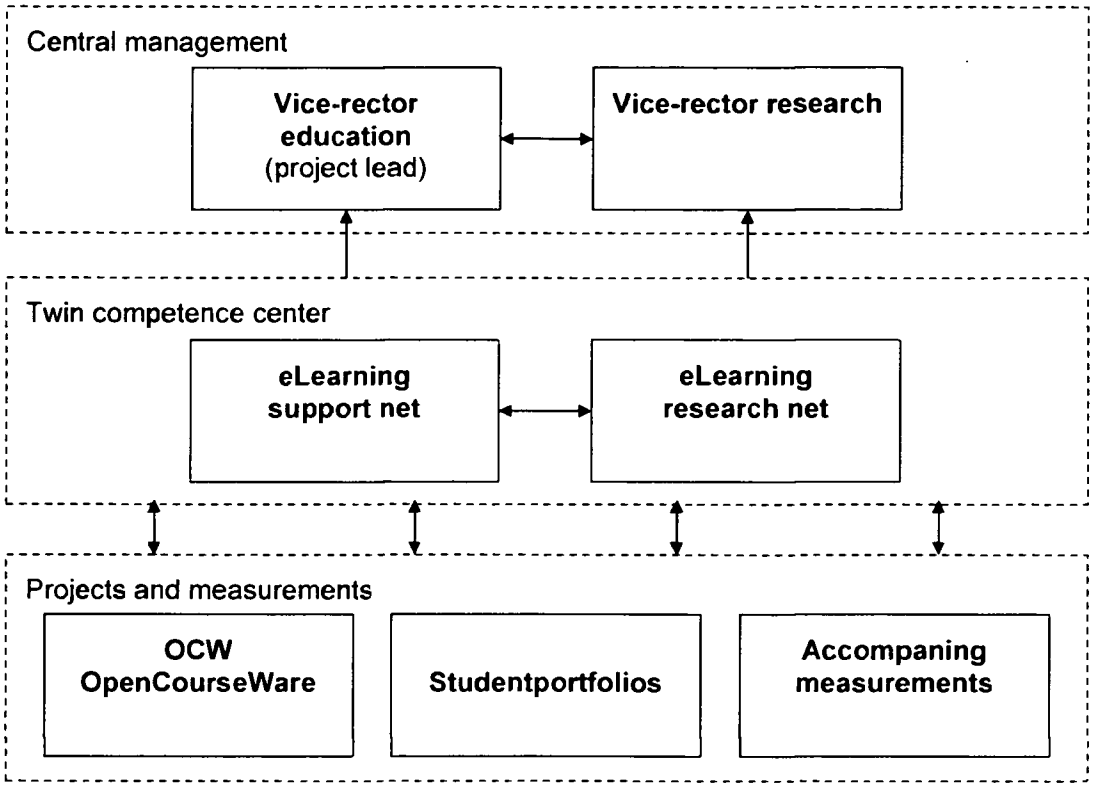

Figure 2.: Organigramm of the eLearning project Open Alpen-Adria University Klagenfurt

eLearning support network

The university already had available resources and support services, which could contribute to eLearning in a broader sense, e.g. a centrally managed, very basic course management system, electronic knowledge resources at the library, a specialised self access centre with learning materials, individual staff training courses, and diverse consultancy services at the central IT unit. These resources and services were maintained and provided by a number of different support units.

	Task	Infrastructure	Consultancy	Training
Learning	Provision of learning materials and infrastructure	• Computer pools • Audio-visual workstations • Media collections, learning resources	• Learning competence • Didactical support of students • Procurement of learning software	• Learning competence • Use of ICT infrastructure and electronic learning resources
Teaching	Didactical concept, evaluation, curricular development		• Didactical concepts • Evaluation • Implementation • Grant programmes • Project management	• eLearning didactics • Online communication and cooperation • Concept and organisation
Media-production	Design and production of learning materials	• Video production • Video editing • Multimedia production • Multimedia software • Scanner	• Production of learning materials • Design of learning materials • Media technology	• Digital image-editing • Video production • MM-production (web, flash, etc.) • Media design
Technology	Test, integration and provision of equipment, plattforms and tools	• Learning and content management systems • Groupware • Forum, chat and video server • Videoconference	• ICTs • Hard- and software-procurement • Equipment for educational facilities	• Standard software • Internet • Learning and content management systems (LMS+CMS) • Communication tools

Figure 3.: Matrix to analyse institutional eLearning support structures. (Bachmann and Dittler, 2005), p. 130, own translation.

However, there was a considerable lack of coordination between these units, which was due to a lack of a comprehensive institutional mission for eLearning. The appointment of an eLearning manager and the foundation of an eLearning support network should overcome these deficits. The investment in the position of an eLearning manager was the main self contribution of the university in this proposal, and a long term commitment of the institution. This person should help to identify existing resources and services, which could be bundled under the focus of eLearning after the example of the LearnTechNet of the University of Basel. Instead of creating an entirely new, distinct infrastructure, this university was successful in analysing existing resources, linking them and complementing them with additional investments. As an instrument to analyse existing structures and to identify deficits, the University of Basel had developed the following table.

The matrix above should be used as an analytical tool to distinguish different core tasks to support the educational process (learning, teaching, media production and technology) as well as different types of support (infrastructure, consultancy and training). It could help to locate existing resources and services, to search for synergies and deficits as well as to create complementary measurements.

eLearning research network

Traditionally, the University of Klagenfurt had strengths in educational and media sciences, as well as in computer sciences. As a research topic, eLearning related to all of these subject areas. In practice, several research units at the university, e.g. computer sciences, media communication, psychology, economics, or education, had started to investigate eLearning and the effects of ICTs on their research fields separately. These strengths were also expressed in the above average success of the university in prior eLearning grant programmes. Quite a few individual researchers were involved in these projects, which were completed in cooperation with several other institutions. A local professors for computer sciences was among the key figures in establishing and fostering the Austrian eLearning community and became the first president of the association forum new media Austria.

However, inside the institution, researchers with an interest in eLearning and the use of ICTs in research worked on an individual basis only. Neither the potential for multidisciplinary research cooperations, nor the potential for joint strategic developments on an institutional level had been used systematically so far. Therefore the university proposed to establish a multidisciplinary eLearning research network. This network should document research activities on eLearning and on the use of ICTs in various research disciplines. It should create links between the involved researchers, foster communication and exchange and try to find ways how to apply research findings to the organisational development of the university.

Funding from the grant programme should be used in two ways. On the one hand, it should be invested in the establish of a multidisciplinary group of researchers, for community building and for the elaboration of forms of cooperation as a topic for communication. The group should have time and resources investigate options and willingness to intensify the interest for closer cooperation, as well as preferable organisational arrangements for the future, e.g. a new organisational unit or rather a loose network. On the other hand, the group should also have some resources available to invest in applied research and development for the institution. Aiming at drafting small concept papers, grant proposals and practical recommendations, the

group should work on issues of institutional or at least multi-departmental interest.

OpenCourseWare

For the past few years, the university had gained some experience with its very basic course management system Claroline[@4]. Due to privacy considerations, it was impossibly to systematically analyse the courses which were provided with the help of this technology. But anecdotic evidence and the impression of the responsible service technicians indicate that the platform predominantly was used to make learning materials available. This made sense in so far that for any form of eLearning the availability of electronic materials was a necessary prerequisite. However, the use of these materials was restricted to the group of enrolled students per course, which limited the possible effects of the materials.

While pioneers of eLearning, especially from the computers sciences, pushed forward towards the implementation of a more advanced learning managements system with better communication tools (a demand that had to be satisfied simultaneously), the university set a priority on producing and publishing learning materials. Explicitly emulating the example of MITs OpenCourseWare[@5] initiative, the university planned to support its faculty in publishing their electronic learning materials. The idea was to give added value to materials that had to be produced anyway, but that carried little chance to make any profit at all. To make it publicly available would increase the efficiency of the learning process (time for presentation could be reduced in favour of discussion), foster reflection (through documentation of the planned steps) and increase attention (since access to materials was not restricted to enrolled students). Technical and editorial support would also reach out to faculty without prior technical skills and encourage them to publish in the virtual space. This could be regarded as an inclusive strategy for empowerment and gender mainstreaming, since it tried to increase access to the virtual space also for authors with limited technical skills. It should encourage faculty to contribute, even if they did not have a technical background.

To create the biggest possible impact for this sub-project, it was planned to address not only individual teachers, but primarily entire teaching programmes. In the preparation of the proposal, some obvious candidates have been identified due to different reasons:

- *Computer sciences*: the study programmes for computer sciences had recently started a joint effort to translate existing learning materials into English. Especially urgent was the support for the entrance phase into the newly created master programme for computer sciences.

- *Joint study programmes*: The Faculty of Humanities was involved in the development of joint study programmes with partner institutions in neighbouring countries. In both cases, the provision of electronic learning materials would offer a good base for the cooperation across two or more locations.
- *Staff development programmes*: The use of the OpenCourseWare approach for internal staff development programmes would create a strong lever for the promotion of the idea and for the dissemination of respective know-how. Investments into staff development courses could be additionally safeguarded by the electronic documentation of learning materials.

In addition to these obvious examples, the project team would also try to involve other study programmes in the OpenCourseWare project. To improve the participation of new target groups in the virtual space, it would especially focus on study programmes in the Humanities, which are also characterised by an outstanding proportion of 74,4% women in their student population, compared for example with an average of 43,7% at the Faculty for Economics and Computer Sciences.

Studentportfolios

As a complementary measurement to the OpenCourseWare initiative, which was primarily focusing on faculty as main actors and target group, the university wanted to address students as authors and contributors to the virtual space as well. During the course of their studies, students did not only collect certificates. They also gained personal experiences (studies abroad, internships, voluntary work and jobs to earn a living) and produced a fair number of electronic materials (course papers, project reports, final thesis's). In the past these materials had mainly been used to earn individual credits and been lost otherwise.

The University of Klagenfurt therefore planned to support students in collecting products they produced during the course of their studies. These collections should be composed as individual student portfolios with the option to make them publicly available. The university wanted to provide the necessary technical tools and the consultancy in content to help students in assembling different items and in integrating them into a coherent personal portfolio. Aiming at a good mix between self description and feedback/assessment by others, student portfolios could be used in at least three different ways:

- *prospectively*, to plan the future course of studies, for goals to achieve and for competences to develop,

- *retrospectively*, to reflect on and to assess experiences, maybe to get an overview and to find possible relations between distinct activities,
- *representationally*, to demonstrate experiences, competences and achievements to others, e.g. to prospective employers.

To get quick results, the sub-project student portfolios would start with more experienced students at the end of their studies, since it could be expected that there were lots of electronic materials produced already. Therefore the placement centre and the alumni service would take the lead in setting up the necessary technical and support structures for student portfolios. If this proved to be successful, it was planned to transfer student portfolios into the responsibility of study programmes and to make them part of the qualification process of formal academic education.

PREPARING THE PROJECT START

Jury decision and negotiation

An international expert jury decided on the proposals in April and the Ministry informed the applicants about these decisions in May. Out of 20 proposals, the jury recommended 11 projects for funding. The project of the University of Klagenfurt was among the selected, since it showed a clear concept and a plausible strategy for its realisation. The experts only asked for a more detailed work plan and for a stronger emphasis on gender mainstreaming. On the basis of this assessment, the Ministry invited the university to react to the recommendations and to enter negotiations on the grant contract.

With help from the group, a written response had been developed. By the end of June, both the vice-rector for research and the vice-rector for education participated in negotiations with the Ministry. Since there were no basic problems with the concept itself, a decision was quickly found. After having agreed to a small reduction of the budget, the contracts had been signed by the vice-rectors.

Workgroups and eLearning manager

As soon as the university had won the grant, the strategy group started to establish the project structure. As part of this activity, the position of an eLearning manager was announced, after the text for the announcement had been developed collaboratively. About 17 people applied for the job, 6 very competent applicants were invited to an interview and the eLearning manager was selected. However, given the summer break and the number

of necessary formal steps, which both slowed down the decision making procedures, the vacant position could be filled by November only. Simultaneously, the official start of the project was adapted respectively.

In parallel to these activities, the strategy group carefully began to expand the number of involved people by outreaching to other members of the university, especially to those who might be interested in taking an active role in the project. Additionally, it started to form subgroups and to set preparatory steps, e.g. elaborating more detailed work plans for their sup-projects. Even if partly successful, this also led to ambivalent results. Driven by their research interest, faculty members especially tended to create new ideas, which were not covered by the proposal, while neglecting other tasks, which were required by the contract. This situation had built up during the summer month and was partly due to a lack of central coordination and of internal contracts, which was caused by the delayed appointment of the eLearning manager.

New friends in the OpenCourseWare community

An external event with important effects on the project was the *OECD/Canada/Alberta Conference on E-Learning in Post-Secondary Education*[@6], which I attended in June, and the resulting thread of communication. To my surprise and pleasure, "open educational resources" were prominently discussed in several presentations and evolved as an unexpected, major topic diagonally to the planned tracks of the conference. I met a representative of the Hewlett Foundation[@7], a sponsor of MIT's OpenCourseWare initiative and told her about the ambition of the University of Klagenfurt to emulate this concept, but also about our search for an appropriate software solution. At the same day she introduced me via email to the Centre for Open and Sustainable Learning (COSL)[@8] at Utah State University (USU), another one of Hewlett's grant recipients, who was funded for developing eduCommons[@9], an integrated software package for the production of OpenCourseWare after the example of MIT.

Soon after my return, I was overwhelmed by COSL's readiness to help. Their director of outreach called me (long distance for three hours) to find out more about my interests and needs. A few days later, COSL had configured a pilot eduCommons/OCW site for the University of Klagenfurt [@10], and my contact guided me through the application, demonstrating its functionality. After having accepted these surprisingly generous offers, I found them supportive in several ways. First, it provided me with a convenient tool to quickly create some example courses for the purpose of demonstration. Second, I learned a lot about the possible challenges for an institution wide role out of this type of activity and about problems inexpe-

rienced users might face. And, last but not least, I was introduced to people in the centre of the OpenCouresWare movement at Utah State University and MIT, who openly to any question I had. The only thing I could return was my feedback on OCW in general, and on the eduCommons software in specific. Even if it was very advanced already, it was still in development, showing some minor bugs and room to improve its usability.

In personal interaction with responsible staff both at COSL/USU and at MIT, I also learned more about the institutional background of the OpenCourseWare movement. Being committed to the promotion of open educational technologies, the Hewlett foundation is (together with the Andrew W. Mellon Foundation[@11])the main sponsor and patron, aiming at the use of the Internet as a strategy for overcoming barriers to access academic content. It tries to establish new standards of practice and to stimulate institutions to freely share ((Casserly and Smith, 2003)). At the begin of the new century, MIT worked out the core publishing concept for OpenCourseWare and started to implement it by 2001, promising to aim at the publication of materials of virtually all courses by 2007. By summer 2005, MIT had about 1.5000 of its own courses published online. It knew about 36 institutions that explicitly used OCW strategies to publish their materials (China: 23, Japan: 6, US: 5, India: 2, Vietnam: 1, Europe: 0) and expected the same number of institutions to start similar ventures soon.

On the basis of MIT's publishing concept, eduCommons is designed as a specialised software package for a more convenient and cost effective publishing process of OCW materials. Funded by Hewlett, COSL at Utah State University employed 11 staff to work full time on the development, test and outreach of eduCommons. The software was not created for the use at a single institution only, but explicitly as a tool for a community of institutions. By September 2005, at least 10 universities had signed up to use eduCommons. Additionally, a OCW consortium was set up to establish a formal framework for future expansion. To secure the further development and support of this tool, member institutions of the consortium should contribute by donation and service contracts. In parallel, COSL also built up contacts to similar ventures, especially to the Sakai project.

Presenting a local OpenCourseWare concept

Given the number of their other obligations as well as their involvement in other subprojects of our initiative, not too many of my colleagues were familiar with the concept of OpenCourseWare so far. Having talked to several people individually, the concept turned out to be very complex to communicate, since it carried at lot of different assumptions and was received with interest, but also with a great variety of concerns. Therefore I

found it necessary to create a common understanding of OpenCourseWare at our university. To structure the debate, I distinguished between publishing concept, editorial concept and technical concept.

Publishing concept

The main literary format of the OpenCourseWare publishing concept was the university course. It was the smallest independent unit for publication and built the context for smaller sub-units, for example individual lecture notes, presentations, simulations and tests. Similar to the literary format of journal articles, which was standardised by definitions of length, conventions of elements (abstract, introduction, references, etc.) and lay out, the format of OpenCourseWare was standardised as well, without predetermining the content of individual courses. Each course had a mandatory home page (including a brief description and an image to illustrate the topic), a syllabus (stating the goals and requirements) and a course calendar (breaking up the course in sequential steps). Optional were other forms of sub-pages, e.g. reading lists, lecture notes, assignments or links to other related resources. Not-to-be-published were materials like the documentation of personal interaction, personal data, unfinished or restricted materials. These were better to be stored in restricted areas and could normally be found in standard learning management systems.

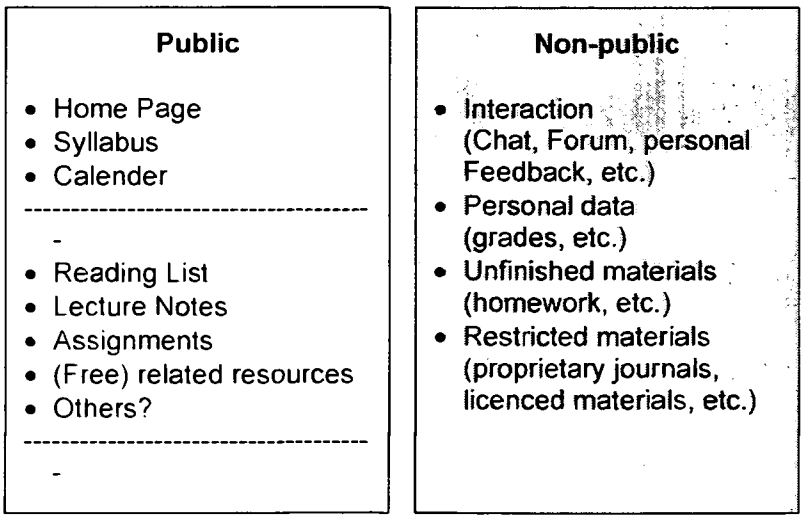

Figure 4.: Distinction between public and non-public electronic materials for a university course. Only public material may be integrated into OpenCourseWare.

While the original version at MIT did not show any link to restricted materials at all, we considered the option for connecting both areas via login-buttons, since it would be too expensive for us to duplicate our efforts by maintaining two parallel, overlapping structures. While MIT's OCW materials can be basically regarded as kind of post-teaching publication, completely separated from the actual teaching process, we would need to organise it as a form of pre-teaching or parallel-to-teaching environment. While in the case of MIT, specialised support staff did most of the work, we would have to count on more effort from our faculty, not being able to offer the same amount of support. In general, this concise publishing concept increased the usability of materials, since the standard look-and-feel made it easier to switch between different courses, even between OCW installations of different institutions. This supra-institutional search was additionally supported by a specialised search engine, the OpenCourseWare Finder[@12].

Editorial concept

Logistically, publishing differs from teaching in many respects, which made an editorial concept necessary. While teachers traditionally had been left alone in their production of learning materials, an attitude very much reproduced by learning management systems, this arrangement could not be sustained. The publication of learning materials required organised institutional support to guarantee the integrity of the publishing concept, to safeguard quality and to protect the reputation of the institution. Similar to the workflow for the publication of magazines, editorial structures had to be created. Drawing from the different roles defined in eduCommons, I suggested to distinguish between producers (authors or individual teachers, writing and composing the content of a course), quality assessors (1-2 people per institute or study programme, facilitating and editing all courses of their sub-unit) and publishers (1-4 per institution, acting as responsible editor in chief). Additionally, I summed up all study programmes that had already reacted positively on my offer to become part of the OpenCourseWare initiative, and proposed, that each member of the strategy group should test the concept on one of her/his courses and in one of the different roles foreseen in the editorial concept.

Technical concept

I completed my input by presenting my technical concept, which mainly proposed the integration of eduCommons in the software environment of the University of Klagenfurt. For me, it seemed to be a shortcut opposite the need to develop a home grown solution by adapting any of the imple-

mented software tools, which would also save some energy that could be better invested in the editorial support for our project. It seemed to provide tools for the development and the delivery of content, materials published for learning and shared conventions for the digital publishing of open resources ((MIT OCW, 2005)). And it promised to offer possible access to an international community of peer institutions sharing the interest in the OpenCourseWare movement.

The group showed mixed reactions to this presentation. As expected, the living examples of a few courses presented after the OpenCourseWare publishing concept in a local installation proved to be attractive. The clear look-and-feel, even a certain "coolness factor" was acknowledged by some. Not too surprisingly, concerns were shown with respect to the introduction of a new technical tool. The advantages of a specialised system had to be weighed against the need to train for and to maintain an additional tool. Therefore, it was demanded to investigate the options and costs for rebuilding the basic functions of eduCommons/OCW with already implemented tools, as well as considering costs for training and maintenance. One position was even further challenging, suggesting basically that the publishing concept in its core was competing with the introduction of a new learning management system, since this system did not provide for publishing in the proposed way. As a result, this would lead to a duplication of efforts for normal faculty, which was seen as a problem of the OpenCourseWare concept, not of the learning management system. Even if I was irritated for a moment and concerned, that this position might lead to a change in the priorities of our strategy by setting a tool prior to a goal or technology prior to content, after a while I began to realise, that this conflict might be necessary. Without a proper clarification of the relationship between OpenCourseWare and the learning management system in the context of our comprehensive strategy, we could easily end up either in competition or in reciprocal ignorance.

CONCLUSIONS

Definition of the products

The project succeeded in specifying outcomes, which definitely make a difference at the product level of the university. OpenCourseWare and student portfolios do not yet lead to entirely new study programmes. Rather they are both new by-products of existing study programmes. In both cases, these by-products reach out beyond the traditional classroom-

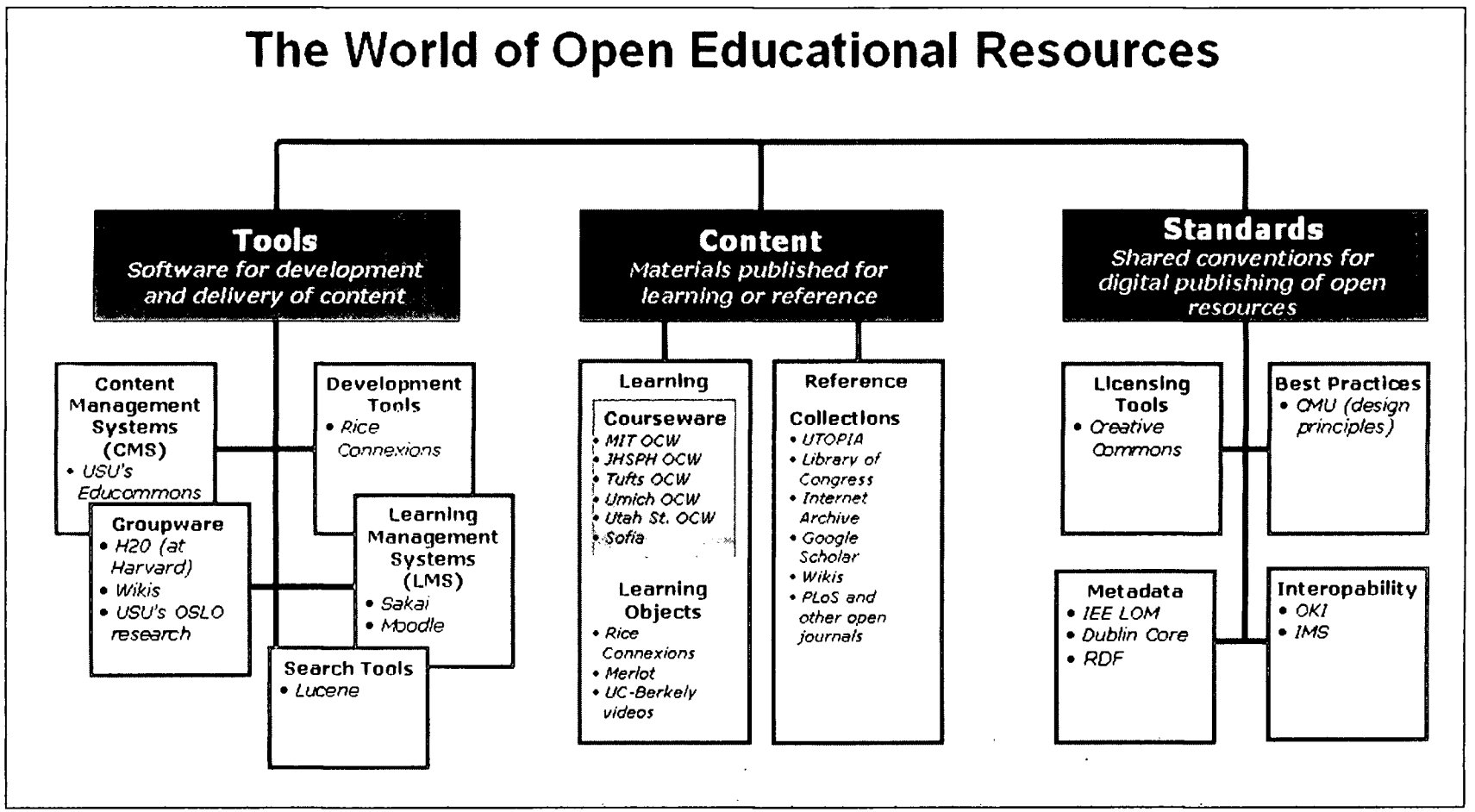

Figure 5.: OCW's unique value: The World of Open Educational Resources ((MIT OCW, 2005))

an easy route to the world of open educational resources, which comprised scenario, providing opportunities for additional uses of materials. Student portfolios work diagonally to the traditional course structure and promise to help integrating outcomes in an individualised, student centred way. OpenCorseWare is closer linked to the individual course and can be created for different forms of study programmes: undergraduate, graduate, post-graduate and continuing education programmes. As a by-product, it can also be disseminated independently from the course and from direct interaction.

It is crucial to understand the social architecture of the places and the related processes a university can create in the virtual space. It is a huge difference, if the university provides places for individuals (e.g. personal workspaces), rooms for limited groups (e.g. virtual classrooms or collaborative web space) or public stages to address a wider audience and to maximise attention (e.g. a portal or other publishing opportunities). This difference is not so much a technical, but more a logistical one, raising questions of social coordination. It is necessary to describe this architecture from an organisational and social perspective, to be able to adequately assess the costs and to plan the necessary logistic for the maintenance of any of these virtual spaces.

Distinction of contents

The basic concepts of OpenCourseWare and of student portfolios are rather indifferent to content or discipline. In both cases, the concepts are general enough to be adaptable for any specific course or study programme. It is more the strategy for their implementation that aims to be content specific. Since the humanities are perceived to be less confident in the use of ICTs, it is seen as a form of empowerment to specifically address them as possible candidates for the implementation.

Another attempt to distinguish specific content can be found in the goal to establish research on eLearning and on the academic use of ICTs as a new institutional research priority. It will depend on the willingness and on the creativity of the involved researchers, if an multidisciplinary cooperation in the institution will come to live. The plan to create an EduTech module for teacher training demonstrates, that at least the need for new competences is acknowledged already.

Positioning at the market

The Alpen-Adria University Klagenfurt uses its eLearning strategy to reconfirm the already existing focus on its regional environment. eLearning is mainly aiming to improve the quality of education by adapting the mode

of delivery to an increasingly digital environment of the global knowledge society. Without focusing on new target groups, eLearning should at least help to increase the accessibility of higher education to non-traditional or disadvantaged groups of prospective students.

However, with the priority on publishing, the university also expands its reach, at least with respect to the dissemination of electronic knowledge resources. While the university still addresses the same catchment area with its educational supply, trying to improve its efficiency and quality, in parallel it publishes content for a larger, supraregional audience.

Part of the process to position an institution at the market is determined by the way it learns from peer institutions. In the concrete case, the search for possible institutional policies to learn from was really a global one, going far beyond the traditional framework of reference, which in Austria normally is limited to continental Europe, especially to Germany. To learn from the most convincing examples globally promises to improve the competitive position of the institution locally and regionally, in the national and European context.

Support of the personnel

Support of the personnel still has to be developed in this project and will be different in the case of OpenCourseWare and in the case of student portfolios. It depends very much on the actual workflows that still have to be developed in detail. While the publication of already existing materials should be a minor additional task, the care for student portfolios will become an entirely new task that can not be done in traditional courses. Either new courses or new consultancy services will have to be created. The necessary resources for these services will have to be found either by a rearrangement (and reduction) of other activities, or by new funds.

During the planning of the project, it became clear, that the publication of materials asks for clearer support concepts than the introduction of learning management systems. In the case of learning management systems, support is often limited to tutorials on the general functionality of the software, while the rest (didactics, questions on content, etc.) is more or less left to the individual teacher. In the case of publication, the expectations on the individual author, e.g. the format of publication and the workflow have to be defined more explicitly. Standards have to be developed, negotiated and put into practice. However, this also has advantages. While the sharing of educational practices in restricted areas is complicated and requires additional effort, the sharing of standards for representation and publication of open learning materials can be done much easier, since examples are accessible without restriction.

The University of Klagenfurt also participates in the joint development of principles and of a roster to award eLearning activities in employment, promotion and staff development procedures. Here again, the open accessibility of outcomes makes it easier to design staff development measurements.

Development of the organization

Even if much eLearning activity was already going on at the University of Klagenfurt in an informal way, there was a lack of places to deal with eLearning on an institutional level in a formally addressable way. A first step to overcome this deficit was the creation of a work group for strategy development, further steps will be the foundation of an eLearning support network and of an eLearning research network. Staff and faculty of the university showed a great willingness to participate in these groups and to assign some of their time to this work.

However, this kind of internal network organisation on a more or less voluntary basis also has its clear limitations. As Grossmann and Lobnig (2004) explain, networks on an inter-organisational level need to carry potential profit for their participants as well as maintenance and organisation. The same is true for inner-organisational networks of subunits or individuals, as they are proposed in the respective project. They also need a chance for a return of their investments. Due to their voluntary character, networks also need a special kind of management, that can not be based on hierarchical instruction. Similar to the management of inter-organisational clusters (described by Payer 2002), a manager of inner-organisational networks has to encourage contributions by the participants and foster the self-organising potential of the group, creating an atmosphere of continually ‚simmering' cooperation. It is not enough to discuss, write and decide upon goals for the respective networks to make them become reality. Rather, it is necessary to organise regular interaction, to prepare decisions, clarify roles and contributions, disseminate information and confirm results by constant communication. The amount of necessary communication can not be overestimated. While the participation in the network-groups is possible on a voluntary basis, the permanent support of these groups rather has to be the task of a professional manager. In the case of the University of Klagenfurt, this task will be fulfilled by a newly assigned eLearning manager.

For the foundation of the mentioned internal groupings, the initiative of the central management, especially of the vice-rector for research, was essential. Without his status and his commitment to the necessary investments (basically work), it would not have been possible to establish the

strategy workgroup, which was the pre-requisite for the later proposal to the grant programme of the ministry. Additionally, he can seen as, what Pellert (1999) described as an academic manager. He both could deal with the ambivalences of often contradictory academic opinions and still steer decision making processes. Without his constant, very economic and reduced use of his authority, we easily would have got stuck in academic arguments and disagreements. However, the initiative to set up the workgroup, and later, the project also has to be seen as successful teamwork of the two vice rectors, since it was carried out by (and it connected to the portfolios of) both the vice rector of research and the vice rector of education. Part of this has to do with the academic background of the involved people and with the characteristics of eLearning as a newly evolving field and task for the central management. eLearning still has a very technological reputation. Therefore, it is understandable, that the vice-rector for research with his academic background in computer sciences was more confident to deal with the topic, even if he had no explicit background in eLearning, than his colleague with her background in the humanities.

Apart from their mission to coordinate and decide upon support and research on eLearning internally, both networks also should collect and build up competences on eLearning, either from an administrative or from an research perspective. In both cases, it is not clear yet, if the respective networks will fulfil these function beyond the duration of the project, even if it is desirable from an institutional perspective. Additionally, there will be the challenge to transfer increased competences of these two networks into recommendations for or decisions of the institution.

Reflecting on the process of this development, I think we made the best of the given situation. At the beginning, eLearning was no topic on the agenda of Klagenfurt University and largely ignored or even regarded with suspicion by many faculty members and decision makers. Additionally, Klagenfurt University, as all the other universities in Austria, was (and still is) under constant political reform pressure, facing tightening budgets, increased external demands and underdeveloped managerial facilities and service structures.

In this difficult situation, it was wise to gather a small number of handpicked individual with interest in eLearning, to develop a joint perspective among them and to elaborate a proposal for an institutional eLearning strategy, which aimed at internal resource allocation and the attraction of external funds. A more inclusive or formalised approach (e.g. to involve more people or to ask deans for the nomination of delegates) might have increased the legitimacy of the initiative, but would for sure have ex-

hausted both our own capacity for project management and the capacity of staff and faculty members to participate.

The composition of the strategy group did not only reflect different organisational units (faculty, support), but also different status groups. While the first aspect was caused by the decision to involve representatives from various units, the second aspect was due to the need to find interested people with experience in eLearning and in the use of ICTs. As a result, high ranking (mostly male) decision makers and professors sat side by side with (often female) junior faculty and part time employees. For all status groups, participation in the strategy group came without direct compensation and was based on voluntary engagement. In difference to other organisations, which are flexible enough to compensate participation in comparable project with relieves from routine tasks, this hardly is the case at universities, which results in additional workloads and stress for participants.

To make the best possible use of the limited time available from group members, much energy had to be invested in the preparation, design and documentation of meetings. It clearly proved valuable to provide carefully composed agendas and suggestions for the structure of brainstormings and debates. It also was helpful to provide written summaries and draft documents as concrete objects for discussions and decisions.

My personal role in this process changed considerably. While in the beginning, I had approached the institution rather from the perspective of an external investigator, faster than expected I became involved in an organisational development project. My new role now became enriched with other aspects. As a group member I had to represent my own organisational unit, as a consultant I contributed to the design of processes, as a project manager I felt responsible to integrate different views to a consistent picture and to achieve results. However, I felt it necessary to step in and to take some operational responsibility for a while, even if I had not been formally assigned for this tasks, which sometimes stretched my own time resources.

Admittedly, I also felt tempted to apply for the position of the eLearning manager. This would have given more continuity to the project and would have provided me with the opportunity to influence the implementation of the developed strategy. However, I resisted this (also economically attractive) temptation, since my real passion is doing research.

Supply with technology

During the work of the strategy work group, the significance of technical decisions became increasingly clear. Each of the respective decisions has consequences, not only with respect to the costs for short term implementa-

tion of a technology, but also with respect to long term maintenance and support (e.g. training and consultancy). Different to the assignment of physical lecture halls, which does not have many consequences for the educational process, the decision on academic software, especially software that carries the potential to be used by many teachers, may have huge consequences. E.g. the use of a content management system in parallel to a learning management system has caused conflicts in our case, since there are potential conflicts and overlaps between the concepts of both software packages. The need for coordination of both concepts seems to be higher, than the effort of coordination needed for the assignment of lecture halls.

Not too surprisingly, with respects to the assessment of software, internal relationships (e.g. questions of additional need for training, or the usability for producing teachers/authors) have been more prominent so far, than external relationships (e.g. the interoperability and compatibility with other institutions, or the usability for consuming students). However, this will be changing, especially if the adaptation of specific software is promising access to prestigious networks of peer institutions, or if it succeeds to provide access to (increasingly) common standards in higher education.

Chapter 8

Competences for the effective use of educational technologies at universities

„We investigate eCompetence, not incompetence!"

Dirk Schneckenberg,
Coordinator of the European eCompetence initiative.

The following chapter[1] reports findings of the European eCompetence initiative. It conceptualises effective practices in the use of educational technologies at universities as phenomena, which are determined by three dimensions: actors in education, educational products or processes, and educational technologies. Based on the description and comparison of 33 effective practices, it defines three different types of competences: organisational, pedagogical and technical. All of these three competences can come on different stages or levels, which helps to understand existing differences between universities and their need as institutions to continuously improve their organisational, pedagogical and technical capacities.

THE EUROPEAN ECOMPETENCE INITIATIVE

The European Commission has declared eLearning as a key element in the long term strategy of the *eEurope Initiative*, aiming "*... to ensure that the European Union fully benefits from the opportunities offered by the Information Society Technologies*" (DG EAC 2003). Within the *eLearning Action Plan*, the DG EAC has identified the importance of "*... training of European teachers and trainers*" as well as the "*... facilitation of cooperation and networking between actors*" (DG EAC 2001).

Whilst eCompetence has been referred to as a subtopic in a number of projects funded under the eLearning Action Plan, there has been, thus far, no deeper analysis or development of the theme on a European level for

[1] An earlier version of this text has been published under the titel eCompetence and effective practices in higher education (Pfeffer and de Vries 2006).

higher education. The *European eCompetence Initiative*[@1] is an attempt to respond to the challenges mentioned above and to develop a substantial in-depth analysis of the theme for Higher Education.

One major research goal of this initiative is to give insight into eCompetences needed in higher education or addressed in eCompetence development programmes in Europe. In this paper, we describe this part of the eCompetence Initiative and our analytical framework. This framework is based on the theoretical notions of *social construction* of communication technologies. The basic idea is that there is a dynamic relationship between technology and organisational form. By applying this framework, we want to avoid the pitfall of putting technology mediated education in the middle of our analysis. We apply this framework in our analysis of 33 practical, effective practices in the use of educational technologies and/or of eCompetence development programmes. We describe our method and results and provide a set of recommendations for further development of such programmes.

The eCompetence network

The *European eCompetence Initiative* is a network that examines strategies for the development of individual and organisational eCompetences in Higher Education. Twenty three partner institutions from European member countries, Switzerland, Turkey and South Africa contribute to this project, with participants serving different functions within their institutions. They work as teachers, researchers or developers, as managers, technology experts or staff developers. Additionally, these individuals also represent a variety of different higher education institutions, including traditional residential institutions, some with mixed modes of delivery, as well as those based predominantly on distance education. The partner institutions also differ with respect to their use of technology in education. Some show recent, still modest, uptake of technology, often only in some organisational sub-units, while others are more experienced, have institutional strategies implemented and show an intensive use of educational technologies. Although this group does not represent the European higher education area in rigid quantitative terms, its heterogeneous composition reflects very much the variety of uses and implementations of educational technologies in higher education. Clearly, the network is an ideal context for an analysis of effective practices in the use of educational technologies and/or of eCompetence development programmes.

A MODEL TO DESCRIBE EFFECTIVE PRACTICES

A common approach for investigating the organisational use of educational technologies are institutional case studies (e.g. Seufert and Euler 2005), but also chapter 8 in this book). As a tendency, these case studies often focus on comprehensive strategy projects, and/or on institutions with long term experiences in managing their educational technology. Due to this selection, they describe examples of comparatively advanced universities and/or of comprehensive approaches, which can serve as good examples of where developments might lead to.

Similarly, other authors develop indicators to assess the maturity of institutions with respect to their use of technologies in education, also based on the comparison of case studies.

Institutional readiness criteria (Twigg, 2000b)

- An institution must want to reduce costs and increase academic productivity.
- An institution must view technology as a way to achieve strategic academic goals rather than as a general resource for all faculty and for all courses.
- An institution's goal must be to integrate computing throughout the campus culture.
- An institution must have a mature IT organisation(s) to support faculty integration of technology into courses or must contract with external providers to supply such support.
- A substantial number of an institution's faculty members must have an understanding of and some experience with integrating elements of computer-based instruction into existing courses.
- An institution must have a demonstrated commitment to learner-centred education.
- An institution must have established ways to assess and provide for learner readiness to engage in IT-based courses.
- An institution must recognise that large-scale course redesign using IT involves a partnership among faculty, IT staff, and administrators in both planning and execution.

While this literature provides lots of valuable insights, it would have been problematic to use similar approaches for our study. While a considerable number of our partner institutions show signs of strategic initiatives, only a few would qualify as ‚mature' institution, measured against Twigg's readiness criteria.

Additionally, we cannot assume that the development, implementation and use of technologies, as well as related educational processes take place on a single organisational level, steered by the management or central sup-

port units. This might be one, but by far not the only way how institutions learn. Rather, we expect practices in the use of educational technologies to evolve on different organisational levels and in different arrangements of social actors. We therefore take actual practices as our unit of observation and ask, how they are influenced by actors in education, educational technologies and educational processes.

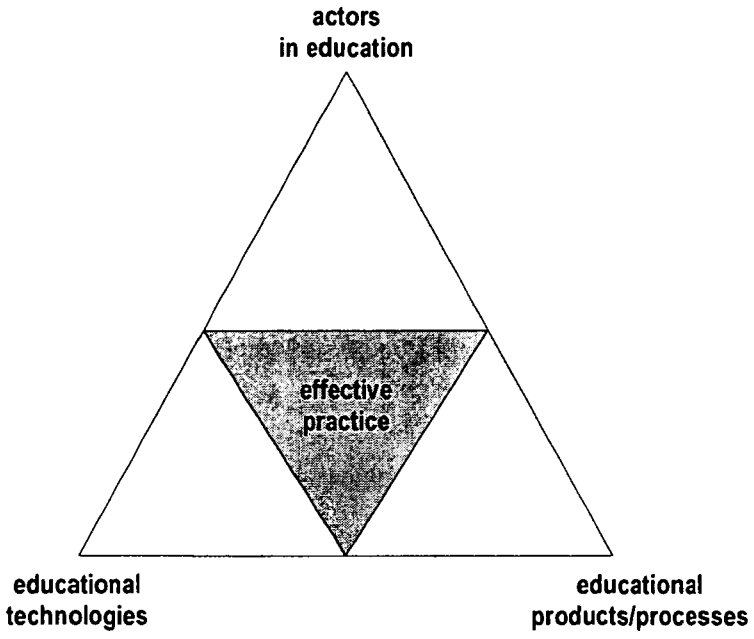

Figure 1.: A framework for the analysis of effective practices in the use of educational technologies

To avoid deterministic assumptions, we base our analysis on theories about the social construction of communication technologies (Fulk, 1993). These theories propose that neither technologies nor organisational settings are given in an absolute sense. Therefore, it would be wrong to assume a linear, uni-directional relationship. Rather, it seems to be more appropriate to think about the *„dynamic relationship of communication technology and organisational form"* (Fulk and Desanctis, 1999, p. 6), a relationship that is constituted by social agents, their attitudes and their practical uses of technologies, which converge in social systems. We therefore assume the practices to be reflections of the given situation in the observed organisations. If competences, both of individuals and of organisations, can be defined as *„the ability to act within a given context in a responsible and adequate way, while integrating complex knowledge, skills and attitudes"* (van der Blij, 2002, quoted by Stalmeier, 2006), then the context (actors, processes,

technologies in education) for the development of effective practices has to be taken into consideration.

Method

We began with a survey to draw from the diverse practical experiences of our partners. For this survey we used an online questionnaire to generate descriptions of effective practices, or solutions, for the use of educational technologies at higher education institutions. As opposed to theoretical models, plans or policy statements, we wanted to receive descriptions of actual patterns of activities which have been undertaken in real contexts.

This questionnaire was based on the example of the *EDUCAUSE Effective Practice and Solution* database[2]. As there, we asked our partners to provide us with a compact description, of a few paragraphs, of a practice or solution they relate to the issue of eCompetence. The descriptions had to contain the following elements:

- Title
- Background, or challenge that was to be tackled
- Practice or solution, a description of the activity
- Benefits
- Shortcomings
- Future plans

We received 33 responses from across the consortium: very different, heterogeneous examples of ‚effective practices.' These can be found on the website of the *eCompetence Initiative*. To analyse these and other contributions from our partners, we use the distinction between actors in education, educational technologies and educational processes.

ACTORS IN EDUCATION

Providers of services and support

With respect to the providers of ICT-related services in higher education, we can distinguish between supra-institutional, institutional and institutional sub-unit levels: thus comprising departments, groups and small networks, as well as individuals.

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[2] By 2004, this was still an independent database. In the meantime, effective practices have been integrated into the EDUCAUSE Resource Center[1@2].

Supra-institutional level

Although the supra-institutional level can contain international actors, such as the European Commission and its ICT policies (Schneckenberg 2006a), here we mainly refer to the context of national higher education systems. Ministries for Education can play a strong role, e.g. by setting up earmarked funding schemes, such as the Irish 'Training the Trainers' programme (Mac Labhrainn 2006), or by reacting to project proposals, as in Greece, where the *Greek University Network* (Balaouras et al. 2006a) proposed to adapt a learning management system for the Greek language. More comprehensive and more integrated, are consortia of universities, which are co-funded by their ministries. Some of these consortia set up virtual organisations, like the *Dutch Digital University* (De Volder 2006a) or the *Finnish Virtual University* (Rissanen 2006), which, in return, provide infrastructure, support and training for their consortia members.

Institutional level

At the institutional level, support units of different shape and mission can play an important role in the use of educational technologies. The *Network Operations Centre* at the University of Athens (Balaouras 2006b) primarily deals with technical issues, like the maintenance of the learning management system and the provision of technical support. In contrast to that, the *Department of Education and Learning* at Aalborg University (Kanstrup 2006) or the *Centre for Excellence in Learning and Teaching* at the National University of Ireland, Galway (Booth 2006) are more focused on didactical developments and teaching support. The unit for *Telematic Learning and Education Innovation* at the University Pretoria is a mix of both types, since it has coordinated the technical integration of campus systems (Le Roux and Jordaan 2006), provides systematic training for staff (Fresen 2006) and gives consultancy to departments to achieve a faculty-wide roll out of learning technologies (Steyn 2006).

It also can be an option to use academic groups or networks to supplement, or to partially substitute for, support units. At the University of Graz, the vice-rector for teaching summoned a group of representatives from different faculties to steer the further development of central eLearning activities (Pfeffer 2006). At the University of Dortmund, a self-organised network was initiated by an academic department, the *Centre for Didactics in Higher Education*, to promote the institution-wide exchange of experiences, to provide training and to develop a qualification scheme (Schneckenberg 2006b).

Additionally, it has to be mentioned that sometimes services can be outsourced to private companies as well. The National University of Ireland,

Galway contracted a small company to provide specialised staff training courses for its staff (Booth 2006).

Sub-institutional level

One type of provider at the sub-institutional level can be the cross-institutional, discipline-oriented network. The *European PhD on Social Representation and Communication* is organised by a *Marie Curie Multi-partner Training Organisation* that includes members from 8 universities in 6 different European countries (De Rosa 2006). The department of Computer Science at the University of Joensuu cooperates with regional high schools for the provision of the study programme ViSCoS (Virtual Studies of Computer Science) (Suhonen 2006a).

Another type of actor is a team that holds responsibility for a study programme at a single university, such as a course committee, study board, teacher commission and the like. For example, at the Autonomous University of Barcelona, teacher commissions organise learning material repositories for the common body of knowledge, specified for the disciplinary fields of individual study programmes (Rué 2006).

A small group or an individual researcher/educator can be yet another type of developer and provider of technology based educational products. The *Educational and Language Technology Group* at the Department of Informatics and Telecommunication at the University of Athens develops rich content and interactive simulations for certain modules in computer architecture (Grigoriadou 2006) or personalised learning environments that accommodate individual learning styles (Papanikolaou 2006). At the Autonomous University of Barcelona, some courses aim at combining the teaching of specific content with the training of skills to use particular software, e.g. the creation of didactic units for basic language training in combination with a standard multimedia presentation tool (Prat Pla 2006), or a course on organisational development in combination with software for concept maps (Tomàs 2006a).

Target groups of services

Institutions

In a broader sense, higher education institutions as entities can be regarded as one target group for educational and technological services. The consortia we referred to above mainly provide general infrastructure, information and support to all the members of their communities, but our partners have not mentioned customised services that are addressed at individual institutions.

Organisational sub-units

The situation is different for another type of target group, organisational sub-units like departments or study boards, which are more frequently addressed as entities. In the case of University of Pretoria, the Department of Telematic Learning and Education Innovation, an academic support unit, offers support and consultancy to individual academic departments to cater for their specific needs. Typically, the support unit is invited to a general meeting of the academic department and both jointly set up a work group for further development (Steyn 2006). A similar approach is taken by the Department for Education and Learning at the University of Aalborg, also an academic support unit, which approaches academic study boards that are traditionally composed of students, teachers and an administrative leader. In several steps and workshops, the process starts in a very open format, gradually becoming more specific and leading to the formulation of a strategy for the study programme (Kanstrup 2006).

Faculty/Academic Staff

The most frequently mentioned target group in our responses was faculty (ie academic staff). They can be approached in different ways. The *Department for Lifelong Learning* at the University of Oslo set up a portal for online pedagogy, providing bite-sized pieces of information on eLearning, the institutional learning management system and a toolbox for teaching online (Koch 2006). At the Autonomous University of Barcelona, the vice-dean of Teaching Innovation at the Faculty of Education moderates a self-organised group of teachers, which shares experiences with the help of 'best practice cards', fosters interdisciplinary teaching projects, and hires experts for pedagogical and technological support on a daily basis (Tomàs 2006b). The *Laboratory of Pedagogical Engineering* at the University of Technology of Compiegne Bât offers two-day seminars on the structuring and transposition of course materials into XML, in combination with a consecutive phase of individual coaching (Piault 2006). The *Digital Chalk* staff training programme at the K.U. Leuven consists of four elective modules, each of which lasts 3 hours: an introductory module on the basic functionality of the institutional learning management system; a design module for analysing the individual teaching practice of each participant; a module about information, focusing on materials from a technical and didactical perspective; and a module about communication, exploring the respective functionalities of the platform (Van den Branden 2006).

The University of Pretoria offers five consecutive staff training courses of sequentially increasing complexity, applying Salmon's (2000, 2002) theories on E-moderating and E-tivities to the practical training in the use

of the institutional learning management system (Fresen 2006). The National University of Ireland, Galway bought in an online distance learning course based on the same model. In parallel to the regular work of participants, it takes place over a 5-week period and is delivered via the institutional learning environment (Booth 2006). The Finnish Virtual University offers two different staff training programmes to members of their partner institutions, the *TieVie Teacher Training Programme* (5 credit units) and the *TieVie Expert Training Programme* (10 credit units), for staff members who plan to become facilitators for other teachers, or to manage eLearning for entire study programmes or organisational units. Both are provided in a combination of national workshops, online modules, individual and group work (Rissanen 2006). The Open University of the Netherlands also uses the distinction between two target groups and respective competence levels, but in a different way. It offers a course for students called "Mouse-based learning". To prove mastery in this course is a prerequisite for teachers to participate in the staff training course "Mouse-based tutoring," which consists of web-based materials and a two-day online workshop (De Volder 2006a).

Students

Most of the examples reported from our partners dealt with traditional student populations in undergraduate and graduate degree programmes. The target group of the European PhD for Social Representation and Communication are doctoral students from all over Europe (De Rosa 2006). The Open University, Netherlands (De Volder 2006a) caters for remote adult learners and the Distance Education Study Centre at Riga Technical University, for adult learners in a specific regional environment. A very special case is the programme *Virtual Studies of Computer Science* that mainly addresses high school students at remote partner institutions, providing them with the opportunity to acquire credit points for the first year of a university degree programme, while still being enrolled at school (Suhonen 2006a).

Modes of delivery strongly cohere with the respective target groups. Predominantly, our partners report about the use of educational technologies in traditional residential settings, or as additional tools in traditional distance education. Most of the reported practices can therefore be regarded as aiming at a variety of blended learning scenarios. Only the last example given above offers full online and distance education, but still uses local tutors.

EDUCATIONAL TECHNOLOGIES

Institutional level

Even if the composition of our group was biased towards people with a strong interest in educational technology, we still were surprised how many of our partners reported to be involved in technological developments. This already is true for the supra-institutional level, but even more so for the institutional level. The University of Athens, for example, contributes to the development of a learning platform for the Greek language context (Balaouras et al. 2006a). The Işık University in Istanbul has developed its own course homepage management system for the dissemination of course descriptions and learning materials (Kuru 2006). Both the University of Pretoria (Le Roux and Jordaan 2006) and the K.U.Leuven (Van den Branden 2006) reported ongoing efforts to integrate commercial learning management systems with other, partly self-programmed enterprise software and to continuously adapt their technologies to the changing demands of their respective institutions.

Sub-institutional level

It can also be necessary to create technological environments for smaller organisational units, not only for the entire institution. At the University of Barcelona, teacher commissions set up virtual libraries specified for individual study programmes (Rué 2006). Another example is the website of the European PhD for Social Representation and Communication that works as a comprehensive technical environment for the study programme (De Rosa 2006). The programme Virtual Studies for Computer Science is generally delivered via a learning management system, but has developed some additional tools for specific tasks, e.g. a visualisation tool for programming activities, a web-based ethical argument tool, and a learning process companion that combines a digital learning portfolio with tools for creative problem solving (Suhonen 2006b).

More specialised tools

Even if learning management systems are very comprehensive tools, trying to support nearly every educational activity inside the setting of individual courses, it is by far not the only educational technology to consider. First of all, there exist widely used desktop applications like word processing and layout, spreadsheet and presentation software, internet-browsing and email, etc., the competent use of which cannot always be assumed as a given, not even among faculty (De Volder 2006b). Apart from that, there sometimes exists the need to apply or even develop more specialised software for

specific educational activities. In a course at the University of Joensuu, a specialised tool was used to support collaborative writing of papers and to track contributions of individual students (Marjomaa 2006). Our partners from Altran SDB have contributed to the development of tools that apply various techniques from *Customer Relationship Management* to eLearning scenarios, e.g. by quantitatively analysing the activities of masses of students in large courses (Arjona 2006). The Digital University (Netherlands) has developed a tool to create competence profiles for individuals, teams and organisations, which support the management of competences at different levels (Stalmeier 2006).

EDUCATIONAL PRODUCTS AND PROCESSES

Specified uses of educational technology vs. eLearning

Frequently, the term eLearning is understood only in a very narrow sense, as a specific mode of delivery for fully online distance education. This understanding can carry a high potential for frustration (e.g. why is there no bigger market for eLearning?), or for limiting one's view (e.g. where do I find ‚proper' eLearning?). And it can lead to useless debates, e.g., about the superiority/inferiority of eLearning versus ‚normal' learning.

Since only a few partners reported to aim at new target groups or to fundamentally change their basic mode of delivery, it seems fair to assume that most of them aim at improving or supplementing their existing educational practices and products. Therefore, it seems best to avoid the overdetermined term eLearning, and rather speak about specific uses of technologies in teaching and learning. This better reflects the actual situation, predominantly characterised by a wide range of blended learning scenarios and often showing a limited and selective use of technologies.

Distinguishing between educational goals and modes of delivery

One additional benefit of this approach lies in the potential to regard the use of information technologies in education not only as a means (e.g. a different mode of delivery), but also as a potential end (e.g. an educational goal) of teaching and learning in higher education.

Both explicitly and implicitly, several of our descriptions reported on the aspect of ‚delivery', i.e. the impact of technology on the way teaching and learning is performed. Many descriptions dealt with the hope that technology can improve the efficiency of knowledge transfer and learning, e.g. by enriching learning materials, by shifting toward more individualised learning scenarios or by increasing interaction among students.

However, it is also necessary to acknowledge the need to teach skills for the use of information technologies and electronic information resources as a major goal in its own right. This makes sense in a situation where culture in general and academic culture specifically, relies on labour and communication that is increasingly mediated by information technologies.

Information literacy

To train and educate for a competent and critical participation in the technology-based culture of the knowledge-society is a major task of higher education. Having said that, it is necessary to acknowledge that even basic computer skills should not be taken for granted, neither among students, nor among faculty. Colleagues reported problems with training in the use of more advanced learning scenarios or educational software/tools, when participants already lacked basic skills. Other partners mentioned training in basic software or introductory courses in the tools and information resources of the institution.

Digital culture

Broader, more general remarks in that respect have been to create a digital culture (Balaouras 2006b), to support the transfer towards a knowledge society (Kapenieks 2006) or to prepare students for the real world that increasingly demands the ability to work collaboratively regardless of location and time (Steyn 2006).

Using existing, and producing new knowledge resources

In some cases, the use of existing knowledge resources was mentioned as an educational goal or activity. For example, one of the assignments of the study programme Virtual Studies of Computer Science, is to make a small investigation on a given subject, not by using ready-made learning materials, but by using the Internet and the library as knowledge resources (Suhonen 2006b).

Several practice descriptions mention activities concerning the production and provision of electronic materials. The Educational and Language Technology group at the University of Athens produces enriched materials, animations and simulations (Grigoriadou 2006), while the course for Language and Literature Didactics at the Autonomous University of Barcelona deals with the production of multimedia-materials (Prat Pla 2006). While these are comparatively complex materials, other descriptions describe materials produced by using regular office software or learning management systems.

Supporting existing vs. creating new educational settings

In most cases, practice descriptions reported activities to support or supplement pre-existing educational settings, such as entire study programmes or single courses, which partly explains the wide use of course management systems - a technical support focused on traditional classes and course structures.

New educational approaches and contexts are also emerging as additional, complementary approaches to teaching and learning, rather than as wholesale replacements for traditional teaching. Electronic student portfolios, for example, can be used across the modularised and fragmented structure of many study programmes by spanning across a range of courses that students take. The creation of knowledge/learning communities for students across different courses is also an attempt to transfer knowledge, skills and understanding between courses and to help students to gain a broader, comprehensive and integrated picture (De Vries 2006).

Self learning vs. increased supervision

Frequently, aims such as the facilitation of autonomous learning (Rué 2006), stimulation of self-motivation and evaluation (Grigoriadou 2006), or to personalise learning environments that accommodate learner's individual differences (Papanikolaou 2006) are mentioned, which are indicative of a focus on student centred and independent learning.

On the other hand, the use of customer relationship management techniques (Arjona 2006) or of tools to track individual contributions in group work (Marjomaa 2006) is not only forms of increased control, but also prerequisites for improved, more individualised supervision. Self learning scenarios and increased supervision therefore are not necessarily contradictory, but rather complementary elements, which is also expressed in the concept of Guided Independent Learning that is used at K.U.Leuven (Van den Branden 2006).

COMPETENCES TO EFFECTIVELY USE EDUCATIONAL TECHNOLOGIES

As these examples make clear, the effective use of educational technologies requires a set of different, but strongly interrelated competencies. Drawing from Bremer (2003), who uses similar distinctions in describing challenges for staff training in the use of educational technologies, we take our basic framework a step further to distinguish three basic categories of competence:

- Pedagogical competences
- Technical competences
- Organisational competences

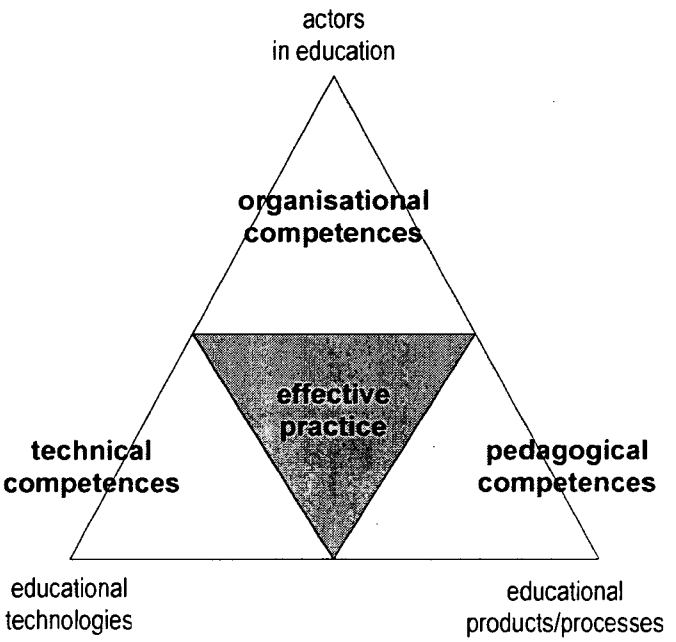

Figure 2.: eCompetence as a set of pedagogical, technical and organisational skills

Since competences are not either given or absent, but rather come in different consecutive stages and have to be developed, we distinguish three different levels for each set of competences. Building on the assumption that competence is the ability to act in a given context, we define competence according to the contextual dimensions we discussed above.

Pedagogical competences

Pedagogical competences can be defined as the *ability to influence educational products and processes*. Drawing from the observations made above, we distinguish between competences with respect to teaching structure, educational product and intensity in the use of media.

Teaching structure:

individual course / coordinated programme / collaborative teaching

Under the handcraft educational paradigm, which still is the most common pattern in higher education institutions, the predominant teaching structure is the single course, run by the individual teacher. To act in this environment, teachers have to act with high autonomy, being responsible for a wide range of tasks, including the selection of contents, the production of learning materials, instruction and supervision, as well as grading and some administrative tasks.

Traditionally, study programmes have been set up as the sum of individual courses, vaguely predefining types of courses. More advanced forms of coordination continually observe the study programme as an integrated entity, e.g. by managing transitions between different types of courses, monitoring results (e.g. completion rates) or by taking care for the marketing of the entire program. Administrative and managerial tasks are required for this coordination, as well as the ability of individual teachers to contribute to this form of coordination.

Collaborative teaching takes place, when teaching is regarded as a collaborative activity, performed on the basis of a functional division of labour (in difference to the segmental division, as can be seen in the handcraft paradigm). Division of labour can take place between teachers, but also include different positions, like tutors and technical assistants. As Twigg (2000a) noted, large enrolment courses taught by groups of instructors are obvious targets for collaborative teaching. However, collaboration also can take place at the level of study programmes, if faculty members work in teams to define content and didactics, or if tasks, which run horizontal to the individual courses (e.g. mentoring of students throughout their study career) are developed. In any case necessary skills are the ability to work in teams and to functionally differentiate teaching.

Educational products

Individual course / coherent curriculum / customised teaching

Closely related with, but not rigidly dependent on the teaching structure are the form of educational products. It is clear that in the handcraft educa-

tional paradigm, the main outcome only can be individual courses, or study programmes, which are the fragmented sum of these courses.

In contrast to that, well managed study programmes can lead to coherent curricula, which can be recognised as coherent products with a clear internal rationale. Based on continuous coordination, students experience this coherence not just as a promise, but also in their everyday learning. This experience additionally can be improved by collaborative teaching.

While individual courses and coherent curricula normally have to provide educational services in a one-size-fits-all mode, student centred learning requires customised teaching activities. A certain amount of individualisation already can be achieved by giving students the liberty to choose time and pace of accessing resources and dealing with online assignments. More advanced forms of customisation would require to assess prior knowledge and preferred learning styles of individual students, as well as to supply several learning paths and alternative teaching modes. Such a complex educational environment can not be provided by individual teachers or coordinated study programmes, but necessarily require collaborative teaching.

Intensity in the use of media

Supplemental / blended learning / fully online

A supplemental use of media is characterised by leaving the given course structure intact, while providing additional resources and technology-based out-of-class activities via the Web.

Blended learning scenarios mix face-to-face meetings with online activities as integral parts of the educational arrangement. An important criterion for blended scenarios is the question, if and how far online activities are graded and thereby acknowledge as part of formal education.

The fully online model shifts most of the teaching and learning activities to the Web.

This distinction should not be understood as evaluation of teaching modes or as an assessment of ‚proper' eLearning. The supply with well structured resources or good supplemental information already can be an helpful for students and is a frequently undervalued task, often a prerequisite for further steps. However, it also has to be clear that blended learning or fully online approaches require enhanced understanding of media didactics and an increased ability to arrange virtual learning communities.

Technical competences

Technical competences can be broadly defined as the *ability to use technical tools and to influence technical environments.* We distinguish between levels of computing and modes of use.

Levels of computing

Desktop / network / enterprise

A broad distinction can be made between desktop, network and enterprise computing, which all create different challenges for the individual and the organisation.

Often neglected, but still a necessary prerequisite for the meaningful use of educational technologies, are the equipment with personal computers and the skills to use standard desktop software for document management, text editing and layout, spreadsheets and presentation. Higher education institutions standardise their purchasing of hard and software not only to get better prices, but also to make permanent maintenance easier and cheaper. Additionally, universities increasingly become aware of their responsibility to foster basic skills among students and faculty, and react, for example, by offering the European Computer Driving[@3] licence as part of their staff training programmes.

Another important step is the shift from desktop to network computing, which connects computers to the internet and provides them with communicative potential in a new environment.[3] Typical network applications are email, internet access, and, to a certain extent, course management systems as well.

The latest, most recent step in this development, at least for universities, is the shift from network to enterprise computing, which can be characterised by the joint, collaborative use of applications inside an institution. While both desktops and network connection has been provided as tools for individuals only in a standardised way (from a teacher's perspective, this often even applies to course management systems as tools to deliver their individual course), enterprise computing requires the collaboration in a digital environment inside the institution, on the basis of differentiated

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[3] It has to be noted that this shift and its huge implications were underestimated even by some big technology companies. Microsoft, which held a quasi-monopoly for desktop software and based its business model on selling software, increasingly feels challenged by Google, a search engine (funded by advertisements), which incresingly offers free software as a supplement to its search engine, or by open source projects, like Firefox (browser), Linux (operating system) and open office (desktop software). One can claim that in technical terms the 1990s were Microsoft's decade, while Google became the main representative of the network paradigm at the turn of the century.

roles and tasks. The collaborative production, sharing and use of documents in a joint content management system or in digital archives is an example for this.

From an organisational perspective, the development from desktop to network to enterprise computing requires competences to provide and maintain different sets of infrastructure, as well as the ability to integrate previously separate applications. For the individual, this creates the need to acquire skills to act in increasingly complex environments, which also makes specialisation for users necessary. While in the case of desktop and even network computing, one could still assume (e.g. in the design of staff training programmes) that everybody should have the same basic skills, enterprise computing requires specialised skills training for differentiated roles and uses.

Modes of use

What is at hand / choose and combine / develop

Another form to describe technical competence is to focus on the way in which they are used.

The most basic form of uptake is to learn how to use technology, that is easily available or regarded as given, either provided by the IT-department or by imitating the behaviour of the near community. This behaviour helps to reduce insecurity, since communication in the local or regional environment is an easy opportunity to share knowledge and skills. It can be observed both on the individual and on the institutional level, e.g. when institutions follow the trend to implement course management systems and select the same products.

A more reflected approach of uptake is based on the specification of needs, the investigation and evaluation of alternative applications, and the informed selection of the most appropriate option. This requires the ability to abstract from given products and to identify types of comparable software packages and functionalities. A closely related competence is the ability to combine and shift between different applications.

The highest level of technical competence is the ability to customise existing software products or to develop new ones. Since many software packages can be adapted via their interfaces without the need of coding, this is not exclusively a task for software engineers or IT specialists, but also for advanced users. In any case, the customisation or development of software requires both a sound technical, but also a good social understanding about how to design and organise collaboration in a digital environment.

It is obvious that not everybody can achieve the same level of technical competence for every available product. However, given the rapid development of technical tools, the presented distinctions make it clear that users (both individuals and institutions) should aim at higher levels of technological skills to gain the ability to take informed decisions. While IT specialists and advanced users are often tempted to produce their own, home grown solutions, they also should take care to base their activities on sound prior research on existing applications to avoid parallel developments and dead ends.

Organisational competences

Organisational competences for the use of educational technologies in higher education can be regarded as the *ability to participate in and to influence social settings*. We distinguish between strategic focus, the support structure at a university and the target units for management and support services.

Strategic focus

Technology / pedagogy / market

Based on a large, international survey that comprised 174 higher education institutions in 7 countries, Collis and van der Wende (2002) broadly distinguished three development levels for the institutional use of educational technologies.

Most universities strategically still focus on the comprehensive implementation of an institution-wide technology infrastructure and to tackle the related challenges.

A serious amount of universities already have reached the second phase and started to develop strategies of how to make use of educational technologies in their teaching activities and of how to redesign their pedagogy.

Only a small proportion of the investigated institutions have started to translate their experiences into strategic attempts to raise their competitive advantage and to pro-actively improve their market position.

Each of these steps requires considerably different types of competences. Following their consecutive order also indicates that, to a certain extent, universities have to take a blind flight through foggy areas into an unknown future, a journey that might take longer than frequently expected. They have to make risky upfront investments in a stage, when they do not see clear outcomes yet. On the other hand, this model also indicates the necessity to acquire skills in the use of technology, before being able to assess its potential for pedagogy and an improved market position. In this

situation, it helps to learn from others to clarify options and challenges, rather than to repeat experiences and mistakes.

Support structure

IT department / instruction and media production / integrated support

At least at European universities, IT departments at universities have existed for quite a while. They are responsible for the basic technical infrastructure and continually expand their service portfolio from desktop to network to and enterprise computing.

A comparatively more recent phenomenon is the evolvement of specialised units for instructional support and media production. They often go in parallel with institutional strategies to improve teaching and acknowledge the fact that the use of educational technologies is not just about pushing the right buttons, but about changing academic practices. At least for Austrian universities it can be claimed that the evolution of instructional support units was triggered by the implementation of educational technologies[4], while in other countries, universities sometimes already had instructional support units, which now included media didactics in their portfolio. An important task for these instructional support units is not so much the dissemination of skills in the use of particular technology to teachers, but rather the provision of „an appropriate instructional framework on which to base their practices." (Bates 1995, p. 245, quoted in Bremer (2003)

The latest step in this development is the comprehensive integration of different service units (e.g. IT department, instructional support, library, staff training, student administration, etc.) under the perspective of the teaching function of the university. The main goal of this integration is to coordinate between different units to provide comprehensive and coherent support for all teaching processes.

Target units for support

Individual course / study programmes / workflows and processes

If support units and services are in place, a consecutive question is, which production unit they target at, either due to their own competences or due to the given teaching structure of an institution.

In most cases, the predominant production unit for teaching still is the individual course, with the teacher as the autonomous producer. This is also often reflected in support and staff training measurements.

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[4] Admittedly, the foundation of these support units also has to be attributed to an increased importance of teaching in general, which partly was caused by the enhanced autonomy and accountability of Austrian Universities since the end of the 1990s. Still, it is remarkable that many of these new units or positions explicitly focus on eLearning.

A more challenging approach is to target study programmes as comprehensive production units. This requires the willingness of the targeted unit, but also the existence of a minimum amount of coordination and functional differentiation, e.g. of a coordinator with whom possible measurements can be discussed. Support staff needs concepts and skills, which address the entire programme rather than the sum of individual teachers.

The most advanced and complex step is to take influence on the redesign of workflows and production processes in teaching. This does not only relate to conceptual questions, but also to reward models and gratification schemes. Many universities still base their gratification schemes for teaching staff on contact hours only, which does not supply rewards for collaboration and functionally differentiated teaching assignments. To change this situation goes beyond the scope of support units and has to be the responsibility of institutional management, in some countries even of governments. In cases, where this flexibility of rewards is given, skills in team work, internal administration and project management gain increased importance.

Pedagogical competences	Technical competences	Organisational competences	
• teaching structure: individual teacher • educational product: independent course • media use: supplemental	• computing: desktop • mode of use: what is at hand	• strategic focus: technical infrastructure • support unit: IT department • target unit: course	**basic**
• teaching structure: coordinated programme • educational product: integrated curriculum • media use: blended scenarios	• computing: network • mode of use: choose and combine	• strategic focus: pedagogy • support unit: instruction, media production • target unit: organisational sub-unit	**medium**
• teaching structure: collaborative teaching • educational product: customised learning • media use: fully online	• computing: enterprise • mode of use: customise and develop	• strategic focus: market • support unit: integrated services • target unit: workflows and process	**advanced**

Figure 3.: Different levels of e-Competences

CONCLUSIONS

This paper described the analytical framework and analysis of 33 effective practices, both applying educational technologies and/or describing eCompetence development programs. Now, the framework is discussed, results are summarised and recommendations for further developments are given.

Based on theories of social constructivism, effective uses of educational technologies in higher education can be conceptualised as outcomes of the dynamic relationship between actors in education, educational technologies and educational products/processes (figure 1). After having used this concept to analyse 33 practice descriptions, it was taken a step further to formulate three interrelated competences for the development of effective practices: pedagogical competences, technical competences and organisational competences (figure 2). Finally, a grid to distinguish between different levels of these competences (figure 3) was suggested.

In comparing practice descriptions, this concept was especially helpful to highlight differences between institutions. It became obvious that different organisations have different problems and therefore often come to particular solutions which are most appropriate for their current situation. For example, some institutions are still concerned with the implementation of their first virtual learning environments, while others already have the problem of integrating their learning environment with other enterprise software. It also makes a big difference if the institution are organised in a more ‚managerial' way (for example, in many northern European higher education systems), e.g. characterised by the existence of specialised support structures for educational development, or if they are organised in a more ‚collegial' way (as in Humboldtian systems), which rather rely on the self-organisation of academics. *To a large extent, these organisational characteristics determine the aims, scope and mode of eCompetence programmes, and the competences that are required.*

In the case of individual practices, it is not always easy to distinguish between the suggested categories of competencies. For example, if new applications for educational technologies are developed, the distinction between pedagogical competency (the ability to create an educational concept) and technical competency (the ability to create or adapt software) can become blurred. However, the suggested distinction between different types of eCompetences can still be helpful. This becomes clear in the relation between basic computer skills and more general information literacy, where basic computer skills are a pre-requisite, but not the same as information literacy, which in return would not be complete without a subset of technical skills.

The suggested categories also proved to be useful in combination with different levels of competencies. This concept makes it possible to realise that *competences have to match circumstances*, especially the social environment in which an effective practice is to be established. For example, it would be wrong to ask for highly advanced online distance learning scenarios in an institution with traditional residential and classroom based education and no prior eLearning experience. It also is too optimistic to ask teachers for advanced blended learning scenarios if they still lack basic computer skills. And it can be quite useless to have very advanced programming skills if one lacks pedagogical competences, or the organisational environment to apply new tools and applications.

Based on this analysis, the following recommendations for the further progress eCompetence development programmes can be drawn. First of all, it is necessary to highlight the importance of basic computer skills specifically, and of information literacy more generally. eCompetence does not start with the use of virtual learning environments. A good command of standard software applications has to be regarded as a basic cultural technique and is a prerequisite for competently dealing with digital forms of information. While it is necessary to acquire information literacy as a general competence, it should be trained in the context of the specific discipline. In other words, it is possible to identify information literacy in general terms, but *it is necessary to apply and train these skills in the specific academic field.*

Secondly, *it is necessary to create a good balance between pedagogical, technological and organisational skills*. Problems or challenges that have been reported in the practice descriptions can often be explained as imbalances between these three aspects, e.g. when sophisticated technology is made available, but pedagogical uptake is lagging behind or organisational support is missing. In these cases, it makes sense to change the perspective from one aspect to another, e.g. to switch the focus from technical solutions to pedagogical or organisational considerations as a way to improve the efficiency and effectiveness of educational technologies.

A third conclusion is that educational technologies and eCompetences are in dynamic development. Therefore *it is necessary to prepare for permanent innovation rather than for a one-time change*, to plan for change rather than for stability. Both individuals and institutions have to face frequent needs to acquire new skills, while at the same time existing skills might lose their value. Permanent innovation also has economic and organisational consequences. Several practice descriptions mentioned the need to shift the economic basis for educational technologies from ‚seed' (or start-up) funding to sustainable funding. Since it cannot be expected that finan-

cial support for higher education in general will be increased, funding for educational technologies will have to come from a re-allocation of existing resources, from organisational re-arrangements, including shifts in workloads and changed roles.

Chapter 9

Why universities have to deal with ICTs at an organisational level

"... higher education will have to educate us
how communication really works
and the real consequences of technology –
especially when what actually happens
is not borne out by conventional wisdoms."

Larry D. Lauer
(Higher Education in Uncertain Times)

ICTs AS A FUNDAMENTALLY NEW CULTURAL PHENOMENON

As has been described in chapter 2, digital media have to be understood as a fundamentally new cultural phenomenon, which creates a functionally distinct symbolic layer and a new set of communicative options for society. Digital media do not substitute previous information and communication technologies, like language, script, print or broadcasting, but rather comprise, recombine and complement them with new opportunities of expression.

New communicative forms

Before considering their potential for cost savings, quality improvements or substitutions (which to a certain extent can be realised as well), it first of all is necessary to acknowledge this fundamental difference of digital media and some of their applications in contrast to other information and communication technologies. This can easily be demonstrated with a few examples. Email, websites and institutional portals are no substitutes for other forms of communication, provide no cost savings and are not any ‚better'. They are just fundamentally different, since they provide communicative functionalities, which can not be met by other media.

The digital divide

Still, society in general and universities specifically increasingly rely on these additional, complementary forms of communication. In the long run,

no scholar will be able to stay in contact with his/her peers without having access to email and the internet, no academic department or institution will be taken for serious, if it is not able to provide information via the internet. I think, similar trends apply to more specialised digital applications in research and education as well. Universities simply will face hard times, if they try to neglect the use of new information and communication technologies for their academic core functions. They will face the dangers of the digital divide, of being left behind. Maybe not immediately, since even decline takes its time in higher education, but in the long run for sure.

Written communication

In their relevance for universities as institutions, digital media should rather be compared with script and print, than with broadcasting, which only showed meagre effects on academic communication so far. Since much scholarly communication takes place in writing, it is remarkable that digital media have a deep impact on existing, and even create a wide range of new forms of written communication. Maybe even more important from an organisational point of view is the fact that digital media, in difference to mass media, tend to support the communication of smaller social structures, like interaction and collaboration in teams, social networks and organisations. They allow to specify relationships between actors and to flexibly adapt communicative arrangements. This carries the potential to support the communication among peers in a global scientific community as well as the collaboration among staff members and sub-units of an institution.

RESEARCH AND EDUCATION

Since universities are constituted by combining research and education in one institution, it is necessary to observe the close links between both academic activities.

Research

As has been argued in chapters 3 and 6, new information and communication technologies influence the forms of scholarly communication, scientific methodology and sometimes even the content of research. A frequently heard metaphor is that *„computing has become the third pillar of science, along with theory and experiment.“* (Daniel A. Reed, director of the Renaissance Computing Institute, quoted in Lohr 2006.) No researcher today can do without at least some basic form of computing. Virtually

every larger discipline develops branches which specialise in discipline specific forms or applications of computing. This trend will continue, since the information processing capacity of computers grows at exponential speed, which has unpredictable effects on the ways new knowledge will be created in future.

Universities already react to this development by providing infrastructure, support services and staff training (e.g. in doing literature research via the internet), by providing them with access opportunities both as producers and as consumers. Maybe even more important is to reflect these developments in the research based education of universities as well. Education has to deal with digital media, because research already does.

Information literacy

In my opinion, the main goal for the use of digital media in education should be to train information literacy for the networked knowledge society, which increasingly relies on new information and communication technologies. Universities have to provide this information literacy at an academic level. Already under an older technical paradigm, higher education has dealt with the search for reliable knowledge resources (mostly scholarly publications, like books and journals), their analysis and understanding, the creation of new knowledge, and the production of knowledge resources (seminar paper, thesis). The task itself has not changed, just the way it has to be performed. Universities can not exclusively rely on hardcopies and on local libraries any more. They also have to deal with digital archives, and have to train academically adequate forms of communicating and publishing. The competent participation in networked communication is not only receptive (e.g. searching and using), but requires the ability to produce and contribute as well.

Authors, like Don Tapscott (2005) claim the arrival of a new type of student, the N-Geners (for net generation), who grew up with digital media and therefore are more demanding with respect to media supply, choices and customisation in higher education. They will put considerable pressure on universities to create media-rich educational environments.

While I generally agree with the assumption that many students today are more technology savvy then, for example, their teachers, I also have some reservations. On the one hand, a considerable amount of students still feel uncomfortable about technology and lacks basic skills, since many grew up in an environment without computers. On the other hand, what counts even more, to be technology literate does not necessarily meant to be information literate. Being able to download music files for the use on one's personal media player, knowing how to handle computer games or

how to communicate in chat rooms does not necessarily mean to be able to search for, assess and create relevant knowledge, even if it is represented in a digital form.

Universities are therefore not exempted from the task to teach students to become information literate at an academic level. Technology skills are an essential part of information literacy, but by far not the only one. They only gain meaning, if they are connected to academic subjects and practical activities. A good practical example is the programme technology across curriculum at George Mason University (Holisky 2002). More general information literacy competence standards for higher education are provided by the Association of College and Research Libraries (ACRL 2000).

Knowledge resources

In chapter 4, three types of knowledge resources have been distinguished: scholarly publications, course materials and academic software. While course materials gain increased importance due to their digitalisation, software can be seen as an entirely new form of knowledge resource. My main argument is that these different types show a lot of similarities and should be treated in the same way, by making all aspects of their creation process (theory, method, findings) open for academic critique and improvement.

Many scholars show concerns about plagiarism, as well as about the quality and reliability of digital knowledge resources. And I agree that the shift from hardcopies to digital representations of knowledge also changes the way in which quality control has to be performed. However, I think this has to be regarded as a challenge for universities rather than as an argument to reject digital media. Who else, if not academia, should be responsible to determine the reliability of scientific knowledge and to develop adequate control mechanisms?

The digitalisation of knowledge resources also leads to an increased institutional awareness about their own knowledge assets. While in Anglo Saxon countries, universities adapt their already existing intellectual property rights regimes to the changes in their environment, often acknowledging the specific ‚ecology' of digital resources by focusing on open access, academic institutions in continental Europe also begin to see the need to establish similar policies for the first time. The Berlin declaration on open access for scholarly publications, which has been signed by the rectors conferences of Germany and Austria and many other academic institutions, but also initiatives to develop intellectual property strategies specifically for learning materials, are strong indicators for this.

As a structural consequence, universities have to set up institutional repositories to allow for the exchange of digital resources. They are prerequi-

sites for increased collaboration inside an institution, was well as within disciplinary communities and can trigger organisational change. While their design seems to be comparatively obvious and tested for scholarly publications, it does not seem to be similarly clear in the case of learning materials. Debates in the field indicate the need for fundamentally new concepts, which do not just consider knowledge resources, but comprise organisational structures, roles and workflows as well. Since design follows metaphor, in chapter 5 I propose to use a ‚literary' rather than other metaphors currently used, because it seems to be more appropriate to the way knowledge resources tend to be used in academia.

INNOVATION IN EDUCATION

Unfortunately, I can not share optimistic view of some observers that the relevance of ICTs is generally accepted in academia. Rather, too many faculty members and even university managers still regard digital media only as an expensive and complicated substitute for the overhead projector, or as tools for centralised administrative control. These reservations are supported by serious concerns about lacking effects, most famously expressed in Russel's (1999) study on ‚the no significant difference phenomenon', comparing more than 300 empirical studies on the efficiency of eLearning. Seufert and Euler (2005) criticised the limitations of empirical studies, questioning their control of variables and the possibility to generalise, since they often lack a clear definition of ‚added didactical value'. I want to elaborate on this argument.

Measuring innovation

There exist serious problems in measuring educational innovation, especially if they bring fundamentally new functionalities, contents and products. Against which traditional criterion, for example, should information literacy in the digital knowledge society (for me one of the most important reasons for the use of new information and communication technologies in education) be measured? Or increased responsiveness to students demands by more flexible learning arrangements? I agree that functional innovations have to specify their intended effects and should try to develop indicators to evaluate effects. However, if the goal is to achieve fundamental differences and innovations, new criteria have do be developed to scrutinise their effects rather than to apply old ones.

Quality improvements and cost savings

It would not be enough to focus just on functional innovation. It also is necessary to deal with the quality and costs of education in traditional terms. However, many universities do not adequately assess these criteria in their traditional settings already, which makes it very difficult to identify changes and to specify respective goals. It is true that the use of digital media does not necessarily lead to improvements, that too many technology projects are too far away from actual educational processes or not sufficiently integrated in curricula. Technical innovations therefore should prove, if they have positive effects, but this prove can not achieved, if no indicators for measurements exist, neither for quality nor for costs (e.g. how to measure potential time savings of individual teachers, if their workload is not documented?). But, as Twigg's (2003) study on course redesign (mentioned in chapter 6) clearly demonstrates, both quality improvements and cost savings can be achieved, if clear indicators are defined and applied throughout an innovation project.

The need for organisational change

While the institution wide introduction of educational technologies (especially course management systems) has its merits, like the availability of technology and the increased awareness and skills of faculty members, it also can create problems. Too often, these technologies are just bolted on existing institution, leaving organisational structures, sometimes even reconfirming the traditional teaching structure of the lonesome teacher. This often creates additional costs for the institution, as well as irritation and increased workloads for faculty members.

Many studies demonstrate that serious effects of information and communication technologies only can be achieved, if they are accompanied by organisational change. Since the direction of educational innovation can not be generalised (too many options are available), it is necessary to increase the organisational potential for innovation (Seufert and Euler 2005). In my opinion, the most important change could come from an increased flexibility of teaching structures. Current resource allocations, steering mechanisms and support structures predominantly focus on the individual teacher and the single course. They hinder experiments with alternative teaching arrangements and undermine innovation and organisational change.

ICTs AS A MANAGERIAL TASK

As has been argued in chapters 6-8, education has to be regarded as an institutional achievement, rather than as the task of individual teachers. I developed some instruments to allow for such an institutional perspective in analysing organisational effects of educational technologies.

An important result of this analysis is that, while bottom-up initiatives play an crucial role in the uptake of digital media in universities, several observations indicate a need for managerial intervention with respect to the development of the technical infrastructure of a university.

The tendency to rate ICTs primarily as a task of the IT department

Historically, IT departments often started with the responsibility for the development of basic infrastructure, like the maintenance of a few computers (mainframes or computer classes) and, later, of a central internet connection. Given the rapid progress of technological developments, their tasks expanded both in scope and range. The provision with personal computers and internet access for every member of the institution became standard. The demand for new, often competing software packages and complementary hardware (printer, scanner, web-cam, etc.) increased. In addition to the provision and maintenance of the technical infrastructure, the need for training and support in its use evolved.

At least in the early stages of this development, end-users, administrators, but also IT departments themselves often tended to regard ICT-related activity as an exclusive task of the IT department. End-users and administrators often did not want to bother with the further implications of technology, and IT departments saw it as a way to expand their influence or, at least, to keep developments under their control. This becomes especially apparent in the case of applications, which go beyond the supply for individual users, like learning management systems or web-portals. There were cases for the implementation of learning management systems, where the decision upon the product was solely delegated to (or taken by) the IT department, without further consultation of other actors in the university. There were cases for the implementation of web-portals or web-sites (central communication tools of the respective institution or organisational unit), where technicians did not only provide the technology, but also took care for the graphical design and editorial maintenance of the content.

The results of this attitude to regard ITCs primarily as a task of IT departments can be unsatisfactory for all involved actors. IT departments come under pressure to cope with a multitude of competing requests and are blamed for resulting costs or for their resistance against new demands.

End-users (mainly faculty, but also students) feel either restricted in their ambitions (pioneers), or left alone in their anxiety about lacking competences and necessary changes of their work routines (late adopters). And administrators are irritated about increasing costs, unclear returns of investments and unexpected implications for the organisation of the institution.

The tendency of academic units to re-invent the wheel

Another problematic phenomenon can be found in the tendency of academic units to re-invent the wheel or to separately commission functionally similar applications without knowing and learning from each other. Examples are the development individual websites for departments, research projects and working paper series, the maintenance of own infrastructure, like local networks and servers, or even the implementation of individual learning management and/or student enrolment systems. While this tendency might reflect the innovativeness and organisational autonomy of academic units (and individual academics), it also indicates a lack of central coordination. As a result, these parallel developments often lead to a waste of resources and sub-optimal solutions.

The tendency of central service units to create separate enterprise applications

There also exist central service units, who create applications in their specific field of responsibility for the entire institutions, e.g. public relations units designing web-portals for the university, research administration units creating documentations of the research output or libraries setting up tools for the publication of working paper series. Similar enterprise applications are virtual learning environments, student registration and management, or enterprise resource planning tools. Each of these applications aim at the entire institution from a centralised perspective, but only within a specific functional domain.

These are obvious initiatives, since ICTs can enhance the productivity in each of the mentioned areas. However, they also create certain challenges. Each of these enterprise applications partly replicate, partly change existing procedures at the university and inevitably cause organisational change. Each of these enterprise applications has to be selected out of a range of offerings, developed and/or adapted to local needs. Each of these enterprise applications has to be communicated and trained to the respective end-users. And each of these enterprise applications can have overlapping functionalities with others, which can offer new opportunities to lever synergies, but also create problems of redundancy and multiplication of efforts.

Examples for the later are grades in both the virtual learning environment and in the student administration system, or electronic publications, which have to be simultaneously stored or documented in the library, in the research documentation and in the web-portal.

Managerial challenges

Growing intensity in the use of ICTs and increasing complexity of applications do not allow to regard ICTs as a containable task of a single support unit. On the contrary, they make ICTs a horizontal issue for the entire institution that cuts across and effects traditional organisational arrangements, since the number of involved actors and effected activities is continuously expanding. Management has to anticipate these changes and to balance the related ambiguities. Management has to provide sustainable resources but also to take care fore cost containment, efficiency and return on investment. Management has to give room for experiments, but also to steer towards standardisation and broad use of provided infrastructure. Management also has to moderate conflicting interests, e.g. between academic departments and central support units, or in between central support units. Management has to keep the balance between technical promises and practical feasibility. And, last but not least, management has to align technical innovation and organisational change with the academic mission of the given institution.

To meet these challenges, the comprehensive steering of ICTs should be regarded as an important task for the central management of a university. The tasks go far beyond the mere administration of technical infrastructure. Rather they effect the core organisation, structures and processes of an institution. Only from an overall perspective it is possible to comprehensively analyse existing workflows of an institution, to assess possibilities for their technological enhancement and to back broader measurements for organisational change at an institutional level.

These responsibilities can be assigned to positions at the central management of an institution, e.g. to a vice-rector of education or to a central information officer. The respective manager does not have to be an IT specialist, but should rather have a general interest for the academic use of ICTs and competences for the organisational development of academic institutions.

RESEARCH AND DEVELOPMENT FOR THE EDUCATIONAL USE OF TECHNOLOGIES

Research for educational innovation

Sustained innovation is necessary, if universities are to meet the challenges and demands of a networked and knowledge society. ICTs are part of the problem, since they create new inherent necessities, and yet ICTs also have to be part of the solution, since they can be used as instruments for innovation as well. The introduction of ICTs is not done in a single step, nor by a single switch from one stage into another. Rather, it is an evolutionary process that has just begun.

However, practitioners, politicians, educators and learners alike are often frustrated by a general lack of innovation in the education system. While other sectors of society undergo fundamental transformations, educational systems and their institutions seem to lag behind and to stick to the *„inertia of immemorial customs"* (Dewey 1998). Or, as the U.S.Department of Education (2002) puts it: *„Unlike medicine, agriculture and industrial production, the field of education operates largely on the basis of ideology and professional consensus. As such, it is subject to fads and is incapable of the cumulative progress that follows from the application of the scientific method and from the systematic collection and use of objective information in policy making. "*

Anderson (2005) attributed this lack of innovation to two main factors: the under funding of educational research and the way in which educational research is performed.

Funding base for educational research

Analysing the funding base for educational research, Anderson compares the spendings for research and development in proportion to the total expenditures in three different sectors: the education system, the health system and the high tech information business. Drawing from Burkhardt and Schoenfeld (2003), he estimates that only .01% of total educational expenditures in North America are spent on educational research, compared to 3% research investments from the total health expenditures, or compared to 10-20% from their turnover spent by information businesses.

Sector	R&D investments
Education	.01 %
Health	3.00 %
Information Businesses	10-20.00 %

Figure 1.: Investments in research and development as proportion of total expenditures in the respective field, according to Anderson (2005).

These rough figures indicate the different esteem and commitment given to innovation in the respective fields. They also can be interpreted as reflections of general attitudes towards change and the approaches to be taken to achieve it, either as something improbable or unpleasant, predominantly to be imposed by governmental regulation (as might be suspected in the case of education), or as a self-imposed need to search for new opportunities, which have to be systematically developed and implemented (as might be assumed in the case of information businesses).

Summing up these arguments, it seems to be crucial for education to invest substantially bigger proportions of total expenditures into continuous research and further development.

Design-based education research

The second factor Anderson (2005) blames for the meagre efficacy of educational research with respect to innovation is its lacking development perspective. This is due to the traditionally used paradigms and the current practice in educational research. The quantitative paradigm applies statistical methods and wants to discover the laws that govern the behaviour of individuals. The qualitative paradigm tries to understand a given context from the perspective of the involved insiders. The critical paradigm aims at investigating and exposing power relationships between actors. However valuable the insights from these types of research might be (which they surely are), they mainly deal with phenomena in the past and the present. As far as recommendations for innovation and change are produced, they are seldom tested and systematically implemented in practice, but rather end up in research publications.

Especially with respect to the use of newly evolving ICTs in education, the focus on the past and the presence provides only limited insights. Rather it becomes necessary to shift the focus on possible futures, to create new applications and practices, to test their efficacy for education and – if proven viable – to disseminate them on a larger scale. Such a development and solution-oriented perspective already is established in other disciplines,

e.g. in the live sciences (where new drugs or treatments are created) or in engineering (where new technologies and mechanisms are created).

To achieve the necessary shift of focus from insights and descriptions towards solutions for practical problems, Anderson (2005) therefore proposes a design-based approach for educational research. In his definition, the design-based approach carries a certain resemblance with action research, insofar as it strongly involves practitioners. But, unlike action research, it is not only a bottom up process, where practitioners carry most of the workload and the responsibility for all inputs, while the researchers merely serve as moderators. Rather, *„this partnership serves to share both workload and expertise of all participants."* (Anderson 2005) Design-based research assigns the responsibility for scientific exploration and well-developed interventions primarily to the researchers, which relieves the involved practitioners (often individual educators) from the task to keep up with the relevant literature and the newest technological developments themselves.

Another characteristic of the design based approach is the need for a flexible and rather long-term strategy. Following Bannan-Ritland (2003), it has to comprise informed exploration of given knowledge, the design and enactment of interventions, the evaluation within a local context, and a broader impact evaluation in multiple contexts. Produced findings have to be fed back into further cycles of innovation. This cannot be done on short term assignments of individual researchers, but requires the long term commitment of large and multidisciplinary teams.

Design-based education research and organisational development

In addition to Andersons's above described two explanations for the lacking innovativeness of educational research, I suggest a third one, which lies in the characteristics of education itself. In the past, education (the purposeful attempt to shape individuals) could only take place in personal interaction between teacher and student, which more or less exclusively was organised in classroom settings. Luhmann and Schorr (1982) called this the ‚technology-deficit of education', indicating the structural difficulty to create cumulative effects in a situation that does not allow for functional differentiation of labour or for specialisation of roles. In functional terms, all educators did the same, since each teacher was equally responsible for the entire educational process in the individual classroom. Traditional communication technologies did not allow for more. This also limited the impact of educational research. As long as education only is performed as teacher-student interaction, all possible innovation focuses on individual teachers and their behaviour, which creates pressure for the

individual and restricts the possibility to accumulate effects of innovation on a larger scale. As long as education exclusively is organised in classroom settings, other parts of the institution merely serve as organisational supplements, which in the best case facilitate, in the worst case irritate classroom teaching.

This situation is slowly changing, largely due to the effects of new information and communication technologies. Student centred learning arrangements, which increase the flexibility to adapt to individual needs, schedules and learning preferences, animations, games and interactive applications that provide training and instant feedback in pure man-machine interaction, or ePortfolios which cut across individual courses and promote the integration and reflection of personal progress over longer periods, are only a few examples of how the notion of education is expanded beyond the traditional classroom settings. It also becomes apparent that the task to provide and maintain these evolving educational arrangements can not be assigned to a number of individual teachers. Rather it becomes necessary to differentiate specialised roles and to coordinate between them.

New educational arrangements require changes of organisational arrangements. Therefore it would not be enough to focus design-based educational research only on traditional organisational settings and to reduce the understanding of innovation to the ability *„to migrate [an effective intervention] from our experimental classroom to the average classroom."* (Brown 1992). The focus of observation has to be expanded beyond the classroom and to comprise other organisational settings as well. Since educational innovation is closely linked to organisational change, it is crucial to make organisational development a top priority on the agenda for design-based educational research.

Research and development for the university

How can universities as institutions react to the increasing need for research and development for education, and keep up with relevant findings? Even if academics at universities are all doing research, for most of them neither education nor information technology is their main research focus. It is true that they still should try to investigate the possible implications of technology on the educational practice of their discipline, but they can not be expected to do it with the same academic rigor they invest in their respective main research fields. On the other hand, traditional academic departments for pedagogy and education research might have the professional tools and (sometimes) the interest to research and develop for the use of ICTs in education. However, in most cases they do this kind of research in

the context of their disciplinary communities, and have no mission or assignment to systematically implement their findings at their home institution.

Boon (2006) put this dilemma into a nutshell: „*Universities can be regarded as enterprises in the knowledge industry. In other industries enterprises have their own research and development units to innovate their processes, products and services. What are the functional equivalents for institutional research and development at universities?*" To keep up with the latest developments in the environment, to create new ideas and adapt them to the core business of the specific institution could be the task of specialised units for educational innovation and development. These units should accumulate expertise for the institution and have characteristics of both academic research and faculty support departments. Like academic research departments, they should perform applied research and development for the institution as their main beneficiary to systematically provide options for the improvement of educational products and processes for the local context. Like faculty support departments, they should also have the capacity to implement and disseminate selected innovations into the organisation and to provide training for individual faculty members.

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Chapter 9

Why universities have to deal with ICTs at an organisational level

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