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Otto Peters

Distance Education in Transition

New Trends and Challenges

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This book is dedicated to

Emi Maria Saft

Pro-Rector for Development at UNISINOS
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Contents:

Series Editors' Foreword

In 1994, Desmond Keegan edited *"Otto Peters on distance education. The industrialization of teaching and learning"* in the Routledge series on Studies in Distance Education. In this way he recognized Otto Peters as an outstanding authority in the field of distance education and acknowledged his far-reaching influence on the development of theory and practice of distance education. The legendary monograph on *"Das Fernstudium an Universitäten und Hochschulen: didaktische Struktur und vergleichende Interpretation – Ein Beitrag zur Theorie der Fernlehre" (Distance education at universities and higher education institutions: didactical structure and comparative analysis – a contribution to the theory of distance education)*, in which Otto Peters conceives distance education as the most industrialized form of teaching and learning, was first published in 1967. His approach to distance education has been extensively cited and became a widely accepted theory in distance education.

Otto Peters has elaborated over a period of more than thirty years the characteristics of distance education endeavors, concepts and practices and stressed its unique potential to democratize education. Throughout the world, distance teaching institutions are providing access to education for a great number of students, particularly in the field of higher continuing and adult education. Carefully developed and designed instruction, produced and distributed in print or in other mediated forms that reaches out to individual students is in the center of Otto Peters' concern and the guiding principle for shaping the every-day practice of distance education.

It is Otto Peters' vision, the vision of a humanist, to bring about more equity and more equality of educational opportunity by designing more models of high quality distance education in industrialized as well as in developing countries. And it is his vision, the vision of a pedagogue, to marry the model of the autonomous learner as the ultimate goal of all successful teaching and learning, with distance education. In his *"Learning and Teaching in Distance Education. Pedagogical Analyses and Interpretations in an International Perspective*" edited in 1998 (revised in 2001) in the Kogan Page Open and Distance Learning series by Fred Lockwood, Otto Peters provides the systematic and comprehensive pedagogical approach to distance education. He analyzes and interprets the impact of developments from industrial to post-industrial societies. And, at its dawn, he assesses the impact of the new digital information and communications technologies on teaching and learning. He also examines the new trends in distance education as it undergoes concurrent changes.

During recent years Otto Peters has elucidated his approaches to learning and teaching in distance education from a comprehensive point of view and reflected the latest developments of its theory and practice. The results – his latest insights and research findings – are compiled in this book on *Distance Education in Transition: New Trends and Challenges.* In it he describes the revolutionary impact of the digital information and communications technologies on distance education and interprets it from a pedagogical point of view. He sees that it will commence unique opportunities for distance education and especially for the independent learner who will be in future more than ever an autonomous, self-directed learner. At the same time Peters develops perspectives on preserving the humanitarian legacy of distance education in the information age.

Even in the early stages of educational applications on the Web, Otto Peters was attracted to the new technology. In 1997, he engaged himself as part of a team of distinguished experts in the development and the teaching of the Virtual Seminar for Professional Development in Distance Education, conducted by Ulrich Bernath and Eugene Rubin. His fascination with this pioneering experiment resulted in his continuing teaching commitment in the online Master of Distance Education (MDE) program. This program succeeded the virtual seminar and since the beginning of 2000 is jointly offered by the University of Maryland University College and Carl von Ossietzky University of Oldenburg. Otto Peters is a passionate faculty, tutor, moderator, and facilitator in the online learning environment, demonstrating and practicing approaches of how to make this new online format of teaching and learning a success for his students.

The editors of the ASF Series are grateful to Otto Peters for making his new scholarly achievements available to his students in the MDE program, to other students interested in more expansive studies of the foundations of distance education, to colleagues in the field, and, of course, to all who are curious and attracted by these latest works of Otto Peters. We are pleased to share with Fred Lockwood the honor of writing the forewords for this book, which was first published in 2002.

The third edition has been updated and expanded by two articles included in chapters 9 & 10 and by a name and subject index. With Otto Peters' "Visions of Autonomous Learning" in the 11th chapter of the fourth edition his impressive work is rounded up.

Franziska Vondrlik deserves our appreciation and gratitude for her constant editorial assistance.

The Editors
November 2004

Foreword by Fred Lockwood

As an educator or trainer, working with school children or university students, trainees in industry or workers in commerce, you will have been bombarded by claims as to the extent to which *Communication & Information Technology* will influence learning and teaching. We are repeatedly told we are at the beginning of a digital revolution that will fundamentally change our methods of learning and teaching; a revolution that will change our lives. However, such rhetoric, and even eye catching illustrations of how the new media can be used, is no substitute for careful consideration of the pedagogy upon which such claims must ultimately be based and how the research evidence is interpreted.

In this book *Distance Education in Transition. New Trends and Challenges*, Professor Otto Peters makes a major contribution to this specific domain of knowledge. He extends his analysis and discussion of the pedagogy inherent in distance education and virtual learning environments; one that was started with his book *Learning and Teaching in Distance Education* (1998, revised edition 2001). These books provide a basis from which this revolution can be assessed, that can combine the best of current practice and allow us to contribute to this revolution.

The fundamental position that Professor Peters adopts is that in preparing our students for life in the knowledge economy, and learning in a digital environment, the aim should be to provide opportunities for *autonomous* learning not *heteronomous* learning. We should strive for a pedagogy that is learner centred and interactive, providing an opportunity for learners to be self-directed, self-reliant and self-regulated. He contrasts this with the pedagogy that has been dominant for centuries – that of expository teaching and receptive learning. In the new environment, that many are embracing, Professor Peters suggest we – the teachers – will no longer be the source of all information and content; our role will change to that of guide and facilitator. We will no longer be the *sage on the stage* but the *guide on the side*. It represents a fundamental change from a teaching to a learning culture. In this digital learning environment the goal will be for learners to plan, organise, control and evaluate their own learning. In doing so they will be involved in navigating, browsing, searching, connecting and collecting information within an environment few of us could have considered less than a generation ago.

We should be under no illusions – we *are* in the midst of a revolution in learning and teaching that has massive and far-reaching implications. We ignore it at our peril and to the detriment of our learners. However, this book was not written for technophiles and we do not need a detailed understanding of computers, software and networks – in fact we only need to be aware that this technology exists. It aims at a *pedagogical* interpretation of distance education and online learning. It advocates and demands pedagogical reform.

This book will challenge many of our long-standing assumptions and practices. This may be uncomfortable of some of us. However, the reward for our efforts will be considerable. Peters describes the pedagogy of a whole new-world of learning and teaching, a gateway to life long learning. It is likely that you too will be convinced that our aim should not be for teacher dominated, goal directed behaviour but for

independent networked thinking – for *autonomous* learners. Our aim should not be to perpetuate previous teaching and learning practices in the new environment but to consider a whole array of possibilities that are open to us.

Fred Lockwood
Manchester, January 2002

Introduction

Owing to the exponential expansion of distance education during the last decade the interest in this particular form of learning and teaching has grown in a remarkable way in many countries all over the world. Never before were there so many persons weighing the pros and cons of this form of learning and teaching, never before were so many respective experiments conducted in this field, and never before were there so many new protagonists of this form of learning and teaching. Now even experts outside the field of traditional distance education see its unique possibilities, a trend which can be observed most clearly at national and international conferences on this field of educational activity. Also traditional universities start experimenting with distance education after a long period of ignoring this method of teaching and learning. As Tony Bates (1997, p. 93) put it: „While the establishment of the Open University initially made little impact upon established universities and colleges, most of whom were quite happy to ignore it, this time technological change is striking at the very heart of conventional schools, colleges and universities." Indeed, many find it reasonable not only to develop electronic forms of distance learning, but also to establish new divisions for distance education. Even Oxford University is linking with Stanford, Yale and Princeton to create an online college for alumni. The idea is to provide lifelong learning and support to some of the world's policy makers and business leaders. Cambridge is exploring virtual learning in its £ 83 million government-backed link up with the Massachusetts Institute of Technology (MIT). The project is known as "the bridge of minds" and is principally intended to foster commercial spin-offs from university research. It also has the potential to become an e-university." (Bates, 2001, p. 32). Also the unparalleled upsurge of publications and the rapid growth of the number of seminars, workshops, and symposiums dealing with current problems of distance education are ample proof of this trend.

The main reason for the rapidly increasing interest in distance education are, of course, the unbelievable advances of telecommunication. Its digitalisation confronts teachers and schools with unpredicted, unforeseeable and surprising promises. Especially for distance educators four astounding innovations are important: improved personal computer technology, multimedia technology, digital video-compression technology and Internet technology. Together with other technologies they make possible unexpected logistic and pedagogical advantages: the quick delivery of information at any time and everywhere, genuine possibilities for autonomous learning, more interactivity, more learner-orientation, more individualisation, better quality of programmes, and greater learning effectiveness.

What does this mean in the concrete learning situation of distant learners? They are provided with the possibility and are enabled to learn „face-to-face at a distance" (Keegan, 1995, p. 108). And – as if by magic – many new virtual ways of contacting persons everywhere „quickly, easily, safely and cheaply" (Hawkridge, 1995a, p. 5) are available. This means e.g. that also distant learners are in a position to exchange views, discuss problems, and take part in scientific discourses, tutorials, and counselling sessions. Likewise they even may take oral examinations and chat with fellow students or with persons interested in the subjects to be learned in other countries. New dimensions for the pedagogy of distance education are opened up and compensate for certain deficiencies

inherent in traditional forms of distance education. Distance education is “at a point of turning (Daniel, 2001, p. 20). Small wonder that the number of students and teachers increases who are eager to learn more about these new possibilities.

However, if we focus on the teaching-learning process and also analyse the consequences of the changes referred to we cannot but see that the surprising advantages of computer-based distance education are bound up with quite a number of problems. The more distance educators are engaged in making experiments with the rapidly developing information and communications media the more they become aware that distance education has been caught by deep-rooted structural change.

This change does not relate to the „new media“ only as being opposed to or supplemented with „old media“. The methods have to be altered and partly developed in new ways, too. And the contents will be affected as well. Increasingly many new learning and teaching programmes will have international and intercultural features. And it stands to reason that subjects taught by means of printed books will be different when disseminated by Internet. It is certainly indicative and telling that experts at the 3rd International Conference on Technology Supported Learning in Berlin presented ideas about „developing and adapting content in order to make it suitable for electronic delivery“ (Online Educa Berlin, 1998). But this is not even the worst of it: On top of this the very nature of scientific knowledge will not remain the same. It will change to a degree similar to the transformation caused by the use of books. Now it will become necessary for us to distinguish clearly between »knowledge« and »information« and also between »traditional knowledge« and »informed knowledge«.

Finally, we will also have to face severe institutional changes. Some experts already maintain that the campus university needs a „reengineering“ in order to prepare it for a digital future. Others believe that the campus universities are doomed anyway under the impact of distance education of the third generation. Will there be a time in which universities lose their traditional significance? Will research and teaching be organised in quite another, highly decentralised way? Will big international commercial corporations take the lead in this field? Can universities influence the developments ahead of us in order to avoid falling victim to those strong technological, societal and cultural trends? Are there new pedagogic patterns, which could support them for being prepared for academic learning and teaching in the knowledge society? Will the virtual universities, so often discussed these days, be ready and in a position to develop these patterns?

The articles presented here deal with these problems. This book consists of a number of invited keynote speeches held at expert meetings in Tübingen, Seoul, Moscow, Shanghai, and Manila during the last years as well as of an article for a book with the programmatic title "The Continuing Education Society", published in Germany in 2000.

1 Growing Importance of Distance Education in the World

At present, distance education is in the process of gaining more and more importance because of its structural relationship to many forms of online learning. As it is able to draw on 150 years of experience in a-synchronous teaching and learning outside the traditional classroom or lecture hall it can contribute substantially to the present pedagogical structure of online learning. The history of distance education has always been a history of its growing importance. This importance, though, differed in the four periods of its history described. It performed, for example, quite different functions in the periods of »pre-industrial distance education«, of »correspondence instruction« and in the period in which more than 40 »distance teaching universities (open universities) « were established in many countries all over the world which has led to the emergence of mega-universities. The single mode distance teaching universities improved the methods, the image and the general impact of distance teaching considerably. Presently the following indicators of the increase in importance can be seen: the rise and integration of online learning, the growing interest of experts, governments, the European Union, and in part of the public as well, the growing demand, and the growing significance of distance education research.

Introduction

"Telematic" applications to teaching and learning are quite often seen as technological processes, which are discussed in the framework of computer science, electrical engineering and communication studies. And even more often they are interpreted merely as means of delivering instructional programmes and of facilitating access to higher education. By analysing distance education, however, interesting and valuable pedagogical aspects and experiences can also be brought in and regained.

Sometimes the new information and communication media are praised for crossing the boundaries and restrictions of time, geographical distance and personal dependencies, this being considered to be a decisive and unparalleled innovation. However, viewed from a pedagogical point of view this means that their protagonists are trying to reinvent the wheel. We should be aware that the achievements mentioned were already attained in the middle of the 19th century, when the first correspondence schools started teaching. Since then we have had a tradition of a-synchronous teaching and learning outside the classroom or the lecture hall. And since then technical media and technologies have been employed in order to provide education to (very) large groups of learners distributed over a (very) large area.

Clearly, there is a structural relationship between distance education and online-learning. This must not be forgotten when we enter the digital era in learning and teaching. We should keep in mind the experiences gained in distance teaching during the last 150 years. This is very important, because practitioners and theorists of distance education have developed quite a number of approaches in order to overcome not only the geographical, but also the psychological, social and cultural distances between teachers and taught. And that is not all: there is a "pedagogical heritage" of distance education related to long experience. It is unwise to ignore or even to deny it.

Historical Perspectives

If we trace the history of distance education we become aware that there was a development from the first singular attempts in antiquity to the unexpected and surprising spread of this form of teaching and learning all over the world during the second part of the 19th century. This development has become quite dramatic during the last 25 years with the advent of open universities and is taking place with breathtaking speed at present with the establishment of virtual universities. Looking into the future we might even predict that this development will continue and become strengthened. In the long run it will expand even more and become an indispensable part of all higher education in most universities all over the world. Its relative cost-effectiveness alone will be critical in this process, especially in "developing" countries.

A Forerunner

The first experiments in distance education were singular and isolated ones. However, they were already of profound importance for the persons involved, because the content was religion and religious controversy, which was taken very seriously at that time. I am referring here to the Apostle Paul, who wrote his famous epistles in order to teach Christian communities in Asia Minor how to lead a life as Christians in an adverse environment. He used the technology of writing and transportation in order to do his missionary work without being compelled to travel. Clearly this was already a substitution of face-to-face preaching and teaching by mediated and a-synchronous preaching and teaching. And it was a technology-based, but still "pre-industrial" approach. At that time nobody could imagine the outstanding importance which would be attached to this very approach all over the world in the twentieth century and, it appears, even more so in the twenty-first century.

"Correspondence" Education

In the middle of the 19th century, the first general approach to distance education can be identified wherever industrialisation had changed the technological, vocational and social conditions of life. Educational systems of the period were not at all prepared for these structural changes. They could not adapt to the severe educational paradigm shift of these years. Thus, many new educational needs were not even identified, let alone taken care of. However, entrepreneurs at the beginning of the industrial revolution, mainly publishers, identified them. They decided that profits could be made by meeting the educational demands of these people and by exploiting the possibilities of mass production and mass distribution and the technologies of the post and railway system.

At that time, many correspondence schools sprang up, in England, France and Germany as well as in other European countries. More were to be founded later on other continents. They became important because they offered tuition to those people who were neglected by the educational system, among them gifted persons who wanted to climb socially in order to improve their living conditions and the quality of their life. They gained importance as workers were challenged in many ways by new tasks and new methods when the artisan way of working became more and more industrialised. They started the commercial competition, which was to become an important feature of higher education in the digital age. And, with regard to the theory of distance education, they developed the

first and fundamental model of distance teaching, which could stand the test of practice as well as of time.

Two aspects of this particular form of distance education added immensely to its importance:

- Correspondence education was used in large, but sparsely populated countries like Argentina, Canada, Australia, and also in the former Soviet Union where it was quite often impossible to offer tuition to persons living in remote areas. They used correspondence education – quite often supported by radio and, in Australia, even by aircraft. In these countries the geographical distance is quite often "overlapped by historical, social and cultural distance" (Coicaud, 1997, p. 152).
- Distance education became even more important for those who lived far away from their home countries in colonies. British people, for instance, serving in one of the colonies of the British Empire quite often had no opportunity to attend a traditional university and had to prepare themselves privately to sit the external examinations of the University of London. They were assisted by the services of several correspondence colleges which relied on the technology of shipping and navigation in order to deliver the teaching material. These particular teaching and learning processes were truly a-synchronous due to the long times it took in order to reach, for instance, students in India and Australia. These activities represent another root of modern distance and open higher education. The same can be said about distance students in French colonies registered in the commercial "Ecole Universelle" in Paris.

Distance Teaching Universities

In the seventies, a new epoch of distance education began. It can be characterised by its additional use of two analogue electronic mass media – radio and television – and later also of video and audiocassettes as well as of study centres. This pedagogical shift cannot be overestimated. It increased the importance of distance education tremendously.

The new technologies were consistently used in an integrated way and not just occasionally. Public funding enabled these universities to develop high quality teaching material. Mass production of carefully developed, pre-prepared and pre-fabricated printed material was supplemented by the broadcasts of these powerful mass media. Autonomous single mode and degree granting distance teaching universities were established. Governments mostly founded them in order to implement their educational policy. In some countries these universities were even open to students with no regular university entrance qualifications. This new beginning and this new approach changed the entire scene of distance education. Its main new features were: considerable progress in establishing and opening higher education for larger groups of adult students, pedagogical experimentation, the increased application of educational technology, the introduction and support of open and life-long learning and the beginning of mass higher education.

The consequences of these achievements are invaluable: They made distance education even more relevant than ever before. Now this form of learning was not only recognised but also actively supported by governments. Its public image improved a great deal. Never before had distance education been so important as in the seventies and eighties.

How far its image had been improved and how attractive this concept had become can be illustrated by a telling example. Large electronic companies offer their appliances for various forms of teleconferencing to American universities by inviting them to enter the field of "distance education", using this term which up to then had not been familiar in this country at all for advertising purposes, (Duning, 1993, p. 209). The irony of this story is that the extension of classroom teaching by means of videoconferences differs extremely from distance education as defined and interpreted with the criteria and standards inherent in this particular form of learning.

Measuring these progressive developments of distance education against the lethargy of traditional universities with regard to university reform and pedagogical experimentation we cannot but concede that distance education has performed a revolution in higher education with many important consequences for the future (Peters, 1992).

Summary

So far we distinguished three periods in the history of distance education. In the first period, singular projects established and tested this method and paved the way towards online learning. The second period represents the era of mainly commercial, but later states correspondence education as well, and the third period stands for the era of distance education by open universities. In this last period that special way of teaching and learning has attracted worldwide attention and we have become witnesses to an unexpected break-through of this method in tertiary education.

In each of these periods distance education performed different tasks and in each of these periods distance education gained significance by expanding its services to more and more students in more and more circumstances in more and more countries and by becoming more effective and more efficient. The reason for its coming into being is clearly that there were those in need of education and no other way to acquire knowledge or to become educated was available. In other words: distance education became relevant because it enabled governments and schools to overcome educational emergency situations or to minimise their consequences. Today we are in an emergency situation again, in an emergency situation which is much more critical and far-reaching. Distance education will become instrumental and will help to overcome this situation again – a development which will add considerably to its importance.

It must be emphasised that the growing importance of distance education can be related to the technologies used in each period: writing, printing and transportation by means of railways, cars, aircraft, transmission by "old media" such as radio and television as well as by "new media", especially the computer.

Growing Interest

Not only has distance education become a necessary and in many circles even an attractive and popular form of learning and teaching. One of the consequences of the third – and so far most important – period of distance education was a definite increase of the number of people who wanted to learn more about the new form of teaching and learning. Distance education became a subject, which was now dealt with by educational researchers and even discussed in newspapers and journals. But there is also another impressive indicator of this new interest: the growing number of practitioners and

experts attending the world conferences of the International Council for Correspondence Education. In 1965 a relatively small group attended the ICCE Conference. Only 80 participants convened, and these were mainly Australians, Americans, Canadians and, for the first time, three or four Japanese. These conferences took place at an interval of four years. In the seventies and eighties, however, this group of participants became larger and larger. At the 20th World Conference of ICDE in Düsseldorf/Germany in 2001 more than 1200 experts from 85 countries had registered. It is already discernible that new groups of experts will attend these important world conferences. Conventions now take place biannually.

Growing Demand

There is also another indicator of the increasing importance of distance education during the third period: a great and still growing demand for this particular form of education. Governments, commercial enterprises, universities, churches, and supra-national concerns became eager to introduce and implement it in order to provide for it.

The greatest demand, and this is most impressive, comes from learners. They are rushing to enrol in distance teaching institutions, especially distance teaching universities, all over the world. A remarkable number of these distance-teaching universities have several hundred thousand students on their rolls. This is an extraordinary and surprising development. Anadolu Üniversitesi in Turkey caters for 577 000 students, the Radio and Television University in China for more than 500 000 students. Keegan (1994, p. 8) claims there are in fact 850 000 Chinese students. Terbuka in Indonesia caters for 353 000, Indira Gandhi National Open University for 500 000, Sukkothai Thammatirat Open University in Thailand for 216 000 and Korea National Open University for 210 000 students. All of these are single mode universities. The advance of these "mega-universities" (Daniel, 1998) is surely the most important phenomenon in the current development of higher education. It should be recognised and taken into account especially when we try to figure out what the "university of the future" may look like.

Expansion and Growth

If we analyse the third period in the development of distance education, which is characterised by the emergence of single mode multiple mass media distance teaching universities, we cannot but be impressed by the fact that so many of these universities were established one after another in the seventies, eighties, and even nineties. In 1994 Börje Holmberg (1994, p. 20) listed 28 of these universities and six organisations, which do similar work. Seven years later he referred to forty of such distance teaching universities (2001, p. 17). Their number may even be considerably higher as he included only internationally well-known distance teaching universities. They are to be found in 26 countries all over the world, as many governments used this new type of a university in order to solve some of their most urgent educational and training needs. How crucial these needs have been and still are can be seen from the development of those mega-universities mentioned above. But even if these distance-teaching universities cater for less than 200 000 students they are still quite often the biggest universities in their countries and sometimes attract more students than all other universities together. This applies to the Open University in the United Kingdom, CNDE in France, Payame Noor University in Iran, the University of South Africa, Universidad National de Education a

Distancia in Spain, Universidade Abierta in Portugal, the FernUniversität in Germany, and the University of the Air in Japan. It also refers to similar distance teaching universities in Venezuela, Costa Rica, Colombia, Sri Lanka, Israel, Taiwan, and Pakistan. All of them are larger than traditional universities with regard to the number of students.

It is very interesting to see that these distance-teaching universities differ from one other considerably, even though all of them are technology-based and more or less influenced by the model of the British Open University. Obviously, different socio-economic conditions, a different cultural heritage, different academic traditions and learning cultures, as well as different ideas about the role of universities and higher education in society, have lead to special versions of distance teaching universities with specific pedagogical structures as well. The fear that the "mechanisation" of education could level down academic forms of teaching and learning seems to be groundless. The following typical structures of distance teaching institutions can be identified as being most characteristic or even paradigmatic:

Distance teaching universities	**Typical media structures**
University of South Africa	**Correspondence university:** Printed course material, study guides, tutorial letters
Open University (United Kingdom)	**Distance teaching university:** Open access. Pre-prepared course material, course team approach, radio and television broadcasts. Counselling and tutoring in study centres
FernUniversität (Germany)	**Research-based distance teaching university:** Pre-prepared course material, video- and audio cassettes, TV broadcasts, tutoring in study centres, seminars
Central Radio and Television University (China)	**Mass media based distance-teaching university:** TV- and radio-lectures, several compulsory classes per week. Supplementary printed material
National University Teleconference Network (USA)	**Video-based extension of face-to-face teaching in a college by a consortium of universities:** Video-based distance teaching together with textbooks and instructors. Interactive videoconferencing
Project North (Ontario, Canada)	**A teleconferencing-based co-operative distance teaching organisation:** audio conferencing, audiographic conferencing, videoconferencing and computer conferencing for extended college tuition

Note: The medium underlined indicates the basic and prevailing form of learning and teaching.

These different types of distance teaching institutions have developed a wealth of theoretical and practical pedagogical experiences, which can be used when designing the university of the future. This feature adds to their importance as well.

Special mention must be made of the distance teaching universities in East Asia and the Pacific. Their progress was first documented by two comprehensive volumes edited by Kato (1992, 1993). They co-operate in many ways and have developed vigorously during

the last fifteen years. I want to point out two examples only. Recently, the Korean National Open University has invited distance-teaching experts from Vietnam, Malaysia, Indonesia, New Zealand, Nepal, Mongolia, Hong Kong, Pakistan and China to take part in a workshop on Teacher Training at a Distance, an activity which is of paramount importance in all these countries (KNOU, 1997). There is also an Asian Association of Open Universities which holds annual conferences, the 12th of which took place in Hong Kong in 1998 and the 15th in New Delhi in 2002.

Most traditional universities have not yet noticed that all these distance teaching universities are in the process of slowly changing higher education in at least four ways:

- Firstly, higher education for adult (and working) students is increasingly becoming a reality,
- secondly, professional continuing education can be further developed and expanded, without interrupting working processes,
- thirdly, substantially more students than before can be admitted to universities, and
- fourthly, higher education is becoming more cost-effective.

The importance of their impact on the future development of higher education cannot be overrated.

How are traditional universities reacting to the growing influence of this new type of distance education? Throughout the seventies and eighties they ignored it but since the mid-nineties a growing number of conventional universities and colleges became interested in it not only because of the advent of WWW and the Internet and the possibility of online learning, but also because of structural changes which force them to adapt to new societal developments and to meet new challenges.

Indeed, many find it reasonable not only to develop electronic forms of tele-learning, but also to offer courses for distance learning as well and even to establish divisions for distance education within the institutional framework of a dual mode university. In the long run, most traditional universities will complement their methods of teaching and learning by including techniques of distance education. In order to do this in a professional way, several or even a great number of universities will co-operate and form special consortia. This second development is gaining more and more importance. There will be a huge expansion of part-time courses provided by conventional universities, especially for continuing education purposes.

Apart from these two important developments – the establishment of a great number of single mode and the increasing number of dual mode universities – we should not overlook a third one: many other shorter-term distance education projects have taken place, being run both by non-governmental agencies and by commercial enterprises. Agencies and associations have been founded especially for supporting distance learning in many ways. Bernadette Robinson (1994, p. 1) refers to the fact that there were 832 institutions in 102 countries offering 28 377 courses at a distance in 1994. She explains: "However, it is clear that distance education is being used for a very wide range of subjects and audiences in a variety of contexts (formal and non formal, high and low technology, in third world and more developed countries alike)." If we analyse the situation in Europe we can see that there were 2 727 772 enrolments in distance teaching systems, four fifths of them in distance training in 1994 (Keegan, 1994, p. 7).

In the United States there were as many as 5 000 000 enrolments in technical and vocational courses from proprietary providers in the same year (Moore, 1995).

Another indicator of the big step forward distance education could make in the third period is the emergence and growth of distance education research. In 1965, there were practically no researchers in this field, with the exception of two Americans: Charles A. Wedemeyer, the liberal protagonist of independent learning, and Gayle B. Childs, the persistent documentalist of a large number of empirical studies in which professors tried to prove again and again that correspondence study could be as successful as face-to-face instruction, an impossible approach if judged with the methodological insights we have today. Apart from those beginnings distance education was an unknown territory of educational research.

But look at distance education research now! What a difference! Today, there is a host of researchers working in many countries all over the world developing theories and conducting empirical studies. They can rely on a large body of disciplinary and inter-disciplinary distance education research on all levels of sophistication. It consists mainly of projects reports about distance education in many countries, detailed and differentiated development and evaluation research, quite often carried out by experts working in major institutes of educational technology, sociological and psychological studies and there is also a growing amount of pure research. Meanwhile, there are at least four internationally recognised professional journals carrying research reports exclusively on distance and open learning. In addition there are 14 additional journals of regional importance, five of them in India alone (cf. Panda, Satyanarayana & Sharma, 1996, p. 216).

The present state of the art of distance education research is documented in the comprehensive "Handbook of Distance Education", edited by Michael Moore and William Anderson (2003). This impressive book is the benchmark for the profession and will influence further theoretical and empirical approaches to distance education and online learning.

The newest trends in this kind of research can be recognised by browsing in the CD-ROM reports of the 18th, 19th and 20th World Conferences of the International Council for Open and Distance Education which took place at Penn State University, Vienna and Düsseldorf. They carry a host of reports about new projects and developments in distance education. The main trends documented there are the changing technological environment of distance education and the educational paradigm shift affecting it. The unparalleled upsurge of other publications and the rapid growth of the number of seminars, workshops, and symposiums dealing with current problems of distance education are also ample proof of the growing importance of distance education in the world.

The Impact of Digital Information and Communication

A pedagogical revolution is currently taking place in distance education: the increasing use of digitised learning environments and the net. This means that we have entered the fourth period of the development of distance education which will differ from the third period in marked ways and become a new era of distance education. Theorists and practitioners now have to face the swift, unforeseen, unexpected and unbelievable achievements of information and communication technologies. Using them means that education will also take place in a hitherto unknown territory: virtual learning space.

This requires the design of new formats of learning and teaching and causes powerful and far-reaching structural changes of the learning-teaching process. It is because of these changes that the importance of distance education is now once again increasing in great measure. We must recognise that distance education and online learning provide for the means to cope with new societal requirements, with the necessity to deal with new educational goals and new groups of students.

This can be explained by analysing the present conditions of higher education. Driven by a number of societal, economic and technological forces, educational processes are changing rapidly and dramatically. The most striking ones are the emergence of the adult student working for a living, open learning, the increase of the number of students, new classes of students, including able but underserved and neglected students, the changing functions, contents and pedagogic structure of higher education, commercialism, globalisation and competition with other providers of intellectual power. The result of these changes will be learning and teaching which will differ from traditional formats. It must be open, learner-centred, outcome-based, interactive, participatory, flexible with regard to curriculum, learning strategies and delivery and not bound closely to institutions of higher learning because it can also take place in homes and workplaces.

In a situation like this it is more than fortunate that instructional designers can base their work on distance education in its fourth, digitised and net-based, version. At the same time they can also fall back on long experience with many forms of distributed, a-synchronous learning which has been developed and tested in its three previous periods. All of them offer a rich fund of pedagogical strategies in both theory and practice. In addition, as distance education makes progress in employing the new information and communication media and adopts its methods to the new possibilities of the digitised learning environment, its importance is growing at an unbelievable rate and will soon be beyond the bounds of our comprehension.

Think of what the various forms of teleconferencing can mean to the isolated learner in distance education! Imagine what the shift from expository teaching and receptive learning behaviour to autonomous learning with the help of databases, hypertexts and hypermedia may mean in such a context. What progress this leads to, if distance students can have all information available at the tips of their fingers and can access relevant courses from other universities; when they can browse and navigate in hypertext databases in order to find individual paths for their learning; when they may meet other students in a virtual cafe for chat sessions; when they may ask fellow students living in another town to help them to overcome a difficulty in solving a problem. And finally, how different will distance education be when the distance teaching universities have changed into virtual universities offering practically all the services of real campuses. Even if we try to remain sceptical and realistic about these already discernible future developments, we have to admit that distance education at its best will then be possible.

European Initiatives and Programmes[1]

In order to underscore the growing importance of distance education in its digital era we should take a look at relevant activities of the European Community. It was certainly a benchmark in the development of distance education when the Member States expressed their resolution "to further the development of distance education" in such an important document as the Treaty of Maastricht (paragraph 126). Furthermore, the Memorandum of the Commission of the European Community (1991) "Open and Distance Learning in the European Community" shows that the planning experts there had become aware of the extraordinary potential of distance and open learning. In their assessment, this potential arises from its freedom of time, place and pace, its extensive flexibility, which makes it readily adaptable to the needs of the learners, and its appeal to the working population, as it can be geared to the requirements of their jobs.

The Commission also identified those areas of education and training in which distance education can play a particularly significant role. These included: extending opportunities of access and participation in education and training at all levels, extending learning opportunities to students living in less favoured regions and remote areas, continuing education, supporting reform and innovation in education and training; and creating a greater cohesion of the European education and training systems

In order to support such legal and programmatic achievements and to put them into practice, the European Commission has allocated several hundred million Ecu/Euro since the late eighties to evaluating the potential of technological and pedagogical developments for education and training at a distance and to supporting concrete projects. Although the Commission published a Memorandum on Open Distance Learning (ODL) already in 1991 there has not yet been a programme related to Open Distance Learning only, but fortunately all the appropriate programmes for education and training, research and development increasingly comprise at least one or more strands or action lines for that purpose. The most important ones are DELTA, COMETT, TEMPUS, TELE-MATICS, LEONARDO, SOCRATES, Joint Call Educational Multimedia, the Information Society Action Plan (e-research, e-education, e-learning). In relation to these funding programmes a number of trans-European associations have been created which also help developing distance teaching, such as EADTU (European Association of Distance Education Universities), EuroPACE 2000 (Trans European Network of Universities, Enterprises and Organisations with an interest in the field of distance and continuing education and training) and EDEN (European Distance Education Network).

In addition, the Commission has provided, and still is providing, funds for studies and reports on Open Distance and Educational Technology topics. We should take note here of the support offered by the PHARE and TACIS programmes for the development and implementation of distance education courses and infrastructure in Central and Eastern Europe.

Clearly, the European Community uses distance and open learning mainly in order to strengthen the economy of Member States and to facilitate co-operation between them in education and training. The development of language skills is another important

[1] This section is based on information provided by Friedhelm Nickolmann

objective which is a necessary prerequisite for international co-operation. Thus, distance education has become an instrument for helping to implement European policies, in particular the "European dimension" in education and training at all levels and in all areas.

All theses activities are certainly additional evidence of the growing importance of distance education.

The process of gaining more and more importance, however, must not be seen primarily from a European perspective. It is a global phenomenon. I have not mentioned South America, although distance education has developed there at a good pace as well. South Africa should be referred to as well, as the new government there is attempting to redress the past inequalities of the educational system by adopting an open learning approach and distance education throughout the education and training system (SAIDE, 1995). Finally, Australia should also be mentioned because of its model of dual mode universities. The Federal government here has repeatedly taken measures to improve distance education at tertiary level. It tried to achieve this at first by centralisation, then by decentralisation (Jakupec, 1993). Lately there have been recommendations that they export distance education courses to India in order to improve the financial situation of Australian universities by making additional profit.

Conclusion

Apart from single and isolated historical approaches there were three significant periods of distance education, each of them important in their special functions within the then prevailing systems of education. Each period topped the previous one by its unforeseeable and unexpected practicability and success.

(1) Correspondence instruction, which accompanied the industrialisation of labour, filling gaps and compensating for deficiencies in the educational system, especially in vocational training, and paving the first alternative (a second) course towards university entrance qualifications.

(2) Distance education in the seventies, eighties and nineties, which helped universities in industrialised and in developing countries to channel a growing number of secondary school leavers through higher education. Not only did it extend the capacity of universities, but it also developed new forms of the combination of work and study, introduced regular university studies into adult education and inspired and brought about important pedagogical innovations.

(3) Digitised distance education, which enables us to react to and cope with the major societal changes mentioned. This represents the greatest challenge ahead of us. Distance education will now assume the highest degree of importance as it can contribute substantially through its approaches, techniques, strategies and achievements to the development of the university of the future. A "re-engineering" (Collis, 1996, p. 17) is on the agenda.

Distance education is now at a premium as it helps us in the difficult process of breaking with tradition and designing something new, with more relevance to the post-industrial knowledge society.

2 The Educational Paradigm Shifts

In this chapter the meaning of the term »paradigm« is explained. The complexity of the phenomenon of the educational paradigm shift is described. It calls for the recognition of several educational paradigm shifts. Many of them are driven by serious socio-economic and structural changes. The focus is on the shift from modern to post-modern curricula and from traditional to digitised formats of learning. These shifts require new learning and teaching behaviours. Increasingly, expository teaching and receptive learning will have to be substituted by autonomous self-regulated learning and more and more virtual interaction will have to replace face-to-face interaction. These shifts affect distance education more than other forms of education.

Introduction

The term educational paradigm shift is being used quite often these days. We read it in many articles and many speakers are in the habit of referring to it. It has been an important sub-theme of the last World-Conferences of the ICDE. The constant references to it have now made it into a catchword, a slogan. In the field of distance education in particular everyone knows and uses it.

Everyone also knows, of course, what it means. Roughly speaking, it means the changes in teaching and learning which have taken place and will continue to take place as a consequence of the tremendous impact of the great number of technological advances in information and communication technologies which have emerged during the last decade approximately. Seemingly, people sense that something very important and attractive is taking place. This may be the reason for the frequent use of this new catchword.

However, the more often catchwords are used, the more their exact meaning remains vague or becomes blurred. This applies to the educational paradigm shift as well. Quite often speakers have only a superficial idea of what they mean when using this word. Quite often they have only a restricted understanding of the term due to their special interests and experiences. This is to be deplored because only if we have a clear idea and a reflected conception of its full meaning we can really grasp the fundamental importance and the drastic and far-reaching consequences of the phenomenon it denotes. The following explanations will, I trust, clarify this concept and demonstrate its importance.

Definition

As linguistic reflections are quite often helpful, let us begin with an etymological look at the term "paradigm". It is derived from the Latin word paradigma which meant model, pattern, or example. A "paradigm shift in education" might mean that in education certain models or patterns no longer exist, because new models and patterns which differ from the old ones in a marked way have substituted them. This means that, very often, we are not dealing with a transitory process in the field of education under investigation but with a sudden, if not with an abrupt change. This characteristic feature is important.

Even more convincing is the second meaning of the term. This is derived from Latin grammar where it denotes an example according to which you can construct the correct word forms in declination and verb forms in conjugation processes when studying a foreign language. If these examples cease to be valid and are substituted by new and entirely different ones, we run into difficulties, because we can no longer speak in the way we have learnt a language and which we are used to. We will have to reorient ourselves and to restructure our way of speaking entirely and fundamentally. We have to develop our way of expressing ourselves anew in accordance with the new examples. This is a good metaphor for describing the current situation of teachers. Adaptation to the new circumstances is not enough. We have to re-think education, to design teaching and learning anew and implement it in new ways under new circumstances. A far-reaching structural reorganisation of teaching and learning is necessary.

The Uniqueness of the Phenomenon

If we analyse the educational paradigm shift in a historical perspective we can easily find out that nothing like this radical and far-reaching restructuring process has happened before in the history of education, or even, with a slight touch of pathos, in the history of mankind. To be sure, teaching and learning has undergone quite a number of changes, and some of them were drastic. The introduction of the technology of writing changed it, because it had been purely oral before. The Greek philosopher Plato (1959, p. 56) criticised this change on the ground that the written word cannot talk back to the reading student. Nearly two thousand years later, print and the availability of books changed instruction even more, because more people were now able to learn than could be present in face-to-face situations. In particular, the nature and the meaning of the academic lecture were altered, to mention just one aspect of this change. In the nineteenth century the railway system and the regular delivery of mail made the development and rise of distance education possible. It was then that the first correspondence schools and colleges were founded. And in our century, the protagonists of audio-visual media, of instruction by radio and television changed teaching and learning again to a considerable extent. To be sure, all these changes of teaching and learning were important and full of consequences, but none of them and not even all of them together can compete with the drastic changes of education and the dramatic consequences which are caused by the educational paradigm shift which we are witnessing and experiencing today.

The Complexity of the Phenomenon

It is not really useful to speak of the educational paradigm shift. Rather, we should become aware that there are many such shifts, which, in a complicated way, influence and condition each other. We should, therefore, use this term in the plural or understand that the educational paradigm shift consists of quite a number of shifts. It is certainly no longer sufficient to maintain that this paradigm shift is necessary or desirable because of the powerful impact of the new electronic information and communication media. This is in most people's mind who refer to it and demonstrates an example of mono-causal thinking only. Many shifts have taken place, which force us to reorganize our system of learning and teaching by integrating these new information and communication media. These marvellous technical achievements alone would not have stirred up even conservative

professors in our tradition-bound universities and have caused them to produce CD-ROMs carrying their lectures. These technical innovations alone would not have induced governments to invest money for the application of these new technical media in schools and universities alike. Nor would it have caused so many experts to look into the future of university education in order to design possible scenarios structured in quite a new way. In fact, looking closer at the phenomenon we certainly become aware of a great number of paradigm shifts which have driven us into the situation we are in today. They can be identified in the economic, social, political and cultural prerequisites or conditions of education already as well as in the very important field of curriculum development and in the very process of learning and teaching. I should like to refer to these three fields in order to clarify my thesis.

Socio-Economic Conditions of Education

According to a Task Force of the International Council for Open and Distance Education (Hall, 1996) there were more than 20 changes which have caused educational paradigm shifts. The following have been detected:

- A definite shift from the education of children and juveniles to the education of adults. The much-propagated concept of lifelong learning is the result of this shift, which gave rise to continuing education.
- An overwhelming shift from the admission of relatively restricted numbers of students to very large numbers of students. This can be best exemplified by the emergence of open schools and open universities, of mega-universities and by the trend toward mass higher education. More and more an elitist paradigm is being substituted by an egalitarian one.
- A shift in the age and status of students. Many are older, some are senior citizens, most of them work for a living, and many of them have children and are married.
- A shift from the university as an autonomous and self-sufficient institution towards an institution co-operating with industry. Public-private projects are at a premium.
- A shift of emphasis with regard to the goals of education. Whereas the traditional university provided a more general and all-round education, even in professional training, because this was usually of general educational value, university education became more and more specific and specialised in order to meet professional requirements.
- A shift in the meaning of university education. Previously it was only a preparation for professional careers, but now it is beginning to be an important asset of a person in his or her struggle for social survival. The links between the length and quality of a person's education and his or her acquired social status are well known. But now the length of schooling is becoming an important indicator with regard to employment and unemployment.
- A general shift of the function of education in industrialised countries. There have been three production factors: physical power, capital power, and mind power. Mind power is now assuming quite a new degree of importance because it is successfully in the process of replacing physical power. Education, however, produces mind power and increases the value of human capital. It has become a basic resource for developing and maintaining national industries, especially in order to make

them fit for global competition. This establishes another strong link between education and industry.

- A dramatic shift in financing education. In many countries there was always agreement that education is a public utility. Therefore the state paid for the schools and universities. Now the idea is being propagated that individuals should pay for their education and that industry should be committed to financing the institutes of higher learning because industrial companies profit from them.
- A deplorable shift in the way of looking at education. Increasingly, the realm of academia is being permeated by the concepts and practices of business. Students are becoming »customers«. Hence, teachers are expected to be "customer-friendly" and to seek "customer satisfaction". Teaching, which was once a sacred ceremony, has turned into a commodity, which can be sold in order to make additional money. What is even worse, universities are evaluated empirically in order to find out whether the input of money corresponds to the output of graduates.
- A shift from academic exclusiveness with regard to research and teaching to competition with other providers of intellectual power emerging in large supra-national industrial companies which are establishing universities of their own.

All these shifts (and others) join and merge and bring about and reinforce a feeling of insecurity and profound irritation. If we want to overcome this, we must be determined to act as agents of change. We should argue as follows.

- If we speak up for lifelong learning and want to stress continuing education for all and higher education also for adults,
- if we are really convinced that the rapid technological, economic and societal changes make continuing education absolutely necessity and a precondition of economic survival,
- if we really wish and even have to open our schools of higher education to larger groups of new students who have up to now been neglected, for example elder and vocationally experienced persons, housewives, members of minority groups,
- if it is true that a university degree has become the critical asset for getting into employment,
- if we have to produce more mind power in order to survive economically as a nation, and finally
- if the universities really have to compete with industry-based providers of education,

we will have to think the unthinkable, namely that our traditional system of education in school and university buildings, in face-to-face classes and lectures, cannot possibly cope with the tasks ahead of us. This system cannot be expanded further by building additional physical facilities and cannot be financed. This means that teaching and learning at university level must be organised in another way, in a way which is more flexible, variable, convenient, cheaper and geared to many different kinds of students, including the large group of employees in the professions. We must be ready for and accept the idea of mass higher education.

In a situation like this it is more than fortunate that the new information and communication media have become available for devising, designing and developing new systems of learning and teaching. They allow for techniques of teaching and learning

which transcend the barriers of place, time, and circumstances and can be more flexible, variable, effective and adaptive to various types of students. The experiences of distance education become invaluable and are at a premium now. It is also especially advantageous that in pedagogical thinking important paradigm shifts are emerging at present. I should like to explain and characterise them by referring to a new concept of curriculum building and to two new concepts of digital learning which are just coming into view.

From Modern Curricula to Post-Modern Curricula

We have to be aware that we no longer live in the modern, but in the post-modern world. This can be characterised by a new way of thinking which has already pervaded the arts, humanities and literature, as well as philosophy, science and social sciences. More importantly for teachers and for those who teach teachers, it has also pervaded general awareness. A definite shift of values has taken place which has changed public consciousness. Consequently, in highly industrialised countries a post-modern self has emerged which we must take into account if we want to teach and learn under the changed conditions and circumstances. According to Wood and Zurcher (1988, p. 125), who have made a very intensive empirical study of the phenomenon, this post-modern self

- rejects delayed gratification and wants it immediately,
- is not ready to endure distress but develops rather a capacity for fun,
- refuses to do empty routine work but wishes to do something meaningful,
- is not so much interested in materialistic objectives, but rather in the fulfilment of human values,
- is not so much interested in achievement, but in self-realisation,
- does not like self-control, but seeks self-expression,
- rejects competition and is interested in a good work climate,
- does not want to become isolated, but is interested in social relations and interactivity.

These examples indicate that the post-modern era has brought about broad cultural shifts. Teachers and those who train them have to know about them, of course, and to adapt their curricula to them, including the curricula for distance education. Traditional distance education will be affected by this change more than other forms of education, because it has relied for nearly a century on the ambitious, upwardly mobile student who is prepared to delay the gratification of his or her learning for years and who quite often is supposed to be a typical example of the self-controlled student who studies at home isolated from his peers. This traditional distance education will probably soon become outdated. Distance education will have to reorient itself and develop new pedagogical structures. Independent and self-regulated learning as well as group learning will become important. Prefabricated courses for very large numbers of students will, however, lose their present significance as will the expository method of teaching which is linked to a receptive way of learning.

However, the main consequence will be a definite shift of our curricula. It is already possible to distinguish typical modern curricula from post-modern curricula. And here it is interesting to see again that, because of the shift of values, quite a number of categories are transformed not gradually, but substituted by the very opposite. How far this may go is suggested in the following table which is based on the writings of William E. Doll (1993):

▪ *Curriculum: Modern and Post-Modern Approach*	
▪ *Modern*	▪ *Post-Modern*
patterned after "scientific management"	patterned after the "dialogue conversation", which transforms the participants and the object being discussed
technical ("technocratic") rationality	humanistic rationality
efficiency	personal development
precise facts	global approaches
specification	generalisation
detailed procedures	interactive
rigid formalism	eclectic
linear	complex
pre-set	improvised
sequential	pluralistic
easily quantifiable	not quantifiable
clear beginnings	in process
definite endings	in process
stable	not stable, dynamic
thinking in cause-effect framework	lateral thinking
predictable	unpredictable
closed	open
teacher has knowledge, student doesn't	open and transformative group of individuals interacting
curriculum a set a priori course to be run	curriculum a passage of personal transformation by dialogue, inquiry, development
organisation is set prior to activity	organisation will emerge from activity
positivism	epistemological pluralism
science imbued with discovery and determination	science imbued with creativity and indetermination

Doll (1993, p. 5–7) characterises this paradigm shift by emphasising in particular three fundamental changes: the change from discovery and determinism to creativity and indeterminism, from systematic construction to pluralism and eclecticism and from linearity of thinking to multilayers of interpretation. All these changes have something to do with the critique of the application of concepts and methods of natural sciences and technology when trying to conduct and interpret social processes such as teaching and learning, with the rejection of the mechanistic approaches and empirical projects in pedagogy and also with the disapproval of the sustained dominance of technological thinking in many areas of teaching and learning.

Pedagogical Shifts in Digitised Learning

Really dramatic paradigm shifts will occur in the digitised learning environment. There the fundamental pattern of teaching and learning in distance education will become a different one, an entirely different one. This shift will reduce the dominance of expository teaching, a tradition which is several thousand years old. It will also open a perspective, which is new, entirely new, and so new, that we still do not yet know what it is all about and where it will lead. The reasons for this shift are, of course, as has been mentioned several times already, the technological advances in computing and networking. They enable students, in principle, to have access to all the information in the world, to all teaching programmes, to electronic books and to electronic libraries and intelligent expert systems. They have to study and learn in a situation and under circumstances, which are fundamentally different. This is not simply an addition of new technical media to the well-known traditional pedagogical structure, as was the case in its audio-visual era in the sixties and seventies, when the pedagogical structure was changed only temporarily and in a superficial way. Rather, it represents such an impact on teachers and students that they have to redesign teaching and learning. If we become aware of the unexpected consequences of the changes ahead of us we will be shocked. This phenomenon can be illustrated by dealing with some aspects of these particular pedagogical shifts.

Example 1: The New Approach

So far it has been natural for us that teachers design "courses", a word which literally means ways, routes, tracks, roads with a beginning and an end as well as with regular stops at given intervals. If teachers want to make the students to follow a particular "way" in which the contents are to be "transmitted" these contents have to be chosen and defined clearly and then they have to be articulated, which means that the contents of the course have to be portioned out, and to be subdivided into workloads to be mastered at given times. In addition, the contents have to be presented to given persons, at given places, and at given times. Only in this way teachers could teach and students could learn. Hence, we have developed the notion that knowledge must always be transmitted by means of such articulated courses, whether it is a lecture, classroom instruction or distance education with prefabricated "course"-units. And this notion is embodied deeply in our consciousness.

We are now confronted with another major irritating and disturbing paradigm shift, this time a pedagogical one. In the digital learning environment many of these important and necessary prerequisites of traditional teaching and learning are obsolete and irrelevant. Students are now able to get hold of any information they need without the traditional preparation, assistance and expository acts of a teacher and outside predetermined places and times. This shift means that teaching and learning is quite a different process in which teaching behaviour and learning behaviour have undergone a radical change.

Students have to develop their abilities of self-instruction and of becoming autonomous learners. They have to develop activities unknown before, for example: quick data retrieval, data management, choosing among vast numbers of central sources, choosing from multiple forms of representation, browsing, navigating or following a guided tour in hypertexts or collaborating with other students in a knowledge building community, learning by using models and simulations, meeting other students on-line, in order to

engage in "virtual classes" and "virtual seminars" or to "chat" with them in a virtual cafe. There is a great difference between this kind of learning and the traditional kind in which students listen to lecturers, read their textbooks and are busy with memorising and recalling selected contents.

Some of the consequences of this shift go even further. According to the Task Force mentioned (Hall, 1996), student productivity will become more important than faculty productivity. Likewise, student learning styles will be in the centre of interest, whereas faculty-teaching styles will be neglected. Most important, however is that what is being taught will no longer depend on faculty disciplinary interest but much more on what the students need to learn. This will indeed be a Copernican change in the pedagogy of higher education.

Example 2: Changed Social Interactions

Social interactions, which are, so to speak, the "vehicles" of communication in teaching and learning, will definitely take new forms as well. The most important change is, of course, that they are no longer real but virtual. Virtual means, "being in essence or effect, but not in fact" (Webster, 1953, p. 2849). If we look back to traditional distance education, this phenomenon is familiar, because the student reading a printed course unit is, of course, also being taught by a virtual teacher. But there is a decisive difference in computer-mediated communication. There are many more possibilities for virtual communication, many more formats of virtual interaction, which can be exploited for pedagogical purposes. Morton Flate Paulsen (1997, p. 120) of the NKI Distance Education in Norway has described these new possibilities. He distinguishes the following four types of those interactions:

- The one-alone-method in which the students work according to the World Wide Web paradigm. Here we have the single learner in a digital learning environment studying a given subject with the help of appropriate software: teaching programmes, databases, expert systems, electronic books, electronic journals, hypertexts and hypermedia.
- The one-to-one method in which the students work according to the e-mail paradigm. This method lends itself easily to all forms of counselling and tutoring and is especially useful when a learning contract is to be negotiated. David Hawkridge (1995, II, p. 87) described successful experiments in virtual tutoring at the Open University.
- The one-to-many method in which a teacher or a student addresses a great number of students according to the bulletin board paradigm. This is the natural format for lectures, symposiums, presentations etc.
- The many-to-many method in which a large group of persons teaches and learns at the same time according to the computer-conferencing paradigm for discussion groups, debates, case studies, brainstorming, project groups and forums.

What is especially interesting with regard to this typology is that four distinct new paradigms of learning and teaching in virtual situations have been identified and all of them are typical offspring of the digital learning environment. It may be possible that these four new pedagogical approaches, namely

- the World Wide Web paradigm,
- the e-mail paradigm,
- the bulletin board paradigm, and
- the teleconferencing paradigm

will become the core of a new pedagogy, which will be the pedagogy of digitised learning and teaching. These paradigms offer special opportunities to distance learners, opportunities which could never be taken in traditional distance education. These four paradigms should be tested and further developed. Research projects are necessary in order to explore their specific potentials and ways of combining these four approaches in order to achieve the desired learning effects in a given situation. We can imagine that typical configurations of these four paradigms will develop in different disciplines.

Example 3: Linear and Lateral Thinking

Analysing the pedagogical structure of independent work in digital learning environments and especially of independent work with hypertexts reveals a novelty in the field of teaching and learning. I am referring here to the openness of the situation. In traditional teaching and learning there is always a general goal and a set of specific objectives. Here the objectives are quite often not yet known at the beginning of the learning process. The learners are expected to find them themselves and even change them if necessary while they are studying and learning. Consequently, there is no linear progress in learning, no logical consistency in developing the thinking of the learners. The learners are not expected to follow one prescribed way in the same manner but have to find their individual way in their individual manner. In the case of hypertexts, their thinking must not necessarily follow the thinking which has developed as a consequence of the paratactic and linear sequence of words and sentences in printed books. In a digital learning environment students are confronted with a wealth of information which can be transformed into knowledge. It is possible for them to start browsing ad lib. somewhere in the text, become interested in what they read there, try to get hold of more information of the same kind, ask themselves questions and try to find the answers by navigating. In other words: they do not learn in a systematic, but rather in a coincidental and intuitive way. This will be quite a departure from traditional teaching and learning. This is the consequence of the new pedagogical paradigm and surely a post-modern paradigm of learning.

Should we be alarmed by this development? Should we think that this is not a real scientific approach? Certainly not! We must bear in mind that the arrangement of knowledge in the linear form which we are used to is by no means a "natural" way of conveying knowledge. It is pressed into a given form, which is itself quite "unnatural". There must be other forms of exploring, of learning, of seeking and finding truth. We should also become aware of the fact that most of our knowledge of the world has been acquired coincidentally and then integrated in our structures of knowledge which again are very individual ones. However, teachers should be aware that a new epoch has begun as new and unorthodox ways of learning and teaching become visible and, in fact, are already emerging in digital learning environments.

Perspectives

Distance education of the first and second generation, including radio- and TV-based models, will be affected by the educational paradigm shifts caused by the altered social, economic and societal preconditions and conditions of education that are described here, as well as by the paradigm shifts in curriculum building and pedagogical thinking. We can see just now that most distance teaching institutions are using more and more of the highly effective and easily accessible new information and communication media. This means that the digital revolution has already begun and is well underway in distance education. This means that all the changes and shifts described in this paper have driven us into innovation and reform – and to new beginnings.

What do the protagonists of digital learning in distance education hope to improve? They may have the following innovations in mind:

- more possibilities to choose from a broader range of courses, data, and data-bases,
- a well planned and precisely calculated and tested combination of various forms of presentation: text, video, sound, graphics, animated graphics,
- more and better interactivity with the contents presented,
- easy and quick access to tutorial help,
- easy and quick access to other students in order to discuss problems,
- easy and quick access to professors, provided that they are available.

All these improvements together constitute definitive pedagogical shifts which might help us to reach the new goals and to solve the new problems in the coming knowledge society.

Which strategy for the implementation of digital learning in distance education should be employed? The shift from the technology of print to the technology of the Internet could be facilitated in three different ways. One is to implant elements of digital learning in the conventional courses of distance education and to see to it that their number increases slowly and steadily. A second way would be the development of new (digital) teaching and learning systems to be offered parallel to the conventional courses. Gradually, this new system could grow and the conventional courses could then be phased out. A third method is the gradual shifting away from conventional teaching and learning in distance education with the help of three types of distance education which follow one after the other. According to Eastmond and Lawrence (1997, p. 106), these models should consist of the following pedagogical elements:

- *Model 1: Textbook,* course guide, simple on-line research or communications,
- *Model 2: Textbook,* course guide, supplemented by computer conferencing,
- *Model 3: Teaching and learning on-line,* course guide on-line, discussion and assignments on-line.

Finally, another aspect of the future role of distance education should be referred to. The economic, social and technological forces referred to at the beginning will not only change distance education in the way suggested, but certainly all processes of educating students. In addition, we are already witnessing and experiencing a fundamental change in the way we think about knowledge (cf. chap. 10) and learning. This will also affect

campus-based universities. They will engage in digital learning as well. Students there will also learn how comfortable it is to use central resources by Internet and how useful it is to become members of virtual communities of students. Sooner or later they will start to manage learning processes of their own by tele-learning as well (Collis, 1996). In this way a convergence of the methods of campus-based and distance teaching universities will become possible (Tait & Mills, 1999).

The university of the future will use and integrate a great number of forms of presentations, face-to-face, at a distance and digital, and will thus develop new pedagogical configurations which will no longer resemble traditional forms of teaching. This university will be open to younger as well as to older adults who will be able to start, interrupt, continue and finish their studies whenever it suits them. They will not have to be present at these universities all the time, perhaps only for shorter periods. These universities of the future will also be variable, adaptive and flexible enough to provide tailor-made programmes for all kinds of undergraduate and graduate students, as well as for persons who want to continue their education at the tertiary level.

This vision of the university of the future indicates how important the educational paradigm shifts dealt with in this chapter really are. Teachers must not only be aware of this fundamental change, but of the necessity to become active agents of this change. At the same time they have to assume responsibility because they must function as protectors of their students against those technological forces which overdo the mechanisation of education just in order to make more profit. Teachers must be on the alert as they must protest and react when the unnecessary exaggeration of technological enthusiasm dehumanises the processes of teaching and learning and thus becomes detrimental to education.

3 Concepts and Models

This chapter deals with the fact that distance education is a format of learning and teaching which is by no means a clear-cut and fixed one. On the contrary, it has always been in a state of transition. Today it is in a state of rapid transition. The result of this development is that we can identify a considerable variety of ways in which students learn at a distance, especially if we look back at the history of distance education and focus on current practices in many parts of the world. If we want to understand the essence – and the real mission – of distance education we should transgress the model of distance education which we happen to know and become familiar with additional concepts of this particular kind of learning and teaching as well. In this way, it will be possible to discover typical pedagogical ideas which are inherent in distance education.

Introduction

When conducting a virtual seminar on theories of distance education I enjoyed the rare possibility of discussing ideas and problems in this field with participants from all over the world. The main problem of this seminar, in fact, the main obstacle even, was that we were trying to speak about and to interpret the same thing, namely, distance education on a tertiary level. But most participants did so with different concepts of distance education in their minds. We discussed the subject by referring to different frames of references. What made the situation even more difficult was that some participants were not aware of this and insisted that they were right when referring again to their concept, which of course, was the only one they had experienced. They criticised the ideas brought forward by other participants on the grounds that they could not be reconciled with their particular experiences and could not be applied to the teaching and learning at their particular university.

It seems that such disparity between opinions is typical for seminars including participants from all continents. It is a new phenomenon. In the global age which we have now entered we have to get used to it. In the past, it was easy to discuss problems when all participants referred to the same cultural setting and the same tradition of teaching and learning. But now the situation has changed. What can we learn from this experience?

- Firstly: we should try to be patient and tolerant when discussing different notions, concepts, models or developments for distance education in other countries. "Humility and a certain degree of caution" (Bates, 1997, p. 100) is to be recommended.
- Secondly: in our era of globalisation we should not try to assert ourselves in this matter but rather become interested in other solutions. We should learn more and try to understand also foreign concepts.
- Thirdly: theorising about concepts of distance education can help us and can be beneficial in this process. It helps us to understand our points of view more deeply. We become aware of criteria against which we can measure, criticise and improve our own practice.
- And finally: the ultimate pedagogical goal of distance education is to initiate and support processes of *meta-cognition* in teachers and students alike. This process can be facilitated by dealing with various concepts and models of distance education.

The True Nature of Distance Education

There is a structural difference between campus-based and distance education. Of course, everyone knows this difference. It is obvious. And yet it is not at all trivial to deal with it. I believe that seeing and analysing this difference is fundamental for the real understanding of this particular form of learning and teaching. There are many faculty members who believe and are even convinced that the only difference is merely "distance" and the importance of technical media needed to bridge the gap between teacher and taught. In their opinion, the rest of the teaching-learning process remains identical. However, this opinion is wrong, displays a wrong approach to distance education and reveals an inadequate pedagogical attitude. There is much more to it. Let me just mention the following:

- the special humanitarian goal, namely, the education of the neglected and underserved, including minorities,
- the extension of university education to adults and persons with vocational and family obligations, to the goal of realising lifelong learning, to a university which is open to all people who are able to study and are offered a "second chance" for enjoying and profiting from higher education,
- the unparalleled opportunities for continuing scientific education which is so badly needed in our age of constant technological, societal and cultural change,
- its contribution to university reform, and
- its function as forerunner of the coming "virtual university".

All this must be kept in mind when thinking about open and distance learning. Distance learning is not just campus-based learning with the help of particular technical media. It is an entirely different approach, with different students, objectives, methods, media, strategies and above all different goals in educational policy. Distance education is *sui generis.*

A Break With Academic Tradition

The conceptual aspects mentioned cannot be dealt with here. We should focus instead on the most obvious difference. The typical and prevalent forms of academic teaching and learning are lecturing and teaching college classes. Both forms are oral, i.e. they use a natural form of interaction, namely speaking and listening in face-to-face situations. This form of interaction has been practised since time immemorial. It is also used in other life situations. In other words, the medium of educational and instructional transaction is not only well known but also highly internalised by everyone. It is a universal cultural pattern. This provides a sense of security for teachers and students. In a way, they know what is expected. Their teaching and learning behaviours are unconsciously governed by conventions. This makes pedagogical interaction relatively easy. The attention of teachers and students is much more directed to, and concentrated on, problems of contents than on problems of the necessary transactional process. It is, so to speak, self-understood, at least in the minds of most teachers and learners. This may be the reason why a special pedagogy of academic teaching and learning is lacking in most countries and why most professors are opposed to it when they are confronted with such an "unreasonable" demand.

In distance education, however, things are quite different. The typical and prevalent forms of teaching and learning are not speaking and listening in face-to-face situations but presenting printed teaching material and using it in order to acquire knowledge. Speaking and listening is substituted by writing and reading, another cultural pattern which, however, is a relatively new and, certainly, a comparatively difficult one. It is not a natural but an artificial way of interacting, which cannot take place without technical media. Therefore, the educational transaction as well is not a natural but an artificial transaction. It cannot be performed more or less subconsciously, but must be planned, designed, constructed, tested and evaluated with full awareness of the pedagogical goals and means. This is quite a different approach. A rational target-means calculation is necessary. It is more or less a scientific process. It is telling that a special scientific discipline is needed to develop this kind of teaching and learning: educational technology or instructional design. This means that we have to deal with quite another form of education. The instructional situation, the learning climate, the methods of presentation and the methods of the acquisition of knowledge are different for most of the time. There is not a direct interaction between professors and students, because there are artefacts between them. They do not have to deal with persons but with these very artefacts. Written language, which is one of the artefacts, differs from spoken language in its typical forms of presentation and in its conventions.

We should recognise and acknowledge that the shift from oral teaching and learning to a technically mediated system represents a severe break with academic tradition. Indeed, we have to face up to a revolution which is aggravated by the emergence of the digital information and communication media. This causes uneasiness and a degree of insecurity in teachers and learners alike and this makes it difficult. Walter Perry, now Lord Perry of Walton, sensed this looking back at the first years of experience at the British Open University. He wrote: "Ours is the most difficult way of getting a degree yet invented by the wit of man."(Perry, 1976, p. 167).

New Learning and Teaching Behaviours

Another proof of the fundamental difference between campus-based and distance education can be presented if we have a closer look at the learning and teaching behaviour required in distance education.

Students have to develop and get used to and even internalise a new approach, because they have to organise their learning independently and have to take over many responsibilities from their teachers. They must be active not only in performing their learning tasks, but also in interpreting and critically reflecting on what they are doing when they learn. Otherwise they can never improve their learning without external intervention. If they are not active themselves, nothing will happen. Adults in employment and with a family may readily assume the responsibility, but many of them often find it difficult to maintain the motivation for a change in learning behaviour of this nature.

Teachers have to plan everything beforehand very carefully, because they have to construct the artefacts that were mentioned above which must be able to perform the required teaching functions. Later on in the process they have to keep themselves informed and to become fully conscious of what is going on in the teaching learning process, in which possibly thousands of students are involved. They have to acquire

relevant data about the progress of this process and evaluate it constantly. Nowadays they are expected to present some of their teaching contents, for instance, in form of hypertexts and hypermedia. They must be motivated and even eager to help the students to become independent students, although this is, indeed, a paradox demand. Above all, they also have to develop a habit of reflecting on their special way of teaching at a distance. It stands to reason that this cannot be done without full awareness of the decisive differences between distance education and face-to-face classroom education.

If we have realised that these differences exist we can understand why it is completely inadequate to judge distance education by applying the criteria of face-to-face education. However, this is frequently done.

Concepts and Models

As already mentioned, there is not just one concept of distance education, but a variety of such concepts. Often these concepts are so strong and convincing that they are cast into the mould of a model which can be tested and practised. In addition, such models can be fixed or even become "petrified" if they are institutionalised. Consciously or sub-consciously these distance teaching institutions are designed and shaped by certain notions and ideas about distance education. Therefore, it might be useful to present a small number of selected models of distance education as this provides new insights into its conceptual underpinnings. We can distinguish the following seven models:

- The "examination preparation" model,
- the correspondence education model,
- the multiple (mass) media model,
- the group distance education model,
- the autonomous learner model,
- the network-based distance teaching model,
- the technologically extended classroom model.

In this way several things can be achieved simultaneously: informing readers about some fundamental ideas behind distance and open education, arousing their interest in some typical, and even paradigmatic, models which are not yet well known and referring them to distance teaching universities which are patterned after these models.

The "Examination Preparation" Model

This model is not discussed in literature. Many practitioners will even deny that such a model exists. However, it is in fact applied and plays a certain role in distance education both historically and in its current situation. It is also worth analysing for pedagogical and theoretical reasons. A prerequisite of this model is a university which limits itself to holding examinations and conferring degrees and which abstains from teaching. This means that students have to teach themselves.

The examination preparation model was institutionalised when the University of London was founded in the middle of the 19th century for the benefit of those who could not afford to enrol at Oxford or Cambridge University or who could not attend any university because they lived in the colonies of the British Empire. This university supported the

students only by informing them about the examination regulations and sometimes by offering special reading lists. At present, this model is being developed and practised by the Regents of the University of New York. Students can go there, sit their examinations and be granted "The Regents' External Degree". There is also a Chinese version of this model called "Self-study for the preparation for a university degree" (Song, 1999). More than 1.8 million working students have already earned their degrees by learning at a distance in this way.

This is certainly a hard way towards a degree. But it has worked in so many cases. For us it is interesting because it is independent, or autonomous, learning in its purest form. This model might comfort those who like to defend distance education against sceptical observers. They could argue that if such an "examination preparation" model can be successful without any teaching activities how much more successful must the more developed and elaborate models of distance education be, in which professors, course development teams and tutors in special study centres are engaged to teach and support students with professional skill.

The Correspondence Education Model

This is by far the oldest and most widely used model: It is, so to speak, the "examination preparation" model plus regular teaching by presenting written or printed teaching texts and by assignments, their correction and by both regular and ad hoc correspondence between the teaching institution and the students. This model is simple and relatively inexpensive, because the teaching texts can be mass-produced by the printing press. We should see and acknowledge that over a period of 150 years this model has developed a considerable number of specific pedagogical approaches typical for distance education, approaches which are not necessary and therefore unknown in other forms of academic instruction. They are relevant because they aim explicitly at distant students and not at campus-based students. At present, when our attention and interest are captured by the tremendous advances in electronic information and communication media, there is the danger that this particular art of teaching at a distance, with its typical strategies and techniques, will be neglected, ignored and finally lost.

The correspondence education model is still used extensively, in spite of the world-wide interest in the digitalisation of distance education. It is also used to a great extent by distance teaching universities which take pride in announcing that they are multiple media and open universities. Quite often it also represents a substantial part of their teaching and shapes even the pedagogical core of these teaching-learning systems. It is therefore useful and by no means old-fashioned to get acquainted with the methodology of correspondence education. A typical institution using this model has been the University of South Africa. At present, this university is trying to catch up with the other international open universities by adding elements of more modern models. Typical institutions are also correspondence colleges in the UK and, for instance, the French *École Universelle.* They have laid the foundation of academic distance education. Their system is outdated, old-fashioned, covered in dust. However, those who want to understand the methodology of teaching at a distance fully will have to study this model of distance education because it represents the first generation of distance education.

The Multiple (Mass) Media Model

This model was developed in the seventies and eighties of the last century. Its characteristic feature is the regular and more or less integrated use of radio and television together with printed matter in the form of pre-prepared structured course material, which may or may not be the main and dominant medium, and the more or less systematic support for students by means of study centres. It became important because it helped to shape the structure of many distance teaching universities all over the world. This model was a great step forward. In fact, it designates a new era in the development of distance education, namely the second generation of this particular form of academic teaching and learning.

There is another important feature of this model. It initiated and supported the movement towards open learning and open universities. These universities are not only open because of their adoption of new methods and media. There are deeper reasons to support this new form of learning, namely motives and efforts which have a societal background. The term "open university" can be interpreted in a multidimensional way. Van den Boom and Schlusmans (1989, p. 6) showed these dimensions clearly in their study "Didactics of Open Education - Background, Analysis and Approaches". According to them, protagonists of open universities attach to this term the following expectations:

- University education is to be made less expensive.
- More people are to be enabled to take part in cultural life.
- The overcrowded traditional universities are to be relieved.
- New groups of students are to be formed.
- The further democratisation of society is to be supported by enabling more people to study while working thus making the world in which they live more transparent to them and empowering them to act autonomously.
- Lifelong learning, which has been propagated for decades, is to receive better opportunities for realisation.
- Additional chances and impulses are to be provided for people to gain more qualifications to enable them to survive in today's employment world.

Another important motive is not contained in this catalogue, although it played a significant part in the founding of open universities: opening up access to university for students without formal entrance qualifications. This has been realised at the British Open University and the Open Universiteit in the Netherlands, but not in many other countries due to different academic traditions, learning cultures and societal conditions.

The British Open University has brought this particular model of multiple (mass) media distance education to perfection. More than 30 open universities all over the world have been influenced by its outstanding achievements.

The Group Distance Education Model

This model is similar to the third one as radio and television are used permanently as teaching media, especially for transmitting lectures held by eminent professors. However, these lectures are as a rule not received by individual students, but rather by groups of

students attending obligatory classes where they follow the explanations of an instructor, discuss what they have heard and watched, do their assignments and take their tests. No special printed teaching material is developed and distributed with the exception of the customary "lecture notes". The Chinese "Central Radio and Television University" is the most prominent example, but similar models are also used in Japan and Korea.

Analysing this model critically we might say that this is not really a form of distance education, although it is true to say that groups of students are taught at a distance. In fact, it is a form of technically extended campus-based education. The lectures transmitted are the same as on a real campus and the instruction in the local classes reminds us very much of classes or seminars on a campus as well. The managers of the Chinese system are even concerned not to depart from the formats of campus-based teaching and learning. They maintain, and are even proud of this, that the Central Radio and Television University is a university just like all other universities. In other words, they do not adapt the pedagogical methods of teaching and learning to the special needs of the distant learners. On the other hand, they like to be considered as "open universities".

The Autonomous Learner Model

This model provides for freedom to develop independent learning. Its goal is the education of the autonomous learner, which is, pedagogically speaking, an ambitious and demanding but also a promising goal. Students not only organise their learning themselves as, e.g., in the correspondence or multiple mass media model, but they also take on curricular tasks, they are responsible for determining the aims and objectives, for selecting the contents, for deciding on the strategies and media they want to apply and even for measuring their learning success.

In this model, professors have ceased to present contents again and again, lecture after lecture or one pre-prepared printed course after the other. Here, the long tradition of expository teaching has come to an end. Instead, professors function as individual and personal advisors, as facilitators, who meet the students regularly once a month or so for long and thorough interviews. In these meetings the students present, discuss and negotiate their objectives and plans. The agreements they reach are fixed in form of a contract between the individual student, the professor and the university. Each party promises to participate actively in the project. The contract guides and supports the students, who work on their own by mainly using local learning facilities. They are encouraged to seek as well the assistance of local experts in the field of knowledge they are studying. In the literature this particular form of distance education is referred to as "contract learning". Its importance will grow as adult distance education of the future has to be autonomous, or at least comprise elements of autonomous learning, especially in the digital learning environment.

The overall pedagogic goal of this model is to substitute the presentation of contents to the students by encouraging the students to acquire them themselves. The students are to be empowered and enabled to become self-conscious, self-reliant and autonomous learners. This deserves praise. However, one criticism might be that this model is not really a distance education model because it lacks the advantage of teaching (very) large numbers of students. A professor will be able to counsel and support only 20 – 30 students. The Empire State College works on the basis of this model.

The Network-Based Distance Education Model

This model is emerging at present as part of the digital transformation of the way we work and live. It makes it possible to work in a digitised learning environment. This is a most convenient learning situation. Students have access to even the remotest teaching programmes and databases carrying relevant information. They may work off-line or on-line. They may use CD-ROMs with distance education courses in hypertext-form or just with databases to be used while studying a subject (expert systems). They may take part in virtual seminars, workshops, tutorial and counselling meetings, tuition or project groups and chat with their fellow students. The greatest pedagogical advantage, however, is that students are challenged to develop new forms of learning by searching, finding, acquiring, evaluating, judging, changing, storing, managing and retrieving information when needed. They have the chance to learn by discovery and to be introduced into learning by doing research.

This model is certainly a complex and demanding one. But it is promising as it opens up new dimensions of pedagogical endeavour in distance education. For the time being we can see that the function of computer and network-based learning and teaching will have to be different from traditional campus-based and distance education. An example which has already proved itself for a number of years is the online course "Master of Distance Education" of the University of Maryland University College.

The Technologically Extended Classroom Teaching Model

This model was developed in the USA and has become popular there mainly during the last ten years, especially in multi-campus organisations. We have to deal with it here because it is also called "distance education". The usual arrangement is as follows: a teacher teaches a college (or studio) class and the presentation or instruction is transmitted to two or more other classes by cable or satellite TV or with the help of a video-conference system. In this way, a single teacher can teach several classes making the process more economical. The advantage is that it is live and synchronous instruction. Desmond Keegan (1995, p. 108) put this advantage in a nutshell by referring to this form of teleconferencing as "face-to-face teaching at a distance".

How did this different and, for experts in distance education, strange form of distance education come about? Eugene Rubin (1997), the head of the Institute of Distance Education at the University of Maryland University College, gives the following reasons. This distance education model is based on the principle of the extended classroom. It is assumed that the "best" model for teaching or taking part in a university course is the model used at traditional universities. In nearly all universities in the USA this means that a lecturer stands in front of a group of students. What happens in the class varies from course to course, but it is always interactive and in real time. Distance teaching on the basis of teleconferencing attempts to imitate this model, and for this reason the criteria "group", "interaction" and "real time" are decisive.

Rubin, who is also familiar with distance education systems outside the USA, admits the disadvantages of this model. It is not as efficient as is normally expected of distance teaching because the size of the classes that can be connected, and their number, is limited. Efficiency here relates merely to not having to have a lecturer in each of the connected classrooms. It is not even possible simply to speak of extended classroom

teaching, because students in the connected classrooms often had the feeling that they were alienated from the main classroom. The lectures often appeared deadly boring. Lecturers require special training and experience.

What is so attractive about this situation? Why is it so popular? Basically, teachers are probably attracted by this method of presentation, because it appears not to differ from that at a traditional university. There is no need for strenuous readjustment processes and time-consuming new developments. Negative aspects are the considerable technical effort and the substantial investment of capital required for this model (cf. Bates, 2000, p. 23) which simply serve to extend their range. But extension is achieved only slightly and by abandoning important advantages of models two and three. We miss the independence with regard to places and times of learning, so valuable for adult students working for a living, the possibility of mass education through the economy of scale, the carefully planned and pre-prepared high quality courses, the selection of the best experts for writing courses, and the distinct opportunity to serve the under-served outside the university. These deficiencies are the reason why Sir John Daniel attacked the protagonists of this model by "taking a hard-hitting look at the mistake of trying to teach the masses by satellite and videoconferencing" (Eisenstadt & Vincent, 1998, p. 12). Indeed, he rejects this "approach to distance learning that involves teaching to groups in remote classrooms through videoconferencing" (Daniel, 1998b, p. 28) and recommends computer conferencing on the net instead.

In spite of all the scepticism about this special model of distance teaching, we cannot ignore its particular relevance in the higher education of the United States and its gradual world-wide diffusion, especially in broad-band Australia. However, the most interesting and pedagogically useful experiments are not those that merely imitate classroom teaching, but those that deliberately carry out individual and particular functions in an overall system of online distance teaching.

Hybrid Models

Which of these models should be given preference? This depends on economic and infra-structural factors, but also on the cultural background, academic teaching and learning traditions and on the advances of technological information and communication media at the time when a new system of distance and open education is to be established, not to mention the importance of educational and institutional policies. Whatever the decision will be, we must not forget that distance education is *sui generis* and requires approaches that differ from traditional formats of education. Furthermore, in this era of constant change we should bear in mind the model of a possible university of the future when developing new distance teaching courses. The university of the future will have to combine distance education, learning in a digitised environment and intensive scholarly discourses face-to-face in real academic learning spaces which allow students to take part in the scientific process of knowledge creation (cf. Peters, 2001, p. 245). The university of the future will be a mixed mode university and distance education will be a prominent if not the basic element in it. This does not apply to delivery to a distributed student body only, but mainly to the methods of autonomous, self-directed learning. The seven models of distance education can stimulate our creativity when designing appropriate instructional systems.

4 Online Learning: Visions, Hopes, Expectations

Conditions for teaching and learning will be increasingly determined by the opportunities for online learning. This will mean that teachers and students will be confronted by new pedagogical criteria and strategies. Those who wish to be introduced to the new learning field and who think about its increasing importance may be stimulated by the following prophecies from futurologists.

Introduction

In general, the use of computer networks in education is regarded as a desirable innovation and a significant contribution to the reform of teaching and learning. To a great extent this is linked to the hope that it may thus be possible to overcome pedagogical difficulties and to compensate for obvious deficiencies. Universities, for example, believe that they will be able to react more flexibly and quickly to the changes in many areas of life and work. University administrations expect a more fruitful and less expensive system of academic instruction. And a favourite conception of distance study experts is that the spatial and social isolation of students can be reduced considerably by means of network-based forms of communication and cooperation, thus removing the blemish from this form of academic studying which is often – wrongly – ascribed to it.

The present level of consciousness was stimulated among other things by two best sellers from the 1960s, when the technical preconditions for computer networks were still in their infancy and their present significance could not even be guessed.[2] In his book "The Future Shock", Alvin Toffler diagnosed the bankruptcy of the contemporary educational system (1970, p. 319) and criticised above all the widespread lecture system, in which he recognised the hierarchical structure of industry. He wanted to replace this by seminars and simulations games in "artificially created situations on a computer basis" (1970, p. 322). Toffler clearly foresaw the restructuring of learning which was required by computers and networks: "The new education system must teach people to classify and reclassify information, to determine its veracity, if necessary to change categories, to move from the concrete to the abstract, and vice versa – and to teach themselves something" (1970, p. 327). Here Toffler was already referring to techniques of self-teaching which have become necessary in digital learning environments today and which are propagated for autonomous learning.

Furthermore, it was obvious to him that digitalisation would structurally alter teaching and learning at university with regard to increased individualisation. "The system of academic examinations, grades and degrees would be ready for slaughter", he prophesied, "long before we reach the year 2000. No two students will be pursuing an absolutely identical degree course" (1970, p. 218). As far as this last prophecy is concerned he underestimated the resistance of teachers and the robust opposition of institutions. At the same time, this demand in particular is being put forward more than ever today under the influence of constructivist thought.

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[2] A precursor was the first decentral computer network ARPANET (Advanced Research Project Agency network) that was developed in 1969 by the US Department of Defense. The actual date of birth of the Internet was in 1983, when the MILNET (Miltiary Network) split off and changed into the commercial INTERNET, which was initially used by universities, where it began its victory march (Döring, 1997, p. 306).

A few years before Toffler published his book the futurologists Herbert Kahn and Anthony J. Wiener (1967, 1971) caused a sensation with their book “The year two thousand: a framework for speculation on the next 33 years”. They described how learning material could be accessed in the home, at work and in school with the help of computer networks. We can see that great hopes for innovations in teaching and learning were linked from the start to the use of computers and computer networks.

Public consciousness of the possibility of learning with computer networks is of course shaped by society and is influenced in individual countries by different mentalities. This can be seen from articles in the press. In Germany we can still read opinions in articles on the subject which tend to run from the sceptical to the critical, but in the USA people are more confident and optimistic. There is convincing proof of the openness of Americans towards the new media: Since 1927, the readers of TIME magazine have been voting annually for a "Man of the Year" to indicate his particular importance for the development of society. In 1982 the vote was not won by a man or a woman but, characteristically, by the computer, which was then, as usual, shown on the magazine's cover. This year, the "man" of the year was the computer. Two thirds of readers polled were already of the opinion that computers would improve education (Kleinschroth, 1996, p. 13). The weight and significance of this technological achievement could not be stressed more.

Empirical Analyses

The considerations referred to so far have been in part selective and in part general. There is no way in which a general trend can be concluded from them. And in no way can they be generalised. Their informative value is therefore limited. If we want to discover more valid information on this subject we will have to examine systematically everything which has been thought, imagined and held for possible in this area. Klaus Beck (1998), a communications sociologist, has carried out this task. He examined forty prognoses on "teaching and learning in the information society" with the help of empirical contents analyses. He arrived at interesting and differentiated results with relatively high evidential value. It is worthwhile looking into this, because in this way we can find important criteria for the future discussion of the new working field.

An evaluation of the examined prophecies shows us the following:

(1) The future role played by computer networks has occupied a great number of authors in the past decades, including many scholars. This topic was current throughout the period. If we take their statements together we obtain wide-ranging and detailed insights into the developments which were prophesied.

(2) The network is in principle not regarded as a medium that would simply be added to conventional media but as a *technical configuration* which attracts attention because of its particular effects on teaching and learning and because it inspires pedagogical fantasies. Some authors are angered by it, others are enthusiastic. In fact: what these authors forecast should impress every educationalist and instructional designer who enjoys reforms. The variety of the unorthodox possibilities for applications shown in these prognoses and of their innovative effects on learning is overwhelming.

(3) It is claimed that computer networks will have a "wide-ranging impact" on the educational system. If we observe in particular the field of teaching and learning,

computers are ascribed the "role of a universal machine with which pedagogical, organisational and educational policy problems can be solved" (Beck, 1998, p. 212).

If we look at Beck's research findings with regard to important details as well, we can detect a broad range of prophesied changes. Taken together, the authors prophesied a total of 26 typical pedagogical uses for computer networks, but we will refer here only to those which might be important for the tertiary sector and above all for distance education. According to this, computers and computer networks will be used for the following functions:

- distributing teaching contents via the network,
- drill and practice,
- control and correction tasks,
- working with learning material prepared using multimedia (with animation and simulations),
- working with adaptive learning programmes,
- hybrid models: links between PC, CD-ROM, CDI + the network,
- synchronous services: video conferences, chat rooms,
- a-synchronous services: e-mail, mailing lists, newsgroups,
- virtual learning worlds as MUD,
- activities in virtual reality.

This selection itself indicates the wide variety of the very different pedagogical processes. Their application will lead to a pluralisation of learning forms, obviously because changing from one form of learning to another is easy and quick. This leads to different weighting of existing forms of learning. Dialogue and communicative learning, cooperative and social learning, learning related to adventure, experience and problems, holistic, realistic learning, project work and self-learning phases will no longer remain goals for study reformers only. On the contrary, they will be given new and better chances of realisation. The authors also forecast the frequently cited change in the role of teachers. According to them, teachers will change themselves into communicators, moderators, coaches, advisors, counsellors, evaluators, inspectors, instructional designers and evaluators (Beck, 1998, p. 218).

On a higher level of reflection, the *mediatization* of teaching and learning is referred to as a further consequence of the use of computer networks and is regarded as particularly serious. This mediatization is imagined in both moderate and radical forms. In moderate forms the computer networks serve only to supplement and enrich conventional forms of teaching and learning. They are an additive which can be left out if necessary. Radical mediatization on the other hand is "disruptive" (in the sense of the word as used by Garrison & Anderson, 2000, p. 25) and leads to a dissolution of conventional forms of teaching and learning which, however, can itself lead to their creative restructuring in completely new learning scenarios.

The authors often then point to the expected processes of *de-institutionalisation*. Here they are thinking of the networking of educational institutes, the opening of schools and universities, the creation of new "learning locations", virtual schools and universities, the

increase in self-learning processes and also of the privatisation and commercialisation of education.

Finally, reference is frequently made to the *individualisation* of learning. On the one hand, this has logistical aspects, because with online learning students can fix the time and place for learning themselves, just as with distance learning, but it is also of eminent pedagogical importance because self-controlled learning requires curricular and methodical autonomy.

In the context of the evaluation of the results of his investigation Beck (1998, p. 277) states the following:

1. While the technology of digital communication has made enormous progress in the period under review (thirty years), the forecast changes to educational practice have not taken place. In spite of this, these changes are still being aimed for.
2. The pedagogical goals which are to be pursued through the use of computer networks were all articulated in the 1960s and have remained the same since then, in other words they still apply.
3. The confidence in the impact of computers and computer networks "appears to be practically unbroken".

Current Prognoses

Four years have passed since Beck's book was published. Given the speed at which information and communications technology develops this is a relatively long period of time in which prognoses of the future of online learning have continued to be made. These are based above all on the methods of polling experts. Those who take part today are naturally in a different situation to the authors in Beck's investigation, because they are under the influence of the stormy development of information and communications technology which has turned practically everything upside down. Their prophesies are more precise. Because a considerable number of authors were polled both in Germany and abroad certain trends of opinions will be detectable which have obviously solidified.

Two Delphi studies will be used at first.

According to the Delphi-II Study (Bundesministerium, 1998), which was organised and published by the then Federal Minister of Education and Science in Germany, the following changes will take place in the period to about 2020:

- From 2005 the distance education system will be used generally for further training of the population.
- From 2007 education will increasingly lead to bundles of individual qualifications and not to final degrees or diplomas.
- From 2008, educational further training measures for employees will be fully integrated in working hours.
- From 2010 virtual world universities will be widespread.

These four prophecies can be interpreted in conjunction. It is obvious that the experts who were polled regard the future of online learning in connection with the increasing importance of distance education. Both forms, whether integrated or not, will become

all the more important as the "individual bundles of qualifications" cannot be mediated by means of traditional teaching, but have to be acquired above all through self study. For this purpose a broad culture of autonomous self-directed learning will have to be developed which will have to define learning in schools, universities and in the workplace. What is amazing is the broad consensus in this question. Only a few percent of the experts believe that these developments will "never take place". With regard to the general use of the distance teaching system the contrary opinion was held by just 1.2 percent. These findings are sensational. Never before has distance education been accepted to such a great extent as a regular form of learning.

In addition, an astonishing 99.4 percent of the experts who were polled agreed that between the years 2008 and 2015 electronically stored information will be retrievable *in all the common languages* of the world. If this trend is actually realised, the globalisation of the education market would probably enter a more intensified phase, whereby as far as the export of online courses is concerned there will be probably more accentuated competition between those universities whose prestige is high. In contrast, two other trend prognoses attracted a larger number of contrary opinions. Just over 15 percent (15.6) did not believe that between 2011 and 2022 computers will be able to put texts together automatically and make automatic extracts from books and documents. And 17.8 percent did not think that between 2010 and 2019 databases will have learned to arrange their "knowledge" without any misunderstandings. At the same time, these values show that the great majority of those who were polled have a positive opinion of these developments in information technology.

The Delphi study by Klaus Beck, Peter Glotz and Gregor Vogelsang (2000) has shown that the trends in online learning are in general regarded very soberly and cautiously by the experts who were polled, and in some cases even sceptically. The chapter entitled “Lifelong Learning in the Worldwide Web? Education through Computer Networks” is based on differentiated surveys of 109 people mainly in Europe, but in other regions of the world as well. The question was explicitly *not* about what will be technically possible in the future, but how computers will change everyday life, whereby in our context we are interested in the daily life of students and teachers.

On the whole this study forecasts the creation of a "specialised educational network" (2000, p. 11) as a consequence of the digitalisation of teaching and learning, but this will not have been formed until about the year 2010. Experts do not believe here in the medium term in structural revolutions of an institutional nature, in other words, they obviously do not believe in a rapid development in the direction of virtual universities, as was forecast in the Delphi II study (Bundesministerium, 1998) and in the scenario "University 2005". They tend to see decisive changes more in the publications and libraries system.

If we assess the prognoses which were determined in this way under the aspect of their pedagogical significance, the following individual results are particularly interesting:

Self-directed learning phases: by 2010 these will have gained considerably in importance with online learning. Only 16.5 percent of those polled thought this would never be the case (2000, p. 171).

The role of teachers: between 2010 and 2015 the role of teachers will have "changed radically", namely in the direction of activities concerned with educating, moderating, coaching (2000, p. 171).

Increasing learning effectiveness: over half of those polled are of the opinion that the individual learning effectiveness increases with online learning. However, this took place to a different extent with current learning contents. The greatest increase in effectiveness was predicted in scientific/technical subjects (82.6 percent), in receptive learning (78.9 percent) and with language-related contents (67 percent). In contrast, a large majority (85.3 percent and 88.1 percent respectively) said there would be no growth in effectiveness with artistic/musical contents and in social learning. It is unfortunate that this survey did not determine what those polled understood by "learning effectiveness". It may be that extremely different criteria were applied in each case.

Forms of communication I: the following were regarded as being forms of communication which were "very suitable" for online learning: teaching materials databases (56.9 percent), simulation software for scientific and economics models (50.5 percent), supplements to CD-ROM software for the purpose of updating in interactivity (31.2 percent), e-mails and mailing lists for counselling and rapid feedback (30.3 percent), adaptive learning programs which adapt to the student's prior knowledge and learning style (25.7 percent), drill and practice software (21 percent) and individually retrievable extracts from teaching films (12,8 percent).

Forms of communication II: in contrast, the following forms of communication were regarded as "unsuitable" or "mainly unsuitable" for imparting general education (both values are consolidated below): live transmissions of instruction/ lectures (40.4 percent), chat forums (36.7 percent), automatic correction software (33.9 percent), video conferences (31.2 percent), WWW courses from the Internet (24,8 percent) and shared applications for group work (20,7 percent).

When we consider the extent of the reservations even today with regard to autonomous, self-directed learning, the findings on the growth in importance of self-directed learning are remarkable. Many students and teachers are naturally attached to traditional pedagogical thought in which expository teaching and receptive learning dominate. And in developing countries in particular group links prevent the individualisation of learning. In spite of these circumstances, self-directed learning has acquired a firm place in the conceptions of the experts who took part in the survey. This is probably an expression of the realisation that the pedagogical structure of online learning must of necessity differ from that of traditional learning.

The findings on the change in the role of teachers also bear witness to the growing realisation of the necessity of this change. The consequence, which has been described again and again and was regarded as necessary already in the discussions in the literature on programmed instruction, is now forecast by a remarkable number of experts (83.5 percent). The prophesied change in the vocational image of teachers is in so far weighty as it will lead to considerable difficulties of both an institutional nature and as far as career and promotion regulations are concerned.

The pattern of opinions on the "suitability" of individual forms of communication for online learning is particularly informative because ranking was carried out. This indicates which technical functions of a virtual learning environment would be used in first,

second and third places in future. Using learning material databases, simulation software, updating information and exchanging information with the help of e-mails and news-groups are quite clearly in front here, followed by adaptive teaching programmes and drill and practice. It is attractive to see these learning activities not as isolated set pieces which are inserted into traditional learning processes, but as components which, combined and integrated, result in a specific model of online learning which must prove itself and be strengthened in practical application.

Those forms of communication about which many of the experts who were polled expressed reservations have to be evaluated in part differently from a pedagogical aspect and because of prior experience with them. We can certainly accept the rejection of live transmissions of lessons and lectures, because this transposes forms of traditional learning into online learning, and leads to dysfunctions. In addition, not the slightest use is made of the amazing specific pedagogical potentials of online learning. Video conferences, if they are used for learning groups separated geographically, are of limited value only. They are expensive, reduce access and are inflexible. However, the actual trend in the USA contradicts this. There, this form of teaching is already widespread and is becoming more and more popular thanks to particularly deep enthusiasm there for technology. John Daniel (1998b) subjected them to harsh criticism. He sees *computer* conferencing as having greater and better opportunities, above all with regard to the urgent requirement for mass education.

Unfortunately, chat forums are regarded by over one third of the experts in the poll as being either completely unsuitable or only slightly suitable. It is possible that in future they will in fact play a subordinate part only in teaching and learning processes, and the prognoses may therefore be correct. However, for pedagogical reasons there has to be a facility for informal exchanges in online learning. This is simply part of a complete and all-round teaching and learning system. I also regard automatic corrections as indispensable for online learning, particularly because an instrument for self-control of those learning autonomously can be developed from this. Because "collaboration" is an important learning attitude in demanding online learning, it would be a pity as well if the prognoses regarding shared applications also proved correct.

The study tends towards caution with the macro-pedagogical prognoses as well. When asked how far online learning will have replaced traditional learning by the year 2010, almost half stated that it would not replace traditional instruction *at all* (10.1 percent) or at most *by up to ten percent* (37.6 percent). Of those polled, 36.7 percent assume that it might be 25 percent of instruction. And only 8.3 percent of them believe that the share of online learning could be higher.

In their book **"**Szenario: Universität 2005**"** (1999), Jose L. Encarnacao, Wolfgang Leidhold and Andreas Reuter prophesied the creation of new types of university. Their theory is that because of the digitalisation of university teaching there will be four distinct forms of virtual universities: international consortia, corporate universities, networks and virtual universities. All this is merely an intensified interpretation of the development which could already be seen clearly when the scenario was determined. The present level of development is described in chapter 9 of this book. This shows that we can in fact observe how different institutions of online learning emerge, and this is verified by means of example. However, in the case of the institutional diversification of the university forecast by the authors we have to ask ourselves what is going to

become of the traditional campus university? Many will have to close, some will develop further into expensive elite universities, prophesies the scenario. The classical university would then be merely a "residual category" (Schulmeister, 2001, p. 31). This prophecy is without doubt exaggerated because it would be extremely difficult to do without the special socialisation and educational processes that are brought about through universities.

Obstacles, Protests, Resistance

Critics of the digitalisation of teaching and learning are hardly heard in the prophecies and the studies which have been referred to here. The reason for this may lie in the fascination exercised by computers. The new opportunities provided by the Internet also put users in an almost euphoric frame of mind. Their attention is directed towards the new form of learning to such an extent that everything else moves into the background. A book by Juan Luis Cebrian (1998) is entitled significantly “In the network, –the hypnotised society”. When the computer network has become a “cipher of general social progress" (Beck, 1998, p. 228), sceptical and critical opinions do not appear to find any resonance and then are often not voiced at all.

The optimism of educationalists, who are often very attracted to the new forms of online learning, may also contribute to this. Sober criticism and cautious, rational judgements are therefore hardly to be expected.

Commendably, in his new book Rolf Schulmeister (2001) lets opponents of the digitalisation of university teaching be heard as well. He even reports on actions to prevent it. For example, members of the California State University fought against the California Educational Technology Initiative, which was to have been called into existence by the university in collaboration with several large computer companies. Nine hundred members of the University of Washington signed a letter to the Governor protesting against an organised Digital Education Initiative. David Noble is carrying on a real crusade in the Internet against the commercialisation of teaching and learning and against the "commoditisation of education", in other words against the ever increasing tendency to regard and treat education as a good. (cf. to Noble 2001; http://www.firstmonday.dk/issues/issue3_1/noble/index.html)

Commentary

The prophecies which were shown and studied here make clear to us just how important the authors think that computer networks will be for the future of teaching and learning. It is obvious that they recognise the social explosiveness of this technical development. Otherwise such large numbers of them would not have occupied themselves so intensively for so long, otherwise the surveys would not have been commissioned. We can see that this is not just praise for and dissemination of a new teaching medium, as happened decades ago with film, radio and TV. Here we are dealing with technical developments which are already altering society and consciousness. The prophesied pedagogical innovations are only part of this wide-ranging process of change. We are on a different categorical level here.

Those who ridicule prophecies of the type shown here and regard them merely as a game for the imagination and people's powers of invention without any empirical reality have to admit that in this case they fulfil an important function: they draw attention

forcefully to necessary and imminent changes. These will be serious, something which is made obvious by the announced introduction, intensification of and support for autonomous self-directed learning. Prophecies of this nature create a leeway for our own considerations, something which is very difficult to find in view of the rapid change and which is therefore costly. We can make use of this by an attentive, concerned response so that we can detect possible wrong digital developments at an early stage and prevent them. This is why Klaus Beck, Peter Glotz and Gregor Vogelsang (2000, p. 12) placed an appropriate play on words from August Comte at the head of their study on the future of the Internet: *"Voir pour prevoir, prevoir pour prevenir" – "See in order to foresee, foresee in order to anticipate"*.

Under this aspect the prognoses we have mentioned receive an additional justification. They are useful even if our own considerations and experience lead us to the contrary opinion that probably only a few of them will come true. Even those prophecies which finally lead nowhere still have a certain orientation value for us in the virtual learning spaces which are becoming more and more unclear.

If we want to evaluate the scenarios shown here on a pragmatic level, we must agree with Rolf Schulmeister (2001, p. 34) when he says that prognoses of this nature in general "overestimate the power of the free market and the speed of developments" while at the same time they underestimate the "inhibitory factors": He includes among these the "tenacity and resistance" of teachers and the fact that the physical presence of teachers is vital for many actions involving teaching and learning because virtual representations of the presence are possible in approaches only.

Rolf Schulmeister claims that the "speed of developments is not as fast as experts assume". However, it can increase suddenly, in bursts for example. While Klaus Beck (1998, p. 227) at the end of the Nineties did not yet find any structural changes to the education system, since then ThinkPad universities, Internet universities, virtual universities and virtual distance universities (Peters, 2000, cf. chap. 9) have mushroomed, not to mention the many *corporate universities*. The latest overview from Helm and Helm (2000) already lists 350 profiles of online degree courses and has a list of around 1,500 academic degrees and diplomas which can be acquired through online studies. These figures have probably increased considerably since publication. Recently, Australian universities have been attempting to carry out a fundamental reform of their teaching operations with the help of online learning. The macro pedagogical consequences of online learning can be studied there. Some of the prophecies shown here have already been fulfilled there, and from this aspect we can understand the boldness displayed by some experts in their latest studies in the last few years.

Analogously to the title of a famous bestseller by Robert Jungk (1977) we can say that the future of online learning has already begun!

5 Digitised Learning Environments: New Possibilities and Opportunities

This chapter assesses a number of the new and diverse possibilities of online learning. It argues that online learning provides for new chances in two separate and distinct fields: in regulated teaching (Part I) and in non-regulated learning (Part II). Its main purpose is to show that online learning lends itself easily to autonomous, self-regulated learning.

Introduction

In Germany and in other western countries learning experts are engaged in a controversy about the nature of learning and about the problem of which reforms are necessary in teaching and learning. To describe it in simplified terms we can say that the traditionalists believe that learning takes place when expository teaching and receptive learning fit together: the teacher presents contents and the learners receive them, store them in their memories and recall them when asked for them in examinations. In fact, this mode of teaching and learning has a long tradition from antiquity to the present day. Lectures in study centres, printed teaching material and educational radio and TV presentations provide ample proof of this. The teacher or the programme developer determines and dominates and is responsible for the teaching-learning process in many ways. This particular kind of learning is called therefore directed or heteronomous learning. We all learned in this way at school and at university. We are used to it and it is easy to continue in this way.

On the other hand, there are the progressives (e.g. Knowles, 1975; Boud, 1988; Zimmerman & Schunk, 1989; Arnold, 1993; Dohmen, 1997; Friedrich & Mandl, 1997) who are opposed to this kind of learning on the grounds that it is basically only cognitive, that students remain relatively inactive or even passive, that the idea large groups of students being offered the same contents and would then learn in the same way is an illusion. They maintain that the competitive industrialised »knowledge and learning society« needs a new type of learning which calls for active learners who are able to initiate, plan, implement, control and evaluate and also apply their learning themselves. Not only factual knowledge is important, but also competence in using the methods of obtaining it, as well as the competence to co-operate with others. Here, learners dominate the teaching and learning process, whereas the role of teachers changes to that of facilitators, advisors, or counsellors. Learners have to take over the responsibility for their own learning. They must also be active in order to be able to learn. Because there is no interference from an external person or institution, this type of learning could be called non-directed or autonomous. We are not used to it and it is a very demanding and ambitious way of learning.

While I hold the view that both approaches are and will remain important, self-regulated learning will have to be emphasised in the future, especially in distance education and online learning.

Part I

Regulated Learning

Protagonists of this type of learning in which the teachers plan the learning process as far as possible, articulate and present the learning content, control its course by means of interventions and guarantee results, should be particularly attracted by the opportunities provided by a digital learning environment. Among these I include those behaviourists who interpret the teaching and learning process above all with the help of stimulus/ response schemata. Expository teaching, according to this theory, means setting stimuli in the hope and expectation of corresponding responses, a procedure which usually expects to achieve its success by means of small steps and close guidance. It is therefore not surprising that programmed computer-supported learning was practised first in digital learning environments, especially as twenty years of experience were already available. Drill and practice programmes are mainly offered in this way. Electronic file courses derived from carefully developed distance education materials are new, as are the "guided tour" through hypertext and hypermedia, in which the "guide" not only determines the path, but also the type and number of "objects" that are to be "visited".

If we analyse this form of mainly presentational teaching, four new possibilities spring to mind which are specifically and pedagogically relevant for distance and open learning:

- several presentation methods can be combined and integrated,
- multi-sensory instruction can be considerably strengthened,
- interactivity can be extended quantitatively and qualitatively,
- the support system can be extended and improved.

The Combination and Integration of Several Presentation Methods

If we reconsider the combination and integration of presentation methods in a digital learning environment we continue to be amazed by the new possibilities which are relevant in particular to distance education. In the latter system, the printed word is the main form of presentation, but now interesting possibilities are also made available for the spoken word in the planning and design of presentations in digital learning environments. For thousands of years this has been the most highly regarded form of presenting teaching content. When it was replaced in distance teaching by the printed word about 150 years ago, this was a sharp break with tradition and had considerable pedagogical consequences. But now, in the digital learning environment, the traditional spoken word is regaining importance for teaching and learning, at first only sporadically, but there will be more in future, and this necessitates a structural adaptation in distance education which this time will be completely different and of pedagogical consequences which we will have to be familiar with.

However, there is even more to it. The image of the teacher can also have an effect on students. There may be an impression of a certain degree of external monotony, such as, for example, occurs in a lecture simply as a result of the lecturer standing at a podium speaking continuously and the students sitting at their desks listening continuously. The image of the teacher can now be made more dynamic by means of different camera angles and settings, and this can lead to a penetration and intensity of the images never before

experienced. There are possibilities here for pedagogic film direction and dramaturgy in distance education whose criteria are still unknown to us.

These two innovations alone would be an achievement which could considerably alter the methods and efficacy of distance education, because then it would become more stimulating, as the abstraction of the presentation through letters and printing can be withdrawn where required, because the person doing the teaching becomes visible and can be experienced, and the presentation of the teaching content could become more variable, more interesting, more diversified, more intensive, more concise and more colourful, both literally and figuratively.

The question of how these new possibilities and chances for digital learning can be used in distance education is of considerable pedagogical importance, and in the beginning simple questions like the following should be asked in the case under discussion:

- When and why should work on the screen be done with written texts?
- When and why should the teachers themselves "say something" and "put in an appearance"?
- When and why is it advisable to combine and integrate both forms of presentation?
- When and why is it better for a neutral voice "off" to be used?

There is no doubt that these are new questions for most teachers and demand decisions from them which should not be made schematically and not at a teacher's discretion. What we are confronted with here are basic questions of digitised teaching and learning which we probably will not be able to answer by means of experience gained with analogue teaching films.

Multi-Sensory Presentations

The exactly calculated combination of the spoken and the printed word and still and moving pictures of the lecturer represents merely a small, almost minimal, section of the many other pedagogical possibilities and chances. Naturally, many more new possibilities and chances that multimedia systems make available are obvious. We do not mean in this context the amazing and remarkable digitised technology, which can change contents disseminated in various modes of presentation into flows of bits (Kaderali, Müller & Rieke, 1996), which means that they can all be transmitted, disseminated, stored and even integrated and processed in accordance with pedagogical aspects in exactly the same way. It is in fact pedagogical aspects which lead to the combination and integration of these presentation modes. The multi-sensory impression can be used for presenting, recognising, understanding, processing, testing and experimenting, or simply for repeating. Not only the spoken and the written word are combined and integrated with a pedagogical intention, but also, where this is required, images, audio and video information, animation and even virtual reality, for example in the form of three-dimensional spaces. What we are faced with here is an accumulation, compression and intensification of presentation that has never been seen before, because it has never before been possible. What a difference there is between writing on a board in a classroom, graphics printed in a study letter, monochrome pictures in a textbook, which are usually much too small anyway, and the potential audiovisual land of milk and honey into which the digital learning environment can lead us.

Regulated presentation can be taken to excess in certain phases in which comprehensibility is a critical factor. In such cases the student's attention is often steered in extremely small steps because this is necessary if a very complex abstract situation is to be understood at a greater depth. The student is then led by the hand by the teacher, who uses the multimedia presentation to do this.

The development of these intensive phases cannot be done by the way, because the work involved is hard, time-consuming and demanding. The pedagogical criteria which are important here must be brought to mind and reflected on before the individual presentation sequences are planned, designed and then realised technically according to a detailed script. On the other hand, the digital learning environment saves teachers from having to acquire, set up, try out and operate several different presentation apparatus. This is a great relief. The pedagogical benefit can be great, as can be seen from the following example of a multimedia course at the FernUniversität in Germany.

An animated graphical presentation is built up step by step in front of the students and is explained and commented on by the lecturer who is doing the talking. Colour accentuates the stages, flashing draws the attention to the terms referred to for exact periods measured in seconds. Students' attention is steered and held in a special way by the movement which the picture gains by means of the parallel displacement of cross-sectional lines. This makes a regularity clear to students at a high level of abstraction. But even more: by clicking a button students can retrieve every single stage of the presentation of these graphics in any sequence they like, which means that the concept and the appropriate commentary can be repeated and understanding and comprehension strengthened and deepened. Multi-sensory presentation is used here for repeating and practising. The multimedia presentation on the screen can be seen in high resolution and brilliant colours. Sections of the graphics can, if necessary, be magnified by up to 800 percent and made much clearer in this way.

When carrying out experiments with multimedia in a digital learning environment it may be advantageous if the teacher has an idea of other specific pedagogical functions which this method of intensified illustration may include. According to Michael (1983, p. 77), it not only supports the impressive presentation and, as in this case, the recognition of a regularity and concept formation, it can also serve as an aid for motivation and reproduction. In Michael's opinion, however, it may also be essential to avoid an abundance of illustrations, because this can in fact be counterproductive. What teachers should do is select the critical points in a course or course unit in which the efforts required for multimedia are best placed to illustrate learning progress and the acquisition of knowledge. Once again, genuine pedagogical considerations are required in these cases.

There may, of course, be objections to the increased and intensified iconic presentation, in particular from academic teachers, possibly with an indication that "illustration" is primarily a method used in school lessons. The first argument we can use to counter these critics is that overhead projectors are being used increasingly in scientific lectures, including even those given to experts of the highest capacity of mind. We accept and even demand this type of visual support because the influence of television has greatly altered our visual habits. Secondly, we should remind them of Aristotle's dictum that "even the most abstract human knowledge is based on sensory perception" (quoted by Wolf, 1970, p. 50).

Higher Levels of Activity and Interactivity

Jerome Bruner (1973, p. 48) the American learning psychologist, differentiates between three methods of confronting reality and acquiring it in the learning process:

- enactive: directly active dealings,
- iconic: dealing in the media of images, schemata and sketches,
- symbolic: dealing in the media of thoughts, terms and arguments.

In traditional distance education, of course, the symbolic method of dealing with reality has been decisive, and this also conforms to the dominant cognitive structure of academic studying. In distance education, the symbolic transformation of content is taken still further, because not only is language the decisive medium but also alphabetically transformed and printed language. The dominant foundation of teaching and learning behaviour in first-generation distance education is writing and reading teaching texts. In the previous section we saw how the digital learning environment can considerably intensify the iconic method of dealing with reality by the use of multimedia systems. We will now look at the enactive method of confrontation.

Criticism of closed learning situations with the dominance of presentational and strictly regulating and controlling teaching, which was received "passively" by students, led to the demand that mature students should participate actively and act in their own learning processes. In doing this they achieve a higher level of interactivity. The break with behaviourist learning models and the turn to constructivist models encouraged this change of educational paradigm still further, because learning was now seen in many cases as the activity of individuals in the construction, development and amendment of their own cognitive structures and comprehended as a holistic process. From the approach of learning theory this presupposes the activation of the students themselves. Consequently, interactivity with the teaching material and with other persons in the pedagogical field has been discussed and is regarded as important, particularly in higher education.

In first-generation distance education, interactivity is aimed at by making efforts to activate students by means of assignments, problems, stimulating them to reflection and self-tests. This includes stimulating students to organise partnerships or small self-help groups with other distance students. An additional aim here is to develop interactive skills (cognitive and social skills).

Second and third-generation distance education intensify this interactivity even more. Because of the presence of a digital learning environment, students find themselves in a much more favourable starting situation. This situation differs markedly from that of students reading and working through printed distance education course material with a pencil in their hand. It is as if students had an opposite number, not just the monitor screen but also the teaching software, which can react in different ways to their activities. And behind all this is the network with a tremendous depth of penetration, because it links the digital learning environment with many virtual databases, institutions, libraries and individuals. Continuous contact can be made with this opposite number and maintained by using the keyboard and this contact is integrated in the learning behaviour and becomes a force of habit with time. Depending on the feedback, i.e. the computer's "replies", feelings of satisfaction, relaxation and self-confidence, but also of disappointment,

amazement, surprise or annoyance are triggered, and determine the situation. Bernhard Koring (1997, p. 13) may well be right when he remarks that the use of a computer is often intuitive, which restricts the abstract-cognitive dimension, while the eventful-concrete, even "physical" dimension gains in importance. Interaction then takes on the character of continued and continuous action which is more physical and more adapted to the technological opposite number and richer in forms than in first-generation distance education. Interactivity here is more marked than in externally controlled learning, occurs more frequently and is more polymorphic and imposing. This is perhaps the reason why students like to learn in a digital environment and why many are even fascinated by it. Another factor is possibly that it is the integration of the three methods of confrontation with reality which makes this type of learning so attractive.

Programmed teaching courses in digital learning environments aim among other things at the following interactions:

- answering questions and reacting to feedback as in programmed teaching,
- selecting and working through prescribed links,
- participating in a simulated tutorial dialogue,
- opening a notes window for writing margin notes,
- opening a comments window,
- placing "bookmarks" to mark defined pages,
- working with a search menu which can be opened by means of central terms in the text,
- working with several indices, each of which enables access to different abstraction levels of theoretical dimensions,
- amending teaching texts in accordance with own points of view: placing sections or searching for sections of text containing the same term,
- completing recommended "drill and practice" programmes,
- replacing a standard teaching text by a longer or shorter teaching text,
- exploring with simulations of economic models, electronic circuits, biological systems, etc. Students can enter their own parameters and in this way acquire their own insights and knowledge,
- conducting real experiments,
- reading chapters under different points of view, storing important sections, editing an "own" teaching text.

These are just a few of the possibilities for increasing student's activity and interactivity. It puts students in a position to retrieve information, to take a look at learning programmes whenever they wish, to amend and to manipulate teaching texts, to try out something new and to reverse incorrect decisions. If we include visits to a virtual museum, virtual visits to parts of towns and the application of acquired knowledge in an experimental situation, dimensions of interactivity become visible for which there are no examples in traditional pedagogies.

For teachers, all this means the demanding task of mastering these and other activities and interactivities, not merely from the technical aspect, but also of deliberately

pursuing pedagogical aims when doing so. Teaching software can diagnose what previous knowledge is already present, students can be motivated and counselled and different learning paths can be provided, offered and used. Finally, as Anthony Bates (1995, p. 191) points out, a skilful combination of tests, feedback, repetitions and diagnostic tasks can lead all students to a mastery of all requirements in the sense of mastery learning.

More and Improved Support

One of the most impressive practical advantages of the digital learning environment is the speeding up of communication between students and correctors as well as between students and tutors. The turn-around time for submitted assignments, which normally takes four to six weeks at the FernUniversität, can be reduced to a couple of days. This is without doubt an important pedagogical achievement and compensates for a structural weakness of traditional distance education caused by the slowness of the communication by mail.

Furthermore students can interact with their tutors more easily and oftener, individually or in groups. a-synchronously or synchronously. In a New Zealand experiment, virtual tutorial groups of three or four students proved very successful (Rajasingham, 1997, p. 3). Students and tutors each sat in front of a computer with a telephone headset on. A student would present her or his written assignment on the monitor, read it and explain it. The tutor could scroll through the text and highlight it. The students could discuss what they were looking at and what they were hearing. Very intensive co-operation evolved and a real co-operative learning took place. This is a convincing example of the interactivity which is highly desirable in distance and open education.

Commentary

There is no doubt that the digital learning environment can challenge students to more activity and intensified interactivity, not only with regard to quantity but also to quality. As we have seen, this is already true for learning controlled by teachers and software developers, in other words mainly directed heteronomous learning. Much greater activity and interactivity is required in the case of self-directed autonomous learning and we will now take a look at these forms.

Part II

Self-Directed Autonomous Learning

The use of the digital learning environment to present computer-based learning programmes, integrate audiovisual sequences or even digitised printed teaching texts is a misuse, because its specific potential is not even seen, let alone actually realised. These examples show how the presentation of conventional forms of expository teaching and therefore of externally controlled learning which can be intensified and increased. We could even draw the conclusion that if expository teaching and receptive learning is a pedagogical error in many respects, this error is made here with particular emphasis and skill. Habitual modes of behaviour are being extended into the digital age and this causes us to misunderstand the special opportunities provided by digitised learning environments.

This has to happen, because what is being developed at present in the sector of digitised learning is more than we can imagine. Is it not a fact that these explosive technological developments have long since gone beyond human comprehension? Our thoughts and actions like to remain on the ground, with familiar things. The first railway compartments and cars were designed to look like traditional coaches, because at the time people were not yet able to comprehend the new opportunities that the technology of the steam engine and the petrol engine opened up for them. With digitised learning we are confronted with a similar problem. Completely unknown opportunities are being opened up that are based on computer, media, network and hypertext/hypermedia technologies. One of these is the intensified development of autonomous learning as self-planned, self-organised and self-assessed learning. The digitised learning environment provides even now unusually favourable preconditions for this special type of learning, because it enables and simplifies it in a variety of ways. We will now examine these ways.

Different Starting Situation

The new and completely different learning situation which was already referred to, is advantageous for this. An interrelationship, an interplay, even a quasi-symbiotic relationship between the individual and the software is created in the digitised learning environment. According to Nickerson (1987, p. 691), the strange dyad "individual/ digitalised learning environment" displays criteria of interpersonal communication, namely "bi-directionality, reciprocal initiative, common situational context, equal status of partners". It does not matter how critically we regard these comparisons; in practice people experience the particular attractions of this learning environment everyday. It is fascinating because students enjoy mastering a complicated system, controlling and steering the processes, initiating the acquisition of information themselves and discovering correlations. In doing this, they experience themselves as actors. This starting situation itself appears to encourage, provoke and even incite students to self-learning. This peculiarity of the starting situation appears to be particularly advantageous to autonomous learning.

Taking a closer look, we can see other characteristics of the digitised learning environment which make independent, self-planned and self-regulated learning easier. We say that students have all the information in the world "at their finger-tips". They have access to many relevant data pools and can even use search engines to make this access more comfortable. They can retrieve electronic books or file courses as if by magic. If they have the latest technology available, they can even have these read out. Spoken commands, such as "meaning" or "encyclopaedia" automatically trigger additional explanations and commentaries which make understanding easier. Students can use the WWW to download teaching programmes and texts from authors all over the world. All they need to do is say words such as "library", "catalogue", "subject", "browse", "download" and they can access the growing fund of digitised books. Nicolas Negroponte from MIT even believes that in future we will work with a single book, which we can "load" with the contents we require at any particular moment. As a result of the networking of learning environments, a cosmos of information will develop, including teaching contents and stocks of knowledge, which autonomous learners can open up for themselves, step by step, by downloading what they need onto their own hard disks, printing and working through the texts. In the history of teaching and learning there has never been a more favourable starting situation for independent and automatic learning.

Let us take a closer look at this cosmos. It seems that above all the three following disjunctive activity fields can be found in the digitised learning environment:

- learning in hypertext,
- network-based learning,
- learning through virtual communication.

Learning in Hypertexts

Hypertexts consists of text blocks representing "cognitive units" which may be located on various cognitive levels. This means that the students are forced to find an interesting start to their studies themselves. To do this they browse through the cognitive units offered and develop an activity for which there is no corresponding example in traditional pedagogies. The word "browsing" reminds us, of course, of grazing animals, which eat something here and there. Once a student has found an important starting point, he or she can start to navigate through an unknown "sea" of information. Browsing and navigating are new terms for new pedagogical activities. What the students are looking for here are those cognitive units of information with the help of which the already acquired information can be developed still further; here again they are guided by their own interests, needs and objectives. In doing this they also activate and co-ordinate elements of text, image, graphics and video files. This is made possible by various links, namely the interfaces to information units that lead the students still further. All cognitive units that are linked with one another (nodes) form a network, and this is presumed to be helpful in the formation of semantic networks in the student's own head (cf. Schulmeister, 1997, p. 252). The students' job consists of finding their way around this network and taking their own learning paths. In this they enjoy a great deal of curricular freedom.

Here we come across the decisive and momentous innovation which will have to be interpreted with regard to self-regulated autonomous learning: the break with linear presentation in set sequences and the establishment of non-linear and non-sequential learning. "Digitalisation and computer manipulation cancel the sequentiality of the different media, their sequence can be manipulated at will … and made interactively accessible. This assigns an emphatic role to the interactivity between the user and the system." (Schulmeister, 1997, p. 22). The required activation of the students and the interactivity enabled here will probably form the fundamental basis of future pedagogical design.

We must now pause here and consider for a moment what this procedure (disseminated and imposed on us by information science) actually brings. After all, this change has basic effects on the pedagogical structure of learning. We are dealing here with a pedagogical paradigm shift. The traditional "articulation" of learning, i.e. the binding of selected teaching contents to defined locations, times, persons and sequences in courses or training, has now been abandoned, although it has determined teaching and learning since time immemorial. A completely different type of learning is being created, learning which does not aim at declared and defined learning targets and which cannot be tested by means of appropriate tests. We are therefore confronted with a break with tradition never seen before. However we judge this process, the removal of the bonds above leads to a flexibility and variability of learning which was never before possible. There is now a free space which can be used for self-regulated autonomous learning.

This approach is so interesting because it lets new elements of a learning behaviour become visible which can become fundamental for the autonomous learner of the future. The way searching is actually carried out in practice shows four types of searching, which Kuhlen (1991, p. 128) designates as follows:

- targeted browsing picking things up along the way,
- targeted browsing in which important information is found which was not the subject of the search,
- random browsing,
- associative browsing.

Other authors have found other terms for the different forms of navigating, namely, along with browsing, scanning, searching, exploring and wandering (Canter, Rivers & Storrs, 1985). The expression "path finding" is also used. No matter how we look at these differentiations, it is abundantly clear that when students develop, design and control their learning they are left to their own resources from the very start and have to develop activities in the interest of their own learning, and also accept responsibility for this. Their search movements and efforts at selection form the basis of their learning. This means that we are dealing here with self-directed learning in which all learners pursue their own goals, go down their own learning paths and arrive at different learning results. The hypertext is a convincing vehicle for promoting autonomous learning.

A fundamental structural difference becomes abundantly clear here. Whereas in traditional learning the presentation and absorption of knowledge determines the structure, it is determined here by searching, finding, selecting, evaluating and applying information.

Network-based Learning

Networks offer even greater opportunities and chances for self-regulated autonomous learning, for example, the World Wide Web. The rapid availability of information encourages students to search for things that interest them and to find them. There are many ways of doing this.

Relevant information, for example, can be obtained easily by means of access to electronic works of reference, with the opportunity of saving important facts, articles, etc. to the user's hard disk and printing them for intensive, long-term work. The 32 volumes of the Encyclopaedia Britannica are available on CD-ROM, for example, but can also be accessed in an updated version via the Internet. Large newspaper groups have already opened their digitalised archives. "Digital libraries", some of which do not have a single book of their own, help searchers to examine and find the required literature by means of digital catalogues and abstracts. Digitised texts and illustrations are already being offered more and more. The American Gutenberg project has been planning a facility to provide about 10 000 electronic books (classics which are no longer protected by copyright) on the Internet by now (Collis, 1996, p. 166). Virtual academic journals are increasingly becoming available.

In this type of situation the implicit and often subtle heteronomous steering of the learning process which is still found in hypertexts is missing, in spite of all curricular freedom, because the cognitive units were, of course, written by authors whose attitudes and ways of thinking still shine through, even where this is not intended or is even

supposed to be avoided. Here students are able from the very beginning to work through subjects they have selected themselves and to pursue their own aims, although this is, of course, accompanied by the risk of failure.

Learning Through Virtual Communication

Networks also offer another important area of self-regulated autonomous learning by opening up opportunities for communication from computer to computer. Students at the Open University in Great Britain who have not been able to understand a text or solve a problem by themselves have sent calls for help to "everyone". This can be regarded as an independent activity and at the same time as an unexpected innovation. Interestingly enough, it is claimed that all these questions are answered within eight hours. Students can also discuss their learning problems with fellow students, tutors or course counsellors on their own initiative, and for their own purposes, by exchanging e-mails. In addition, they can also use their own initiative to work with the bulletin board, which is set up for certain courses or departments and constantly updated. Here they can read messages from other students and can also pass comments on the subjects the boards contain. Interactivity here develops outside official teaching and learning programmes. It challenges students and makes them more independent.

On the periphery, these activities are often enriched by chatting about subjects of general interest. This sort of "association" with other students whom the chatter knows or is friendly with can have a positive feedback effect on self-directed learning.

Computer conferencing has been developed the furthest under present conditions for this purpose. Examinations of a contextual problem on a discussion basis, something which tended to come off second best in first-generation distance education, can now take place virtually. If students start these computer-supported discussions with their own intentions, on the basis of their own decisions, and possibly with their own strategies in mind, what they are doing is controlling their own learning themselves. Virtual seminars are now held in great numbers. Whether they are successful depends to a great extent on the active participation and co-operation of the distance students themselves (cf. chap. 8).

From the point of view of pedagogies, these virtual seminars play an important role because they individualise the heavily structured course range on the model of industrialised mass-production, which has to be the same for all distance students, by making active participants in discussions out of receptive students and at the same time granting them autonomy. Worthy of note in this context is an IT course at the Open University in Great Britain in which 1364 students took part. They each received a book consisting of newspaper articles and watched 16 teaching films on television. But instead of counselling in study centres they took part in computer conferencing. A total of 65 virtual seminars were set up, each led by a tutor. The pedagogical advantage was that the contributions from participants were recorded by the computer, and this can be a great advantage for assessments and research purposes. For example, the computer can verify just how many autonomous suggestions, stimuli and initiatives there actually were.

A particularly attractive form of self-directed and self-responsible learning can be achieved if a knowledge building community (Scardamalia & Bereiter, 1992) can be established successfully in which several students communicate via a central computer.

They work jointly on the same subject and inform each other regularly about what they have experienced, discovered and worked out. At the same time they can criticise or praise information and texts they have received. In this way a virtual project group is created which produces new knowledge through joint discussions and individual contributions. The pedagogical advantages are obvious: not only are we faced here with an ambitious form of autonomous learning (found originally in research) but also with partnership learning and group learning, which strengthens the components of communicative learning. Furthermore, new knowledge structures are developed here jointly, which can be interpreted roughly in accordance with the radical structuralist learning model (cf. Siebert, 1996, p. 16).

A form of autonomous learning is being developed here which leaves expository teaching and receptive learning far behind, replacing them with independent achievements. The new learning behaviour manifests itself in the search for, assessment and application of suitable information and in careful (written!) communication and co-operation. The proximity to learning by doing research and to academic work in general is quite astounding.

Commentary

The teaching behaviour that is created in these two basic forms of digitised learning has different approximations and pedagogical potentials with regard to self-regulated autonomous learning. Their advantages and disadvantages would have to be described by pedagogies for distance education. Proposals for a suitable combination and integration of these types of learning forms, which could lead a great number of new configurations, would have to come both from theoretical approaches and from reflected initial experience. A clear difference has to be made as to whether this self-regulated autonomous learning is inserted like islands in conventional distance education, or whether whole programmes of study should be created by the individual students, and thus be autonomous through and through. Models for this approach are available. The most convincing of these, pedagogically speaking, are probably the ones developed by the Empire State College of the State of New York (cf. Peters, 2001, pp. 224–229).

As far as the social and working forms of teaching and learning are concerned, the digital learning environment enables a greater variability which autonomous learners can make full use of. According to Morten Flate Paulsen (1997, p. 120), four different models have emerged in current practice: the one-alone method (the WWW paradigm) is probably the most marked one. The one-to-one method (the e-mail paradigm) can be used for tutoring and counselling autonomous learners as well as for communicating with other students. The one-to-many method (bulletin-board paradigm) can be used on the one hand for teaching events, such as lectures and symposia, and on the other hand students can act in accordance with the one-alone method and send messages to all and wait for the feedback. Finally, the many-to-many method (the computer conferencing paradigm) can be interpreted as an interplay of largely autonomous learners in the form of discussions, simulations, role playing, brainstorming and project groups.

If we see things correctly, elements of a pedagogy of learning in a digitised environment are being introduced here which will have to be developed still further. The educational paradigm shift is often referred to in this context. We can also encounter the supposition that traditional pedagogical thought could erode as a result of the incursion of working

methods from communications technology. Anthony Bates (1995, p. 202) assumes on the other hand that this process is merely the continuation of traditional social and working forms. We are faced here with basic problems which will have to be clarified theoretically.

Summary

Digitised learning environments open up new opportunities and chances not only for heteronomous but also for autonomous learning. We could conclude that they make directed heteronomous learning even more heteronomous, and self-directed autonomous learning a great deal more autonomous.

With regulated heteronomous learning, the pedagogically substantiated combination and integration of two or more modes of presentation means that multimedia teaching contents can be offered on a multi-sensory basis, which enables a precise close over-lapping of stimuli whereby better sensory perception can be prepared, effected and strengthened. In addition, much higher levels of activity and interactivity can be achieved.

With autonomous learning, there is in addition a wealth of desirable preconditions. In the first place, the starting situation is different because students are brought immediately into an interactive relationship with all types of information. This increases accessibility to the findings of scientific research as well as to academic teaching programmes stored in the media. The digital learning environment enables open learning situations and learning based on active interactions. Instead of "passive" receptive learning we find the independent, self-determined and self-regulated acquisition of knowledge based on the student's own strategies for searching, finding, selecting and applying. Learning by discovery and research can become a basic paradigm of academic teaching. Furthermore, different forms of teleconferencing enable not only the academic discourse, something which is neglected in traditional distance education, but also partnership and group work. Collaborative learning is given a much more important part to play than in traditional distance education, with the remarkable exception of the radio and television universities of China, where obligatory group meetings take place regularly. Video-conferencing establishes a new configuration for distance education, whose special features have been aptly characterised as "learning together apart" (Kaye, 1992, p. 1) and "teaching face-to-face at a distance" (Keegan, 1995, p. 108). Learners will have to be accustomed to dealing with many virtual partners and communities.

Today as well as in future it is important that we get away from the pedagogy of instruction and create and implement a pedagogy of enablement in its place, as Rolf Arnold (1993, p. 53) demands. The digitised learning environment will probably be the most efficacious "enabler" of independent and self-determined learning. This approach is promising because it does not modify the traditional methods of presentational teaching and receptive learning, but provides a completely different challenge for learning.

On the whole, the pedagogical restructuring required in distance education is deep and extensive. Some experts (e.g. Collis, 1996, p. XXII) even go so far as to demand a "re-engineering" of distance education. We could in fact start to speak of the beginning of a new era, in which distance education will develop into an extraordinarily open, flexible and variable form of teaching and learning which can be adapted and adjusted to the learning requirements of students, who will differ greatly from one another with regard

to their age, social background and vocational orientation and position. A clear student-oriented form of studies will have been created.

In so far, the new opportunities and chances of learning in a digitised learning environment will have great significance for the future of distance education. Helmut Hoyer, the present Rector of the FernUniversität, emphasises this statement by telling visitors that the university of the future will look much more like a distance teaching university than a traditional one.

6 New Learning Spaces

"The world is growing digital."
Desmond Keegan (1995a, p. 16)

In the context of learning in the networked digital learning environment we increasingly find the expression "learning spaces" being used. This expression implies the idea that new spaces could be opened up as an extension of our familiar learning environments. They have been enabled by electronic information and communication technology. Many experts believe that these new spaces can be used as learning spaces and complement or replace the real learning spaces with which we are familiar. This chapter shows how these new learning spaces differ from traditional learning spaces, and what this means for learning and teaching. Fundamental preliminary considerations in the field of education can help to sharpen our awareness of these new spaces. We should not make use of them blindly, without testing them. And it is also incorrect to interpret and evaluate them using outdated educational criteria and ideas.

Introduction

Teaching and learning in the networked digital learning environment begins for those who are unprepared with a surprising, and for some even staggering, experience: learning locations bound by doors and walls, which we have been familiar with it seems for ever, have now disappeared. Students' eyes are now focused on the screens of their PCs. Their attention is focused on this relatively small area. The standard learning location is now restricted to sitting in front of a workstation and looking straight ahead. It appears that this area conceals an unlimited, incomprehensible sphere which spreads beyond all familiar learning locations and can encompass the world. The strength of this strange impression can be seen in the terms invented by journalists to characterise this sphere. They report on an "immaterial world", a "fantastic computer world", the "tele-cosmos", "digital new ground", an "unexplored continent", "electronic" or "immaterial reality" (Der Spiegel, 1996, pp. 66–67). The expression "Internet galaxies" can also be seen. In the face of this wide sphere the computer even turns into a "flying carpet for the mind" (Kleinschroth, 1996, p. 2).

Experts for computer-supported teaching and learning refer in this context rather more soberly simply to a learning space. For example, this expression is regularly used by the FernUniversität in its announcements of a virtual university. The expression ››learning space virtual university‹‹ has become one of the university's slogans.

There is a series of parallel examples for the designation of a sphere which is not defined more closely and in which something is to take "place" or be carried out. In colloquial German the word "Spielraum" (literally "playroom") is used to mean "scope", "latitude". More recently, German has adopted the word cyberspace. "Problem spaces" are also referred to, and there are corresponding terms in scientific language: the computer scientists' information space (Allinson, 1992, p. 287); cognitive space, familiar to learning psychologists, and the transition space of psychoanalysts (Tenbrink, 1997, p. 38). In his book, "Grundlagen hypermedialer Lernsysteme", Rolf Schulmeister (1997, p. 24) analysed in detail the multimedia space. Friedrich W. Hesse and Stephan Schwan (1996, p. 247) use the expression virtual space. In English, the terms teaching space and learning space

have become common (Tiffin & Rajasingham, 1995, p. 10). The expression hyper-space is also used on occasion (e.g. Haack, 1997, p. 155).

The term “learning space”, which is suddenly being heard everywhere, indicates a state of affairs which is new for educationalists. However, these experts will have to concern themselves with structural changes to teaching and learning which take place in this space. First impressions also make clear that the educational consequences of changes from traditional learning locations to imagined learning spaces are often overlooked, neglected or underestimated in the enthusiasm for the enormous advances in information and communication technologies. This is another reason for taking a closer look at the spatial relationships in computer-supported learning.

Derivations, Differences, Demarcations

Terms

The term “learning space” has not yet been described accurately, let alone defined. This is in fact difficult, because it remains uncertain what is actually meant by “space”. In general, we understand this as a three-dimensional expansion, an area with a length, height and depth in which objects are found whose positions and directions can be altered. The precise meaning of the term expansion remains unclear. For this reason, space is also defined as a "configuration of concrete physical objects" (Hamm, 2000, p. 250).

However, our everyday life does not take place in this type of abstract space, but in a naively perceived space. If we attempt to describe it, we refer to objects which give rise to the impression of a defined space through being on top of and underneath one another, and the distances between them. The people who see this space are important. Because the objects referred to have a different significance for each observer, and this significance is integrated in the individually experienced structure of the space. With traditional forms of teaching and learning we have to assume this form of perceiving space. A lecture room, seminar room or classroom is therefore a "concretely experienced human space" (Bollnow, 1984, p. 16). This will be referred to as a “real” learning space. The actual space has a completely different structure from the objects which constitute it. Materially it is fundamentally different from them, because it does not even exist. It is "empty" or "abstract" and, like time, is merely a form of perception in a Kantian sense.

This reminds us of mathematical space. This is created by generalising and abstracting the space for everyday experience. This space is defined simply through elements, e.g. dots, vectors and co-ordinate systems in which mathematical transformations take place. These spaces can be three-dimensional, but also n-dimensional, and are only imagined as well. They are lacking in all concrete reality.

The enormous expansion of familiar experience space through the networked PC confronts us with a new "space" which is not constituted by real objects but by virtual objects. This leads us to speak of virtual space. While it is difficult to imagine a space as "virtual" which does not exist, we should not forget the potential space which psychoanalysts create between themselves and their patients to enable them to discuss earlier traumatic experiences (Tenbrink, 1997, p. 41). The virtual space could also be explained with references to merely imagined clearances and distances of the virtual objects from each other, clearances which actually exist and can be measured in the physically real world. As in mathematics, this virtual space is only imagined as well. It may be this special

characteristic which causes the developers of digital learning environments to speak of a "learning space" analogous to mathematical space. It appears to be obvious to them above all if, as electrical engineers or computer scientists, they have learned to conceive this space mathematically.

The question arises which functions this empty space can have for teaching and learning, how it should be occupied and structured from a pedagogical aspect, and what the educational effects of this would be. In this context, two authors from New Zealand have offered an initial pertinent definition of the term *learning space*. They see this as "any kind of distributed virtual reality that can be used for learning" (Tiffin & Rajasingham, 1995, p. 10).

Analogous Terms

The word "learning space" has not yet found an entry into the language of educationists and because of this it cannot be explained using categories from the language of education. But contextual connections to other terms may still be diagnosed which themselves refer to spatial boundaries for learning, for example "learning field", "learning location" or "learning environment". These terms are linked with concrete educational perceptions which are suitable for preparing our comprehension of the circumstances under examination here in an initial approach using comparisons.

The concept of the "learning field" was created on the basis of theoretical fieldwork by Kurt Lewin. This intensified the consciousness of the interlinking of all its factors and for the global viewpoint. Lewin (1982, p. 377) described field as "the totality of simultaneous facts which must be understood as being interdependent of each other". Friedrich Winnefeld (1971, p. 34) speaks in this context of "factor complexes on the educational field", Paul Heimann of a "pedagogical reference field" on which learning processes are "very dynamic processes of interaction of strictly opposite relatedness" (1962, p. 149). Even today, the learning field is seen as a "totality of learning-significant facts and the interlinking of its structural and dynamic characteristics" (Kutscha, 1986/1995, p. 532). This interpretation means a turning away from the isolating and restricting observation of what happens in learning and teaching through the teaching theory of behavioural psychology.

The "learning location" is seen as the spatial precondition which enables teaching and learning in the traditional sense. In tertiary education, this location is mainly the lecture hall and the seminar room, the workplace in the library or the laboratory, in the learning centre or at home. But these spatial preconditions were not always described as learning locations. It was not until students began to leave them, for example to take part in trips, to walk the wards, or take part in practical training and field research that the term extramural learning locations (Rieck & Ritter, 1983/1995, p. 384) began to be used. In the field of school education learning locations as such were not referred to until efforts were made in the scope of school reforms to "open" them up, and pupils began to make visits to learning locations "outside school ", e.g. the school garden, museums, factories or the post office (Kron, 1994, p. 291). The term is found even more frequently in vocational training, where the idea of the "company as a learning location" (Arnold & Lipsmeier, 1995, p. 18) is claimed for it. According to this, the workplace is to be the learning place. If we assume the physical existence of a learning place with practical

appliances, the digital learning environment is also a learning location, albeit in a restricted understanding of the term.

Two criteria are typical for the three examples referred to here. Firstly, people did not become aware of learning locations until teachers and students temporarily left the traditional learning locations and their limited facilities. Up till then, the learning location was completely obvious. Its function and significance were only fully recognised when people deviated from tradition. The new learning locations also caused wide-ranging restructuring of the teaching and learning processes because, for example, they offered new and particularly effective chances for individualising, independent and activating learning, and at the same time invited them. There are analogue developments on the transition from the real learning space to the virtual learning space. It is in fact digitally imparted learning which makes us aware of the role played by learning spaces in traditional teaching as well. And the transition to the digital learning spaces itself provides opportunities for the development of new forms of learning and teaching.

The concept of the *learning environment* was created on the basis of the educational paradigm change from empirically founded, target-reaching instruction to constructivist learning. Learners are no longer seen as *objects* but as *subjects* of the learning process. Their learning no longer consists of receiving and processing offered knowledge, but in active dispute with a learning object they have selected themselves in a defined situative context with simultaneous interaction with other learners in which they themselves develop or alter individual cognitive structures. Teachers no longer concentrate on presenting selected and articulated teaching contents but on "discovering and shaping stimulating learning environments … which enable students to create their own constructions." (Schulmeister, 1997, p. 80). Here, too, we are dealing with a particular type of learning space which in many ways enables autonomous learning, invites students to take part in it and supports it.

If this learning environment is digitalised and networked, an immense extension of the educational field takes place in the imagination of the learners. They are provided with new opportunities and chances, particularly with regard to the educational targets which are characteristic of the real learning environment.

Traditional Learning Spaces

General Characteristics

We will take a look first of all at the concrete rooms conceived, planned and equipped for teaching and learning, e.g. lecture halls, seminar rooms, the laboratory, the classroom. These are all fixed in a permanent location, relatively confined and enclosed, and equipped with practical furnishings and appliances. They constitute those familiar learning environments in which the average European spends about 10 000 hours of his or her life, or even as many as 20 000 hours in the case of continuing education (Flechsig, Haller & Hillebrand, 1983, p. 4).

What characteristics are relevant in these spaces? According to an analysis by Otto Friedrich Bollnow (1984, p. 17), the following can be said:

- There is a central point, namely the person who perceives the space.
- There is a vertical axis which is provided by the person's upright posture.
- The spaces are three-dimensional.
- The objects found in the spaces are real and qualitatively different. Their relations to one another provide the space with a contents structure.
- The people acting in the space are at different distances to one another, and this has an effect on the quality of their interactions.
- The space can support or restrict actions that take place in it.
- The space is experienced as an "internal space" which is contrasted with the "external space" (cf. Grossklaus, 1997, p. 103).
- The space is not value neutral. Each place in the experienced space has its meaning for the person. The space does not exist without the person who "experiences" it.

Ecopsychological Interpretation

How far are these spaces educationally relevant? To be able to answer this question it is necessary to understand the effects of experienced learning spaces. From a general point of view, this is a special case of relationships between people and their environment. In relation to teaching and learning the theory might be supported that learning spaces interact with the activities taking place within them. According to what we know from the psychology of perception and psychophysics, students do in fact absorb the incentives of the real learning spaces, and not only through the eyes but through *all* their senses. This induces feelings, associations and attitudes. However, these are no processes which run in one direction towards learners and teachers; they are in fact interaction processes. They integrate the needs, expectations, interests and experiences of learners and teachers. Perception here is a process which is interlaid in the interpretation of learning spaces and in actions in them. "Perception of the environment by the individual and his actions in it are insolubly related processes." (Kraft-Dittmar, 1987, p. 8).

If we want to find out more about what real learning spaces can mean for teaching and learning, and what educational processes would miss if they were suddenly lost, it is advisable to study these processes more closely. We can base our studies on the findings of ecological psychology. On the basis of general environmental assumptions, put together by Gabriele Heidler (1987, p. 19), the following may be postulated for the special case of the real learning space: this not only creates the preconditions for the interaction between those taking part in the learning process, it can also influence their interactions. It can even influence the contents and forms of these interactions, e.g. by inviting or challenging to a defined behaviour, or deterring it, by affecting the participants aesthetically, and by enriching their experiences. The significance of the space was shown most widely by Karlfried Graf Dürckheim (1932, p. 389): "The concrete space of the developed individual must be taken seriously in the totality of the significances, because in the unique nature of its qualities, divisions and orders it is a form of expression, acid test and realisation of the subject living and experiencing in it and relating to it". This may all be applied to the traditional concrete learning spaces referred to here.

According to Martin Burckhardt (1994, p. 8) the "nearest things" in the experienced space also indicate defined times and intervals, they mark the "strata of a history which is far in the past, and still has an effect, even now". In this context, he even speaks of a "history room", which he defines as a "thought room".

Cultural History Interpretation

When learning and teaching take place in one of the real learning spaces referred to, at first this appears to be nothing out of the ordinary, because it is something we have all experienced. However, if we analyse these circumstances we find certain features which refer back to customs extending back into archaic times, but which very few people are conscious of today. For example, a particular location is provided exclusively for particular actions, which in addition are carried out at particular times and with a certain degree of regularity. At some learning locations a set uniform has to be worn. These characteristics are reminders of rites with have a religious origin in which location, time and action were also linked with one another. Learning and teaching are thus experienced globally and at the same time elevated above the more wide-ranging structures of experience. Learning and teaching may be based on unconscious, but at the same time "deep-seated", patterns of behaviour, not only of students but also of teachers. Their ritualisation lends solidity and permanence to the actions taking place in the teaching spaces.

Teaching and learning do in fact have sacred origins, and we should bear this in mind. Teaching was originally reserved for shamans and priests, who recite holy texts to their adepts for them to memorise. The sacred character of the contents was matched by the forms in which they were transmitted, which were characterised by the honour paid to the teachers and the ceremonial course of the actions of teaching and learning (cf. Keay, 1950, p. 40). After a long process of secularisation, all that remains of this today is above all the uniform basic space-time structure and the dominance of the teacher. The "lecture" is an impressive example of this. Max Horkheimer (1953, p. 24) regarded this as an "unsuccessful secularisation of the sermon" and for this reason described academic teaching as a whole as "archaic".

This recourse is important for the context of our argument, because it makes the function and significance of learning spaces in a traditional interaction structure even clearer. Learning spaces enable the necessary regular interplay with defined persons at set times. Above all they are also the result of a *historical* development. The educational structure, which is expository teaching and receptive learning, created by the interplay between space, time tradition and subjects acting in learning spaces has been in existence for thousands of years and is found all over the world. It has in fact become a universal cultural model.

Educational analyses are usually concerned only with the processes of teaching and learning which take place in these real spaces, with the actors, contents, methods, media and teaching results, but not with the spaces in which they take place. The question is whether the material "existence", the quality and the characteristics of concrete learning spaces and their effect on learning processes that take place within them, should also be examined. At the moment this aspect becomes more important than ever before. We are forced to imagine what actually happens if these real learning spaces disappear, as if by magic, and are replaced by virtual spaces.

Uncertainties

The following questions arise from the above discussed with regard to learning in digital learning spaces:

- The sketch of the term “learning field” has drawn attention to the relationship and interlocking of all factors in the educational field. Does this complex of factors exist in the virtual learning field as well? Is it missing, reduced, halved or only indicated?
- Does the "jump” from the traditional learning location to the virtual learning space lead to a gain or a loss of effective educational factors?
- Are the efforts towards reform of the traditional learning environment continued in the digitised learning environment? Is it regarded and used as a new field of development? Will it lend itself to constructivist approaches to learning?

Virtual Learning Spaces

General Characteristics

The boundlessness, uncertainty, inconceivability and "emptiness” of the space seen on the monitor’s screen probably makes the greatest impression on the observer. It is associated with thick fog, with an infinite sky, and sometimes with a "black hole”. When attempts were being made to provide metaphors to describe this space, the developers of the Virtual University at the FernUniversität in Germany used pictures of a "desert” (Hoyer, 1998a, p. 4) and "space” (Kaderali, 1998, p. 6). We are now, and this is what these pictures signalise, in a space beyond previous learning locations, and to a certain degree beyond the learning experiences which can be gained at previous learning locations.

It is this non-defined space in which educational actions are now to "take place” and in which teaching and learning functions are to be exercised. This creates special virtual learning spaces. Typically, these are limited in time, because once the learning and teaching functions are completed, the virtual learning space simply disappears. We are dealing here with temporary imaginary images which can, however, continue to exist in the memory and consciousness of those acting.

These imaginary images are generated above all by visual stimuli on the screen. They naturally have other characteristics in some respects. To demonstrate how they differ from real learning spaces the following may be said parallel to the features which have been ascertained for them:

- their locations are not fixed and they can therefore change, sometimes accidentally.
- They are not surrounded by walls but are open and unlimited.
- Because of the fleeting nature of the text, representations and images, the function of the viewer as the central figure in the space is reduced and attenuated.
- There are no vertical axes. The horizontal dominates as a result of the linearity of the relatively large and concentrated texts and images, but above all because of the constant domination of the axis of sight and observation.
- Two-dimensionality takes over from experienced three-dimensionality, with the exception of those cases in which three-dimensionality is simulated for reasons of lucidity.

- The objects and persons which constitute the space are not real, but virtual.
- The distances to the persons who are shown or symbolised are not relatively constant but relatively unstable, variable, fluctuating. They have no effect on the quality and interpretation of their relationships. For example, there are no "preferred places" in virtual spaces.
- "Inside" and "outside" are no longer contrasted.
- Spaces appear more "value-neutral" and therefore do not have any quality of experience comparable with real spaces.

However, pointing to these differences between virtual and real learning spaces only hints at digital learning spaces. More detailed explanations are required to characterise them more precisely.

Unlimitedness

Because of its sweeping significance, their potential unlimitedness must be stressed. The screen itself is associated with infinitely large spaces. Rainer Kuhlen sees the virtual space behind the screen as "a galaxy of thousands and thousands of asteroids", or as a "universe in permanent flow which does not recognise any precise cosmological lines, or even the chains of time" (1991, p. 279). This results in something unprecedented for students. The existence of the Internet and the *super information highway* enables all terrestrial distances to be overcome in split seconds. Digital learning spaces can in fact span the world, if, for example, participants in a seminar are spread over all the continents (cf., e.g. Bernath & Rubin, 1998). The great impression this distance makes can be seen above all in the designations used by some experts as synonyms for the "digital learning space". Robert Kleinschroth (1996, pp. 160, 175) for example uses the expression *learning landscape*, Franz-Theo Gottwald and K. Peter Sprinkart (1998, p. 50) refer to the *learning world*, and Rolf Schulmeister (1997, pp. 79, 381) puts this expression into the plural: *learning worlds*. These designations go beyond conventional concepts of *real* learning spaces and attempt to put their amazing opening up and unlimited extensions into words.

No Spatial Arrangement

In order to bring out the contrast between real and virtual learning spaces more clearly, the *loss of the familiar spatial arrangement* of all places and objects is referred to in particular. According to Götz Grossklaus (1997, p. 112), in the media reality "nothing has 'its place', but everything has 'its time': its short-term presence as a trace of light on the screen. Constellations appear and disappear from view: in this accelerated process of appearance and disappearance … all depth of space and time is done away with". Consequently, objects, images and symbols, including the writing on a blackboard, have lost their "grip" and have become dynamised. The "letters appear imperturbable, appear out of nowhere and return quietly to where they came from when you command them to do so, and when you delete them, they dissolve" (Kuhlen, 1991, p. 280). The familiar top and bottom, left and right no longer exist. Gravity has been conquered. All representations are "liberated from the constraints of physical reality" (Turkle, 1998, p. 103). This results in unprecedented opportunities for designing these new learning spaces. And: for the individual a "degree of world comes into existence which is no longer covered by reality" (Burckhardt, 1994, p. 313).

Opaqueness

If the screen does not offer any pointers for structuring the learning space, spatial concepts of diffuse indefiniteness (opaqueness) are created. The empty, milky-white screen is associated with spaces of undetermined elongation, with associations of immeasurable deep space, and in particular because both in space and here enormous distances can be bridged in seconds. To return to the metaphors used by Rainer Kuhlen (1991, p. 280), "the whole is an undersea symphony of soft links and fractures, a galaxial round of autophagous comets."

The contrast to this is provided by learning spaces in virtual reality. The efforts to occupy the empty and diffuse sphere behind the screen, more precisely, behind the data viewing screen, are stressed here. Three-dimensional (stereoscopic) rooms can be simulated here, which imitate real rooms in an often amazing manner. It appears that the limits set by walls, the relationships of objects to one another, and their proportions, and the effects of distance and relationships, are reconstructed here. Even more: students do not *observe* the three-dimensional room, they are immersed in it, they pass through the interface, so to speak, and find themselves within the virtual room. The border between real learning locations in the digital learning environment and virtual space has been overcome as far as consciousness is concerned. Students can now develop a perspective feeling for space, even from different aspects. We can almost believe that the "experienced space" referred to by Otto Friedrich Bollnow has been reconstituted. All the more, because students in this virtual room come into contact with objects and can even carry out actions using them. New opportunities arise if several students have simultaneous access via the Internet to this type of learning space in virtual reality (cf. Alsdorf & Bannwart, 1997, p. 237).

Virtuality

The virtuality of persons and objects is of similarly great importance. The dictionary definition of "virtual" is extremely fitting here: "being in essence or effect, but not in fact" (Webster, 1953, p. 2849). An obsolete meaning of the word is even more precise, namely "having the power of invisible efficacy without the agency of a material element" (Webster, 1953, p. 2849). Jürgen Wurster (1997, p. 2) reduces the circumstances to the bare minimum. For him, virtuality means "real, but not tangible". At the same time he points to the important part played by digital data in the definition of the virtual learning space. Because the virtual learning space is just as empty and abstract as the real space, it is in fact these virtual data and objects which help students to form spatial structures, which, however, have a different appearance to those in real learning spaces.

Tele-Presence

The phenomenon of tele-presence is an important spatial characteristic. This drastically reduces the distance between students and teachers, and between students themselves, and enables "mental presence with physical absence" (Kleinschroth, 1996, p. 237). Students may sit in their digitised learning environments in Cape Town, Wellington or Reykjavik to take part in a virtual seminar, for example. In spite of this, their words, whether written or spoken, unemotional or animated, appear at a distance of about 40 cm from the eyes of their teachers or fellow students. In their thoughts they conceive their partners as being and acting at great distances away from them, but at the same

time they can take part in discussions with them as if they were sitting opposite. They are closer than if they were in a seminar room or lecture hall. This is a split experience of space and a completely new way of being involved in the teaching-learning process.

Metaphors

The choice of the term “learning space” for the above is significant. It appears obvious that the metaphorical use of this term (cf. Kuhlen, 1991, p. 135) is an effort to come to terms with the disquieting phenomenon of emptiness and lack of structure in which teaching and learning now has to take place. This endeavour is easy to explain. One of our basic needs is for spatial orientation. Perception of space, a "fundamental function of perception, above all of sight" (Städtler, 1998, p. 906), is developed from birth and has become a fixed habit. "Spatial cognition", in other words the mental representation of spatial relationships, and "spatial memory", play an important part here. If we leave real rooms and immerse ourselves in the "sphere" in which bits can be transformed into words, drawings, picture or videos, we are unable to do anything other than imagine this sphere spatially as well. The terms Net, Internet and Web are spatial metaphors as well with which an attempt is made to ward off what is unusual, strange, or even uncanny, about this phenomenon. We imagine our own computer as a node in a net or network, and in this way we gain a certain local orientation. What is interesting here is that we even speak of a network topology (Voss & Raabe, 1997, p. 479), which is understood as different links between nodes. The inherent endeavour to regain on the screen familiar spatial relationships is seen most strongly in the development of the Virtual Reality Markup Language (VRML), which enables students to navigate in a three-dimensional space. The home page then becomes a home space (cf. Collis, 1996, p. 146).

Spatial Structuring in Virtual Learning Space

Learn-Theoretical Classification Concepts

The monitor passes on the appearance of virtual learning spaces which are constructed by the students inspired by visual and sometime acoustic stimuli. These spaces are created by the view through the monitor's screen. This screen is the interface between the real learning space and the virtual learning space. Of course, these abstract and merely imagined learning spaces lack most attributes of real learning spaces. Not even internal spatial relationships can be exactly defined. These are usually two-dimensional and are constructed by means of static surfaces. But there are also learning spaces which are three-dimensional and even dynamic (in other words, which include the time dimension). In the face of this situation it seems obvious to consider how a virtual space of this kind has to be structured to enable it to be used for teaching and learning.

Speaking generally, this learning space can be subdivided as follows (Schulmeister, 1997, p. 26):

Presentation space	**Semantic space**	**Occurrence space**

In the presentation space students are shown objects which are represented by symbols (writing, graphical characters, pictures). In the semantic space the significance of what has been presented is opened up by means of metaphors. And in the occurrence space students interact with the objects which have been shown, e. g. by navigating or browsing.

This interaction is decisive for the link between the presentation space and the semantic space. Here, the "physical interaction becomes a semantic interpretation." (Schulmeister 1997, p. 27). The occurrence space proves to be the actual learning space.

Peter Michael Fischer and Heinz Mandl (1990) subdivided the learning space in a similar manner:

Surface structure	**Rational and associative structures**	**Subjective structure**

Both suggestions make clear how the three learning spaces must interact in the learning process. And both make certain functions of the students into the basis of a "multimedia architecture", whereby spatial concepts dominate once again.

Spatial Metaphors

An obvious reaction to the initially still unfamiliar, unstructured and discontinuous learning space is formed by the attempts to transfer concepts of traditional real learning spaces into the virtual space. These concepts are wakened by spatial metaphors. A spatial metaphor as an "electronic counterpart" (Haack, 1997, p. 15) to a familiar physical space. The virtual space, which is at first still "empty" and opaque, is occupied and structured in part (by islands), and this enables the beginnings of spatial orientation.

This process is by no means new for working with computers. If we look at the operating system we can see, for example, that the metaphor desktop is aimed at giving the impression of an actual desk, and this is joined by paper basket and folder. In this way, the user's workplace in the office or at home is simulated in the digital learning environment. Expressions such as menu bar or user interface bring processes which come into being separate from each other into a spatial context.

Spatial metaphors are also found with regard to the actual learning process itself. Even the term "learning space" is such a metaphor. Students are led by this metaphor to behave as far as possible *as if* they were in real learning spaces. In the field of hypertext, the metaphors *network* and *node* also aim to provide spatial impressions of a presentation, although the hypertext itself is in reality not visible, and is in fact stored in an encoded form in the smallest possible space on the microchips in the hard disk, or on a CD-ROM, something which is inconceivable for most people.

Even more important are metaphors of real learning spaces which are used, e.g. when virtual classrooms, seminars or laboratories are referred to, or guided tours through virtual landscapes or cities are carried out. These metaphors create virtual spaces in which students "move". They are also enabled, at least rudimentarily, to demonstrate a learning behaviour with which they are familiar from corresponding real learning spaces. They then act as if they were in real learning spaces and acquire a certain security through this. In addition, spatial metaphors can even produce a "correlation for the variety of information which makes sense" (Schulmeister, 1997, p. 53).

Friedrich W. Hesse and Stephan Schwan (1996, p. 243) have pointed out the role played by spatial metaphors ("*interface metaphors*") in virtual seminars. They first describe the function of metaphors which designate "*larger geographical spaces*", such as the virtual campus, virtual buildings and virtual rooms (lecture rooms, seminar rooms, entrance

hall, cafeteria, reading rooms, etc.). These metaphors are used "*to visualise the complex functional structure of computer conferences in terms of already familiar topological features*". They then discuss "*small-scale spatial arrangements in specific locations*". In real rooms, they assume, interactions by students are spatially organised and arranged, whereby they orient themselves according to defined features. For example, many discussions take place at round tables. During lectures, a speaker faces listeners, and this also leads to typical fixed arrangements. Spatial togetherness is also significant here for personal and social relationships. When work with corresponding metaphors is carried out at computer conferences, students are provided with starting points with which they are able to imagine spatial togetherness and co-existence. In this way, according to the authors, the appearance of belonging to the learning group is created and those students acting at a distance are made socially present in thought (tele-presence).

Such attempts at imagining real learning spaces, say the authors, can only be successful up to a certain and very limited degree. On the basis of the structural differences referred to here, full correspondence between happenings in real learning spaces and in virtual learning spaces is often simply not given. In my opinion, it will not be achieved by improved software and further interventions. There is a world of difference between a seminar and a computer seminar on the same subject, simply because of the change from oral to literal, and, following this, from synchronicity to a-synchronicity of communication (cf. chap. 8).

The Transposition of Traditional Learning and Teaching Behaviour

If students and teachers are encouraged to imagine real learning spaces in virtual learning spaces as models, it seems obvious for many of them to retain the learning and teaching behaviour familiar from real learning spaces and, as far as possible, to transpose this to the virtual learning space. Apart from the difficulties which arise here, which must be examined from the aspect of learning psychology, this type of transaction also gives rise to educational doubts. David Hawkridge (1995a, p. 7) drew attention to these doubts by repeating his impression that "old media are used for good new teaching methods, while new media are used for bad old ones". He arrived at this paradoxical result through a comparison of traditional teaching offered by the Open University in the UK with electronic teaching events. It turned out in fact that traditional distance teaching was designed professionally in accordance with the rules and based on the experience of instructional design, whereas traditional lectures were too often put in CD-ROM and transmitted in the digital learning environment, and traditional face-to-face teaching was used in the scope of a videoconference.

Those who proceed in this way fail to recognise the enormous instructional potential of the digital learning environment and its media and methodical variability, both of which are extremely difficult to conceive. Old instructional models block the view of the richness of their educational forms and their specific possibilities. Often these still have to be developed, by recognising, seeing through, analysing the new technical facilities, and examining them for possible teaching and learning effects. If this were to happen, a fundamental change in educational science could be initiated.

All this of course exceeds our imaginative powers. The situation is similar to that following the discovery of cinematography. At first, people were unable to imagine what might be done with this new and unusual technical opportunity, other than showing the usual

scenes from fairs, circuses and variety theatres. It took some time before the new technology was used for film's own dramaturgy (e.g. exterior shots, takes, moving cameras, close-ups, detailed shots, cutting, montages, animation, cartoons, blue box), and before film-makers departed from the traditional pattern of stage representations and arrived at completely new solutions. The enormous difference between a theatrical performance bound by time and place, and a film, which is bound by neither time nor place, took some time to be recognised. There will probably be a similar development in the pedagogy of the digitised learning environment. In a similar way, this may open up new dimensions to a system of teaching and learning liberated from the bonds of place and time. Innovative forms of learning in virtual learning spaces may be a result of this development.

However, before this happens, we must become aware of the enormous difference between real and virtual learning spaces.

Summary

We have seen that there is a vast difference between traditional and real learning spaces and virtual learning spaces. This is important because it helps us to understand why it might be beneficial and even necessary to innovate learning processes drastically when using the net. Careful adaptations will not be enough.

Another consideration can reinforce this assertion. Traditional or real learning spaces as, for instance, lecture halls, seminar rooms, classes in colleges or schools are part of our everyday experience. All of us are intensively familiar with them as we are products of what happened in these learning spaces. But have we ever thought about the main and fundamental function of these traditional technical learning environments? Basically, they were planned, designed and built for accomplishing one main purpose: to provide for convenient locations where students and professors can meet face-to-face, assemble, live and learn together. *Convocatio* (calling together and assembling) was the fundamental organisational principle of the medieval university as well as of all campus universities today (cf. Hall, 1996a, p. 7). The reason for this was that at this time teaching was and still is today basically an *oral* process. There was no other way for oral instruction than coming together in order to speak and listen to each other. The real learning spaces represent the *technology of traditional teaching and learning*. The size and proportions of rooms were adapted to the requirements of certain formats of oral teaching.

These traditional learning spaces have specific and important properties: learning activities have to be fixed with regard to time and location. These spaces protect from outside disturbances, facilitate the forming of groups, make possible experiences of togetherness, feelings of belonging, and the common aspiration after and the common quest for knowledge. Furthermore, there is an interaction between real learning spaces and the students. Students absorb their incentives, not only through their eyes but through all their senses. This induces feelings, associations and attitudes. Even more, somehow they also influence form and contents of their interactions.

Small wonder that these real spaces created the preconditions for very specific strategies, techniques, procedures of teaching and learning have been developed. We should be aware of the fact that these strategies have developed in a long historical process which reaches back to its sacred origins in archaic times. And we should realise that all

instruction in real learning spaces is based on historical experiences and the tradition of given learning cultures, of oral learning cultures. *Lectio* and *disputatio* were the medieval forms which still exist and prevail as lecture and the scientific discourse. The monologues of teachers in school and college classes are still part of this tradition.

If we focus on virtual learning spaces we are confronted with an entirely different scenario. Imagine: all the properties mentioned so far have vanished. The main purpose of real learning spaces, the gathering of teacher and taught, becomes meaningless. The unlimited, incomprehensible sphere behind the screen of the monitor spreads beyond all familiar learning locations and can encompass the world and the cosmos even. Time and locations are not fixed. This unfathomable space is not closed, not sheltered, persons and objects are not relatively fixed, but rather fleeting and transitory. They change often and quickly. They fluctuate. There is no real environment the students can interact with and establish relations to. The students do not interact face-to-face in groups, but have to contact fellow students somewhere else. Hence, the learners are not bound up with each other. But what is most important: The students do not speak and listen, but read and write. Oral teaching and learning is substituted by literate teaching and learning. This means that a learning tradition is broken up. And the historical dimension is lost altogether. These virtual learning spaces differ from real learning spaces so extremely that a shock of recognition seizes anyone reflecting closely and seriously upon them.

Why is it necessary to focus on this particular difference? Because we are confronted with a fundamental pedagogical problem here. Is it adequate, permissible, or recommendable to transplant methods of learning which have been developed in real spaces to virtual spaces? In other words: may we replicate forms of learning and teaching which are inherent in real learning spaces? We all know how often this is being done. Could methods of learning specific for our traditional predominantly *oral* learning culture be transplanted to a predominantly literate learning culture? Do we not face severe structural incompatibilities when doing so? Is it not necessary to define learning anew when using the net? In the last analysis I believe it is obvious that learning in virtual spaces requires pedagogical strategies specific to their digitised learning environments.

What could these pedagogical structures look like? The answers cannot be found by falling back upon the methods we are familiar with because of our experiences at schools and universities. No, we have to open up new paths. We should analyse the digitised learning environment carefully under innovative pedagogical perspectives. We should ask ourselves: Which are the new technological possibilities which can be exploited for new learning purposes? Is it possible to derive new pedagogical strategies from them? In which way can we structure the virtual learning spaces for the benefits of the students? These tasks have high priority. By solving them we might become able to discern the emergence of a pedagogy of online learning.

7 A Pedagogical Model for Using Virtual Learning Spaces

> *"The principle of the autonomy of learning is realised in learning spaces based on multimedia, because in them individuals can continue to learn still further of their own accord, without help and assistance from outside. They will arrive at a stage of self-determination from which they can control their own learning revolution. A fundamental task of future educational policies is to make this stage achievable for everyone." (Gottwald & Sprinkart, 1998, p. 56).*

An analysis of the special technological opportunities provided by a digital learning environment leads to the discovery that the wide and indeterminate learning space on and behind the screen of a computer can be subdivided at least into ten different learning spaces (cf. Peters, 1999). They enable educational activities thanks to the special technological situation. Admittedly, some of these appear unusual, if not strange, to the traditional understanding of learning. The teaching and learning situations in these virtual spaces are structurally different from those in corresponding real spaces. To fill them with activities based on traditional education models is therefore inadequate, and in some areas would lead to confusion. The question also arises whether virtual spaces can be recognised and understood in a technologically specific manner, and at the same time made useful for genuine educational purposes. The possible educational benefits of each one of ten virtual learning spaces are sketched and related to one another. Corresponding teaching and learning behaviour can be derived from this which in some points deviates decisively from that experienced in real learning spaces. If these deviations are used together with the undisputed advantages of the digital learning environment, a new model of autonomous and self-controlled learning can be created which is oriented in accordance with the educational models of learning by "discovering" and "problem-solving", and with the example of the independently researching academic. This type of model will in all probability be suitable and desirable for learning in the coming knowledge society.

Introduction

In the attempts to use the technical unit consisting of the PC, multimedia and the Internet for teaching and learning there are often designs based on the user's own ideas or on processes and models from information and communication science, and also from computer technology. This is obvious, because most of these projects were developed by experts from these disciplines and because there is a certain proximity between »information« and teaching contents. At the same time, we must consider how the new technical media and processes can be used from the start for educational purposes and with educational methods derived from educational experiences. For example, the teaching concepts and the learning model which is held to be the correct one, are both very important. Even more important is the human image which is integrated in the teaching and learning process. Are students perceived in their individual and social situation and as responsible persons in the learning process, or are they reduced to "users"? This question is fundamental for the use of the digital learning environment and must not be ignored. However, in the enthusiasm for the rapid technological advances in the field of information and computer science, educational aspects are often neglected by many protagonists of the digital learning environment, because they think

that a new era is opening up with the computer-mediated, network-based multimedia learning system in which educational considerations can be left far behind because they allegedly point to the past, a pre-electronic era, and might get in the way of the emergence of a new age of learning and teaching.

In contrast to this, the primacy of educational and even of pedagogical goals must be stressed. Even the most powerful digital learning environment equipped with the most up-to-date appliances remains an empty apparatus if all it is used for is to transport data or information. Both have to be converted into "knowledge". Educational science can provide teachers and students with inestimable services here, to name just one important aspect.

Educational Perspectives

From a pedagogical point of view the virtual learning spaces sketched here are each unusually attractive, because the specific activities which have become possible in them can be developed individually and separately, as well as combined, bundled and integrated. They provide new space for instructional design.

The profit to be gained here cannot be overestimated. Even if the digital learning environment had opened up just *one* of the sketched new learning spaces, e. g. the multimedia space, which enables different modes of presentation to be bundled, or just the information space with its rapid access to the databases in the World Wide Web, this in itself would have been a remarkable advance which would have aroused the enthusiasm of the instructional designers and amazed the educationalists. Instead, we have at least *ten* of these learning spaces each with its own specific learning activities which, taken together, structure the virtual learning space for the digital learning environment in an innovative manner. We are faced here with a modernising thrust of the first rank which is without example in the history of learning, and whose effects still cannot be foreseen.

In daily use, because of the unique nature of these new learning opportunities and the possibility of the easy to manage combination, the digital learning environment proves to be an unprecedentedly versatile and extremely adaptable configuration of specific hardware and software. Thanks to its flexibility and adaptability it can be used for many educational services, not only to imitate traditional forms of instruction but also to design innovative learning architectures. The purposes for which it is used depend on many situational, institutional and economic factors, which of course also include the learning-theory orientation and the willingness to innovate of teacher and students.

Technological Functions

The structuring of the virtual learning space through traditional forms of learning and teaching are obvious and at first understandable as well, because we are moving here in a new and previously unknown territory. However, they do not reflect the actual potential of teaching and learning made possible by electronic systems, and in fact hardly touch them. For this reason, I wish to propose a different structuring, one which is based essentially on the opportunities provided by information and communication technologies. It is important here to recognise their pedagogical possibilities.

Which are the technological functions that deserve special attention of instructional designers? Speaking generally, what must be done here is to point to important working

fields in computer science, namely the "compilation and presentation of information", the "representation of knowledge" and the "management of knowledge" (Kuhlen, 1991, p. 275). In particular, the new opportunities arise from the addition and integration of the three electronic technologies: computer, multimedia and network technology. These technologies are themselves based on special technologies for communication, transmission, display, search, access, analysis, storage, virtual reality and management. Put together, they result in units with different configurations with an efficiency never seen before. They enable the computer to perform the following functions:

1. Presentation of information
2. Storing
3. Retrieval
4. Communication
5. Collaboration
6. Browsing
7. Multimedia
8. Hypertext and hypermedia
9. Simulation
10. Virtual reality

These functions as such have *not* been developed for learning and teaching purposes. They are *not* part of traditional and current pedagogical experience. They are *alien* to pedagogical thinking. Their designations are *foreign* to the specific pedagogic jargon. And yet it is interesting and useful to analyse them in order to find out whether they can be interpreted in pedagogical terms. Could it be that these functions can be used or even exploited in learning and teaching processes? The following consideration might be useful for answering this question.

The Transformation of Technical Functions Into Pedagogical Functions

1. *Presentation of information.* Traditionally, learning was conceived of as a consequence of teaching, which had to be offered to students, brought "prescriptively" to them and "imparted" to them, and as a result of this, most teachers see this as being their main task. Offering, presenting, showing and illustrating have all therefore become a basic educational model which structures and characterises the activities of teaching and learning in a unique manner. The digital learning environment may be regarded as an unusually effective medium which assumes, exercises and perfects just these functions. The reason for this is on the one hand the possibility of designing the subject-matter for teaching in a micro-didactic, multimodal manner, and on the other hand, the variety and differentiation of the forms of representation made obvious by multimedia. In particular, it is possible to offer learning programmes in which teaching adapts itself to the prior knowledge, skills and requirements of students (cf. Leutner, 1997, p. 139).

2. *Storing.* The unbeatable efficiency of a PC in saving information can relieve the memories of teachers and students alike. The systematic retaining and arranging of thematically relevant information, which is imperative for academic work can be integrated easily into the learning process. In the long term, skilful documentation management can be developed, an objectivication of personal knowledge, which

constantly changes and can continue to be developed over the period of a lifetime – if the electronic documents will last that long.

3. *Retrieval.* This function is an exciting support of the process of recalling what students have stored in their memories. With the help of servers and search machines information can be procured in internal and external databases, on Web pages or sites, in electronic libraries, dictionaries, and professional journals, found and used. These sources of information, which are available globally, are easily accessible to students.

4. *Communication.* E-mail and video links mean that dialogues and discussions with teachers and other students, but also with outsiders and strangers, can be sought and maintained at any time and from any place, and depending on the situation on several levels, from simple chatting to academic discourses.

5. *Collaboration.* With the help of the communication referred to here a series of important forms of joint planning, developing and evaluating is possible from any location simultaneously and consecutively, from working in partnerships through project work to collaboration of self-organised teaching and research groups.

6. *Browsing.* Browsing, surfing and navigating in the net extends the traditional search of information by reading in an unexpected way: A global cosmos of information becomes accessible. These activities lead to »exploration learning« on the basis of one's own interests and preferences. They prepare and promote »autonomous learning«.

7. *Multimedia.* With the help of the accumulation, combination and integration of several presentation modes teaching results can be presented and imparted in a particularly convincing manner. Teaching contents can be presented intensively to learners in the same way as in reality and sometimes even more impressively. The modes of presentation include: text, two/three-dimensional graphics, pixel images and even video, audio and two/three-dimensional animation. Electronic word processing can be a powerful learning device. Students who are skilled in compiling, entering, transmitting, processing, sorting, saving, linking and outputting information and, in addition, are able to create texts in the interface, to format them and structure them clearly, can draw immeasurable benefits from this for their learning. The link between reading, thinking and writing becomes important. This creates a specific learning behaviour in which activities are concentrated and integrated which are far apart in real learning spaces. In addition, the exact semi-professional presentation and distribution of relevant findings are simplified enormously.

8. *Hypertexts and hypermedia.* Non-linear learning programmes presented by hypertext and hypermedia enable the learners to develop self-regulated, autonomous learning styles. They allow for strictly individualised, problem-oriented learning in complex fields of knowledge. They support constructive learning processes and cognitive flexibility.

9. *Simulation.* Students can be put into a position in which they can contact simulated (model) reality. This is particularly advantageous if processes are observed or even controlled, for example, management science or macroeconomic trends or scientific experiments or real experiments in a virtual laboratory (Hoyer, 1998b). Spaces are also simulated which students have to inspect or visit. Most computer games work with simulations which enable players to "experience" new spaces. Virtual museums and virtual guided tours work with similar effects.

10. *Virtual reality.* Students can communicate interactively with three-dimensional objects and persons in the three-dimensionally simulated spaces and landscapes of a virtual reality and even move in these spaces and observe. Through this immersion in virtual space the attention of the students can be drawn to given points, intensified and shielded from diversions from the real world. Their interaction with a learning programme is more direct and more intensive, because their actions are converted directly into data, and the consequences of the actions are experienced directly in the three-dimensional learning space. Complex and abstract facts can be made more easily learnable through the senses. The habit of thinking in spaces can be satisfied in a particularly impressive manner here, in that special "knowledge spaces" and "information landscapes" are constructed (Alsdorf & Bannwart, 1997, p. 442). Many learners will find it advantageous above all if they are able to apply, try out and strengthen their knowledge and skills in these spaces in the same way as in the real world, e. g. pilot and train driver training, or learning and practising operation techniques on the human body. Students have learning rooms available to them which only simulate emergencies, and so they tend not to be afraid of the consequences of errors.

We can see how the technological functions mentioned have an affinity with and lead to specific educational activities with which we have to come to terms with. If we wanted to summarise where the teaching-learning situation in the digital learning environment deviates from traditional teaching and learning, the following six activity fields, which are not found in traditional learning, would be among the first mentioned:

- The computer is used here as a universal teaching and learning medium which basically contains all the media which have previously been used.
- The computer enables students to compile files containing knowledge they have gathered themselves, and to return to these files again and again.
- The computer mediates rapid access to distributed information where this is required for learning.
- With suitable learning software the computer can make interaction with the learning program or learning software into a relevant and even to a dominant element of the learning process, if the learning situation requires it.
- The computer enables and simplifies communication and collaboration with spatially distributed partners.
- The computer also enables the simulation of dynamic models.
- The computer enables and simplifies discovering learning. Learners become the "designers and co-authors of their education" (Kleinschroth, 1996, p. 173).

These functions are not, however, structurally linked to one another as in real learning spaces, but are available separately, on request. To remain with this metaphor: digital learning spaces are not linked together in a virtual school or university building, but exist somewhere in a virtual learning cosmos.

If the possibilities for using the technological advances have been recognised, tried out and integrated in the arsenal of learning processes available for instructional design, the misuse of computerised communication for presenting traditional lectures ("talking heads"), for holding conventional lessons with domineering teachers, or with holding traditional seminars with papers being read and films being shown, is not merely seen as

a complete lack of imagination, but also as crass educational misconduct. In the new learning spaces it is not primarily a question of expository teaching and receptive learning, but of completely different things. The great differences between real and virtual learning spaces themselves show that electronically imparted teaching and learning can also be designed to be structurally completely different to traditional methods. The technological innovations which have been referred to do in fact enable activities which are greatly desirable in the sense of educational reform. In the foreground we find the chances of the further development and consolidation of self-governed and self-controlled learning, as well as for reality-oriented, communicative and collaborative learning.

If these opportunities are used, the respective pedagogical activities will of necessity deviate from the conventional forms of teaching and learning, and in some case this deviation will be considerable. This will strike those who adhere to tradition as odd, if it does not shock them. The reform aspect is to be stressed here, because the number of practitioners is not exactly small who, in their enthusiasm for the new technologies, think that with networked computers we have now obtained a powerful medium with which we can transport conventional teaching and learning in future and facilitate access to higher education. The question here, however, is to develop *new methods*, procedures, rituals and conventions, and to use them to occupy and structure the infinite virtual space at various positions so that a new educational field of operations with its own legitimacy can be created.

The Result: Ten New Learning Spaces

The close relationship of the innovative educational activities to their respective technological basis makes it seem obvious to provide different *designations* for the virtual learning spaces which they constitute. This is also appropriate because, as we have seen, we are in fact dealing with spaces which are in essential *separate* from one another, namely

- instruction spaces,
- documentation spaces,
- information spaces,
- communication spaces,
- collaboration spaces,
- exploration spaces,
- multimedia spaces,
- hypertext spaces,
- simulation spaces, and
- spaces in virtual reality.

Of course, and this must be repeated, these spaces do not actually exist. What is "real" for students is only the digital learning environment with the screen of the monitor as the interface. Virtual spaces are only created, and this has also been said, when the imagined empty space behind the screen is made into an imagined "stage" for activities, in our case for educational activities. We are not content with objects and symbols on

the screen, but we imagine these actions in their spatial dimensions, although their clarity can vary.

In order to demonstrate some of the typical pedagogical activities enabled by digitised learning environments one might point to the difference between learning activities in real learning spaces and the way in which students

- exchange information with fellow students via e-mail or multimedia,
- compile folders and collections of text, sound and photo documents for a subject in a learning project,
- search for information required to solve a problem from a sea of data,
- solve a difficult problem in a virtual seminar with several other students and in this way arrive at new knowledge,
- navigate around an extensive hypertext to find the individual access and path tailored to their learning requirements and aspirations,
- develop and publish their learning results in the form of graphically demanding presentations,
- study learning contents using professionally multimedia presentations, including animation, simulation an experimental phases,
- use video programmes stored on CD-ROMs to visit an *arrondissement* in Paris, for example, or to be inspired by the collections of the Prado in Madrid,
- use the creation of a virtual reality like architecture students who experience the effects of the rooms in the plans for a house, or like medical students who take a trip through the human body.

The ten new learning spaces characterised here confront us with the necessity of educational innovation. They offer us a previously unknown plethora of new teaching and learning possibilities. We are faced with the challenge of familiarising ourselves with them, developing them further and using them – with imagination, a willingness to experiment and the courage to walk down new roads. However, this will only be successful if we are aware of the special features of the new learning spaces, and know their educational and pedagogical advantages and deficits exactly. We must be aware of the "jump" from real to virtual learning spaces as an abrupt change to another world. We must dare to take this step, above all because of our educational responsibility. All those working in higher and continuing education are faced with the task of preparing their students for learning in the knowledge society. And this will take place mainly in the new virtual learning spaces.

The Ten Virtual Learning Spaces Considered

Some of the particularly impressive educational chances of the new learning spaces will be sketched below in more detail. In doing this, the starting point will be the relevant *pedagogical* activities, and the technology they are based on will merely be referred to or neglected. The motivation for explicating the virtual learning spaces in this way is to demonstrate their innovative power. They help to reform and „modernise“ learning.

A. Learning by Expository Teaching

Traditional teaching and learning behaviour in accordance with the "instruction paradigm" (cf. Reinmann-Rothmeier & Mandl, 1997a, p. 359) is, as we have stated, often transposed into the virtual space. Oral and written texts are brought to the monitor with the pronounced gestures of presentation, whereby this is based on the models provided by lectures, talks, papers, distance teaching courses, electronic courses, essays, monograph articles or entries in encyclopaedias (instruction space). This corresponds to the pronounced gesture of reception and absorption by the students, which is expressed for example in traditional lectures by busily taking notes, and in the digital learning environment by working through, copying and storing texts (documentation space).

In some of these virtual spaces the effectiveness not only of presentational teaching but also of absorptive learning behaviour can be increased. We should bear in mind the cumulating, intensification and acceleration of presentation stimuli and modes (mullet-media space) as well as the thoroughness, accuracy and clarity with which the presented teaching is processed and graphically designed, and the speed with which it can be safely stored and accessed again and again for repeating teaching and learning (documentation space). Here the student's memory enters into an apparent symbiotic relationship with the computer's memory.

But there is even more. If we interpret such traditional learning as tending to be heterogamous, because most curricular and procedural decisions are taken by teachers, the digital learning environment appears to be able to perfect this traditional learning still further and to carry it to extremes. Presentations can be fixed step by step, and students "kept on a short lead" as it were (instruction space). The theoretical background for this form of teaching and learning is provided by David P. Ausubel in his "theory of expository teaching" (1968) and his concept of "meaningful receptive learning" (1980).

An overlapping of expository teaching and receptive learning takes place if "programmed instruction" (computer-based learning) is offered in the digital learning environment. Students are led in very small steps from frame to frame, have to answer a test question on each frame and are provided with feedback on the success of their learning. Because these learning programmes were offered initially in printed form, and then through the computer, it appeared obvious to many to regard the digital learning environment as the ideal place for their presentations. In fact, there is something to be said for this, because programmes can be presented in a demanding and impressive manner (multimedia space), a tutorial-type dialogue is possible with the software (communications space) and branching off is easier to manage. However, this form of teaching and learning is in practice often educationally underdeveloped. In the past it was criticised for this very reason (cf. Bates, 1995, p. 201). Often it is only useful for drill and practice. The versatile technological unit of the digital learning environment simply exercises the functions of presenting and page turning (instruction space).

Typically, the ambitious goal of programmers consists of using diagnostic tests, performance tests, information on results and selective repetition with individual learning times to bring all (or nearly all) students to answer all the test questions, whereby the concept of mastery learning (Bloom, 1968) can be used as a guide. The domination of teachers in the procedure cannot be exceeded. Students are turned in a behaviourist manner into the objects of their teachers. The development of these

programmes is based above all on varieties of instruction technology (cf. Romiszowski, 1990, p. 165) and models of systematic instruction design (cf. Issing, 1997, p. 201).

B. Autonomous, self-regulated learning

Another form of learning places students in the foreground, and not teachers. It believes that they are capable of planning, organising, controlling and evaluating their work themselves. Teachers exercise the functions of advisors, mentors and moderators. These are certainly not incidental or selective activities, but are tasks which have become even more demanding and important for autonomous learning in the digital learning environment than ever before. The digital learning environment provides unusually good preconditions for these special forms of "self-controlled learning" (Friedrich & Mandl, 1997, p. 237) because it has learning spaces available which enable, simplify and accelerate the appropriate activities.

- **Learning by exploration**

Work in hypertext represents a form of learning which is located between heteronomous and autonomous learning and stretches into both forms (hypertext space). This makes it very flexible in its handling. It is clear that contents are set and presented by teachers, often very artistically and at great expense with the collaboration of experts. If learning paths through the hypertext are then prescribed in the sense of guided tours, the external control of students is patently obvious.

At the same time, hypertext and hypermedia offer new learning spaces for self-controlled learning. The main reason for this is their non-linearity. The teaching text is not offered in the usual linear sequence, but consists of relatively self-contained information units which are worked out in the form of a network. The fundamental difference becomes clear when we consider the remark by Michael Joyce (1989, p. 221) stating that hypertext represents "thought in space rather than thought in time". What is meant here is the space which is built up in front of the students. Rainer Kuhlen (1991, p. 337) speaks in this context of networked "spaces". In these spaces (hypertext spaces) students must "advance" and "explore", to use terms taken from space exploration, if only to characterise the high level of activity which students must provide. They must decide themselves to explore the networked spaces of the hypertext, obtain an overview, gain and process impressions, select the most suitable access for them, and finally discover and move along their own individual path through this special learning space (exploration space). A series of pedagogically and educationally desirable skills is developed and practised here.

Students profit here from an increase in autonomy because they can select the learning paths themselves on the basis of their own interests and associations, and at their own discretion and for their own strategy (exploration space). Ideally, each student takes his or her own personal learning path which is not used by anyone else. This makes hypertext and hypermedia into an effective instrument for individualising learning paths and at the same time into a pre-school and school for autonomous learning.

This educationally completely new, and therefore for many people unusual, procedure changes learning behaviour and even more teaching behaviour. Activity, and a considerable amount of independence is demanded of the students. In addition, they must have a number of explorations techniques available which have never before been described in

educational science: navigating (moving from node to node without the path being fixed); browsing (wandering through the hypertext); searching (through selective queries to the database); connecting (making new links between defined information units); and collecting (innovative additions of information units to form larger units of knowledge) (cf. Haack, 1997, p. 156). Robert Kleinschroth (1996, p. 178) also refers to flagging, in which information units or illustrations are marked for use later so that they can be found more easily; annotating, in which the student's own ideas are written onto electronic "notepaper"; and editing, in which selected texts, illustrations or sound documents are copied and added to a word processing programme. This is an amazing innovation for those who are used to purposeful and presentational linear teaching. In addition the students are introduced to active, constructive and context-related learning and get used to practicing it. The opportunity to learn cognitive flexibility must also be stressed. These three quality features are at present derived from findings of cognitive psychology (cf. Tergan, 1997, p. 129).

The disadvantages of such heavily stressed independence of learning in hypertext are seen above all if students lack experience and routine. They can then easily lose their bearings in this space or take on too much information at once (cognitive overload).

Teachers are also faced with unusual problems. The question for them is not to present defined contents articulately, and thus to teach, but to create special learning environments with the help of hypertext/hypermedia which provoke self-initiated and self-controlled learning. To do this they will select complex and interdisciplinary content ranges and present them in a form which enables quick access to each required set of facts and the individualisation of learning paths. Proximity to reality and the application of acquired knowledge are simulated with the help of hypermedia (multimedia space, simulation space).

In this way, a type of learning is constituted and practised in the exploration space in which pre-formulated knowledge is not learnt and the goal is not reached by means of given paths. Here the emphasis is on searching for, evaluating, structuring and arranging information, and associative, occasional and transversal learning is practised (Peters, 2001, p. 149). It is not serial thinking which is aimed for and practised, but multi-channel, structural, networked thinking. In this way, consequences from the research findings of constructivist psychology are drawn (Watzlawick, 1994; Stangl, 1985).

The model which most closely approaches this is learning by doing, which was developed by Jean Piaget (1973; 1954) and Jerome S. Bruner (1961). Resource-based learning and project-based learning are related forms of independent learning by exploration.

- **Learning by searching for information**

What are the activities which can contribute in the digital learning environment to structuring the learning space which is initially diffuse and unstructured? What must happen to discover which space is available for extracting and processing information, and how to move in this space? There are several possibilities for this. Students can check their hard disks and floppies to see if material which has already been stored is suitable for helping them achieve their learning goals. They can find out whether electronic journals, books, dictionaries and libraries can contribute anything to the subject. They can look through the electronic list of books in print, gain access to databases and

suitable search engines, check in a mailing list or newsgroup, put questions to an expert via e-mail and request digital teaching programmes and search them for relevant information (information space, communication space).

Sceptics may argue that searching for literature is not particularly innovative because it is a fixed component of traditional methods of studying. In principle, this may be correct, but the great differences are overlooked. The digital information space is so extensive, wide and deep, and so multi-facetted, in ways in which the most intensive research in a library cannot be. It is international, which is imperative at present in many disciplines, and is becoming more important in others. And it is accessible day and night. Users do not have to travel distances or use transport. And the information is obtained amazingly quickly, provided the complex technical architecture does not break down. Basically, all the information we require is "at the tips of our fingers".

We should not underestimate these activities and think that they only play a role as preparation for working through a subject. In reality, they accompany the work afterwards and finally become an integral part of autonomous learning, and indeed of academic studies. Certain attitudes, strategies and working methods are required which must be acquired as a type of research propaedeutics. Constant precursory and exploratory sorting of large volumes of information must become second nature to students. In fact, these activities may themselves be interpreted as a learning process. Firstly, information which students have searched for, and information they have not searched for directly (serendipity effect) is absorbed and assimilated, and, secondly, the comparative evaluation of this information with regard to the students' own learning intentions, their calculated selection and strategic application is itself a demanding cognitive process. The point here is to bring the neutral information into the students' own work and learning context, and at the same time to arrange it in the given social and location/time context, so that the information can only now be converted into knowledge. Cognition must therefore always be accompanied by metacognition, in which, among other things, the preference, priorities and selection criteria must be brought into equilibrium (cf. Döring, 1997, p. 323).

If we take the researcher working independently as the model to be aimed at for the development of autonomous learning, the great significance of the ability to move around in the information space becomes immediately clear.

- **Learning through storing and information management**

Learning was originally learning by heart. It consisted basically of receiving, retaining and memorising the contents which had to be learnt. The point here was to "store" knowledge and experience in the memory and to develop a special skill in accessing and reproducing what had been learnt at the right time. This must be said to counter the opinion that storing and recalling information in a computer are merely technical processes, and to indicate just how strongly they are linked with learning itself. The close relationship with one another of the two elements was greatly changed by writing and printing. For five hundred years, learning, and scientific work, was based on the interplay of the memory with external stores of knowledge made possible by technical means. The load on the memory was relieved, and this created a free space for other cognitive operations. In the digital era, this change has intensified both qualitatively and quantitatively to an extent which is difficult to conceive, because information can be stored on hard disks, diskettes and on CD-ROM without any effort and in seconds, and

recalled from there. The volume of the external memories is in addition extended drastically through the development of special databases which can be accessed from a distance and used for educational purposes.

These circumstances place students in a digital learning environment in a new situation. They must internalise the greatly changed weighting of the internal knowledge store and external knowledge stores, and make the best use of them for their learning processes. It is important here to develop and optimise specific strategies and routines for these learning activities. The reason for this is that "education increasingly means a symbiosis of biological and artificial memories" (Tiffin & Rajasingham, 1995, p. 43).

If the interplay of the human memory with an external information store has been achieved, during learning students can store selected information at the flick of a wrist for practising, learning, retaining and applying, and recall the information at any time in seconds. They have no problems in compiling a personal file related to the learning object and in extending it continuously. The work of academics with their files, the way they handle information they regard as important, searching and finding, remembering and checking, comparing and relating, becomes more significant and is integrated into the learning process. In this way, activating learning techniques are practised which are not found in this way, and certainly not as manageable, in traditional face-to-face teaching and in first-generation distance education. Storing can be developed further into proper information and knowledge management (cf. Erlach, Reinmann-Rothmeier & Mandl, 1999; Mandl & Reinmann-Rothmeier, 1998).

The advantages of knitting together a research and learning technique, and its importance for the development of autonomous learning, must be emphasised here.

- **Learning through communication**

Talks, discussions, discourses and the written exchange of information as such are of course not innovations. They are traditional components of many forms of academic and scholastic learning and teaching. However they are increasingly pushed to one side here by the dominance of presentational teaching, spoken and written, whereas in the digital learning environment in the communication space several interesting chances for realisation offer themselves which are available quickly and without great expense. In contrast to traditional learning locations, with the help of networking, links to communication partners, from a technical point of view, are provided everywhere and at all times. Working in the net becomes an important learning activity. The following forms have developed: electronic mail, electronic noticeboards, newslists, computer conferences and Multi User Domains. With additional devices audio conferences, audiographical conferences and video conferences can be offered parallel, as can be seen, for example, in the Canadian Project North (cf. Peters, 2001, p. 235).

“Electronic post” (e-mail) can be used to send text simply and in seconds to other students, teachers and others in the learning-teaching process. Normally, "messages" are exchanged between two or more persons. In this way, written "talks" or "discussions" and the ever-popular "chatting" (which can also take place in specially set up chat rooms or cafeterias) materialise which can become the focuses for social integration. These are new forms of communication which carry out very different educational functions in different virtual spaces.

The “electronic noticeboard” (bulletin board, news group) is a freely accessible discussion forum. All users can publish their information here, or question, comment on or criticise other information published here. Students can also request and download the discussion contributions and articles posted here and process them in the context of their learning process. This special form of communication should not be regarded as being casual or even trivial. Students who have specialised in a certain area can exchange information here with students of the same subjects in other universities. Specialists have already formed knowledge-building communities with this facility, even in research. The electronic noticeboard is becoming a "main source of professional growth" (Collis, 1996, p. 67).

“Computer conferences” provide a framework for longer discussions on defined aspects of the learning object. Participants can ask for the floor at any time and make a contribution, comment on other contributions, or make a contribution based on their own experiences. These discussions are particularly interesting, but also difficult if members of the seminar group argue from the basis of different cultural contexts (cf. Bernath & Rubin, 1999; Bernath, 2000).

With all these forms of academic communication, and this is obvious, students remain invisible because of the unique nature of the virtual learning space. Their learning behaviour is expressed only in the methods of their written participation. For this reason they have to be introduced with the help of photos and biographical sketches so that all participants can see what the others look like. In this way a structure is provided for the initially diffuse learning space. Two introduction levels are created: firstly, communication takes place with people who become clearer and clearer, whether they are in Kobe, Melbourne, Manila, Dubrovnik, Oldenburg, Vancouver or Mexico City; and secondly, the influence of the metaphor "seminar" leads to participants imagining themselves together in one room, and their a-synchronous contributions are converted into synchronous contributions, whereby, in the same way as in a face-to-face seminar, participants think they can differentiate between others who are particularly dominating, eager, reflective, careful, timid, self-conscious and silent.

At the same time, the virtual learning space is structured by means of specific social arrangements. In face-to-face teaching, the social structure of the learning group is traditionally relatively stable, thanks to the link between place and time, and to difficulties in changing it, but in learning in the Internet it can be changed easily and frequently. Consequently, several constellations are possible in the virtual learning space which Morten Flate Paulsen (1997, p. 121) has identified and designated as follows:

- one person communicates with another person (paradigm: e-mail),
- one person communicates with several others (paradigm: noticeboard),
- several persons communicate with several persons (paradigm: virtual conference).

The decisive question which the educationalist has to pose here is, how do learning processes develop if communicative actions of the type shown here are available easily and at short notice, consecutively and simultaneously, and in quick succession. This gives rise to other questions. Which learning functions are compatible with the three social configurations and their corresponding learning activities? Will teachers and students be able to handle these three forms of communication confidently? Will

orientation models have to be provided? Work on these research questions could lead the way to an educational theory of communicative action in the virtual learning space.

All the forms shown here have the aim of giving students in the digital learning environment the feeling that they are not alone (although normally they are in fact alone). They should be able to assure themselves from time to time that they in fact are "linked" to other students and to tutors and teachers. "Connectivity" has become a key pedagogical term in this context.

The innovations discussed here go far beyond the forms of communication in traditional studying. Their importance for the pedagogical structure of digitally enabled learning must be seen as very great.

- **Learning through collaboration**

The term "collaboration" is not found in the pedagogical technical jargon in Germany. In English it is understood as working together in particular in "writing and study" (Webster, 1953, p. 524). What is meant by this in Germany is traditionally dealt with in connection with »group education« and »group instruction«. Here the social relationships of the members of the group are made into the medium for pedagogical processes, which naturally includes collaboration. From the aspect of pedagogy, aims are followed such as the individual development and maturity of the participants, their social integration, social responsibility, self-realisation through interaction in a relatively control-free space, as well as helping them to cope with their existence. Efforts are made to use the advantages of group work and mutual help in learning, e.g. in solving problems and imparting values and standards. Often, group instruction is emphasised and supported, to modify block instruction (in classes), lectures and individual work (self-studies). Partner work and learning in small groups and in project groups have taken shape most strongly.

In the digital learning environment processes that serve these aims are termed collectively "collaborative learning" (collaboration space). This is understood in general as "individual learning occurring as a result of group processes" (Kaye, 1992, p. 2), as in traditional pedagogy. Naturally, what takes place here is virtual collaboration, which is why it has been described paradoxically as "learning together apart" (Kaye, 1992, p. 1). In the context of this representation, the opening up of new working and learning spaces is important, for working with a partner, for working in small groups, but also in extremely large groups, which enables completely new social forms of learning (e.g. IBM's in-house system).

In the central point of collaborative learning are computer conferences, and the following forms of collaboration have developed using them as a foundation: the virtual seminar, the on-line classroom, on-line games and simulations, and of course joint learning and working projects such as, for example, "knowledge building communities". Partner work should also be mentioned here, which may also be a question of the spontaneous solution of special problems, but also of jointly planning and resolving to take a course.

- **Learning through representing and simulating**

In traditional teaching and learning what has been learnt is usually repeated orally or in writing, in papers, examination work, notes, essays, reports and articles. Learning effects results which are often created when students write out something they have learnt,

reformulate a problem, give new reasons for a solution they have already found and discuss them, or illustrate complex findings for others. From the point of view of pedagogy, these may be repetition, training or application activities. At the same time, representing what has been learnt can also lead to creative ideas, to turning an existing solution into a problem or to metacognitive considerations.

In the digital learning environment, these activities correspond to the efforts made to reformulate what has been learnt for the students themselves and for others, and to present it, in this case with the means presented by word processing systems, including special graphics and presentation programmes and multimedia (presentation space, instruction space, multimedia space). This gives rise to many new opportunities. The multimodality of multimedia should be emphasised in particular, which is seen by Paul Klimsa (1997, p. 8) as the absorption of information via several sensory channels and the parallelism and interactivity which is possible at the same time.

For students learning autonomously, this leads to an increase in the importance of the effects referred to for conventional learning. We should pay attention to them in the digital learning environment as well. At the same time, their pedagogical function changes. We should no longer regard the presentation of what has been learnt simply as the conclusion of learning processes, but as an integral component. Nicola Döring (1997, p. 324) has provided some apposite examples. Where the question is to grasp and understand a problem, the presentation of the "explicit knowledge structure" can be very helpful which "appears plausible to us and is understood and accepted by others". When solving problems, "an organisation and reorganisation of available information representations in interplay with the reorganisation of our own cognitive constructs" should be aimed for. When students want to visualise or simulate, they are forced to become clear about their own thoughts with regard to the object which is to be represented, and to work it out in the form of a model and in detail. These representations not only support learning and lead to new knowledge, they can also demonstrate the learning success which has been achieved, and this can have an effect on the learning motivation.

If the product is a paper, an article, a Web Site, a posting or a message, what is represented achieves particular importance in the digital learning environment, in that it can be received and if necessary processed by a partner, several members of a learning group, or indeed from anyone. The chances of not simply working for something which will be put into a drawer are therefore increased. Representing what we have learnt becomes an instrument of communication and co-operation. The success of jointly researching learning in a »knowledge building community« (Scardamalia & Bereiter, 1992) is only possible if all members inform the others of what they have thought and worked out, so that the "common knowledge" of these groups can be held in a central database to be used at any time.

Accordingly, students learning autonomously must be thought of as people who always think about presenting what they have learnt, train themselves in this and acquire particular skills by entering texts, composing them, design convincing graphics for them, develop diagrams and design simulations. They do not simply absorb information, relatively passively, but work with it and present the results of their work. They do this with all the technical facilities provided by the digital learning environment. The

graphic programme PowerPoint represents only one dimension of their multitudinous possibilities. Numbers are converted into coloured diagrams, complex sets of facts shown in the form of three-dimensional networks and surface diagrams, animated mathematical models are developed to simulate processes.

However, the danger of the easy visualisation of facts and learning results is always seen if it does not in the first place serve to achieve pedagogical goals but becomes an end in itself. The question must always be put here whether the selected presentation has an educational "added value" (Kuhlen, 1991, p. 212).

In spite of the innovative nature of the forms and functions of representations of acquired knowledge, there is still no lack of previously relevant pedagogical endeavours. Structural communication (Hodgson, 1974; Egan, 1976) must be mentioned here. This is a cognitive approach to self-instruction (Romiszowski, 1986, p. 181), and is based on findings of cognitive psychology and field theory.

Interpretation

All the learning types shown as examples here have strongly innovative tendencies. They change conventional teaching and learning and adapt it to the requirements and circumstances of the post-industrial knowledge society. Whether some of these learning types are practised separately, or whether procedures can be constructed in which several, or all, of them are found together, must be decided on the basis of the respective learning situation and with regard to given curricular links. The educational gains which are possible here can be seen today: learning is more flexible, variable, adaptable, available and more easily accessible. According to Heinz Mandl, Hans Gruber and Alexander Renkl (1997, p. 439) it is also gaining more "closeness to reality", "problem orientation", "learner activity" an "adaptive instructional support". Impulses emerge from what happens or can happen in the new learning spaces which restructure teaching and learning. In this context, there are indications that a new educational epoch is in the offing. If modern learning can be described as

> linear, causal, logical, hierarchical, systematical, concentrated, located and with a closed curriculum,

in virtual spaces it is developed in essentials in a manner which in contrast can be regarded as post-modern. It is

> non-linear, non-causal and not constructed logically, but is associative, random, decentralised, fluid and opaque, dislocated and distributive, and the curriculum is open.

If we attempt to image the pedagogical structure of learning in the new spaces, the following dimensions of the change in particular spring to mind:

- Teaching and learning are no longer focussed on the group but on individual work.
- The function of learning itself is changing: in the industrial society knowledge and skills were essentially stockpiled for future vocational and private use, but in the post-industrial knowledge society learning on demand (Schönwald, 1997, p. 6) is

establishing itself more and more, and this may lead to greater integration in these two areas. It is in fact the new learning spaces which enable and facilitate this.

- As a result of doing away with distances and time, the media and the methods derived from them are enormously consolidated.
- As a result of the establishment of distributive learning in virtual learning spaces the impact of universities and schools is weakened. Important "processes of dismantling borders and destructuring" (Kade, 1989, p. 789) are taking place.

Consequences

Altered Teaching and Learning Behaviour

The greatest innovation effect can be verified if we analyse the extent to which teaching and learning behaviour is changing in the new learning spaces.

- **Students**

We will soon have to get used to a different image of our students. According to Franz-Theo Gottwald and K. Peter Sprinkart (1998, p. 59), students must possess five skills to be able to study in virtual learning environments, namely, self-determination and orientation, selection and decision-making, instrumental-qualificatory acquisition, construction-qualificatory acquisition and learning and organising skills (cf. Lange & Hillebrand, 1996).

This means that students must be ready for, and capable of recognising, actual learning goals and learning possibilities on the basis of changes to their lives and work, be willing to plan and organise their learning independently and to absorb and organise it largely independently of teachers. In the face of the indeterminable abundance and variety of the information which is now available in all accessible databases, the capability of searching for, finding and evaluating information which is important for a student's own learning will be difficult and unusual. The most difficult task will probably be to assess contents and offers of support with regard to the planned learning processes, because this presupposes metacognitive experience and considerable pedagogical insight. Finally, students must be able to handle the technical equipment of the digital learning environment routinely and creatively. All this must be supported by an approach which is observant, attentive, calculating, navigating, exploring, communicative and collaborative.

Critics will argue that these five qualifications are basically nothing new, because they are required in traditional university teaching. This also requires self-determined learning activities (e.g. seminar work, papers, etc.), information is looked for and found (e.g. researching bibliographies), selections must be made from the abundance of the complete teaching range, decisions are taken (e.g. for and against seminars, lectures, learning modules or teachers, etc.), handling media must be learnt (e.g. books, audio and video recorders), the learning path through to the examinations must be carefully and strategically planned, and specific learning techniques must be acquired and trained.

This is of course correct. But all these activities, and this is overlooked, are only rudimentary here. They are much more important for learning in virtual space, because students have taken over most of the functions of teachers. This creates a structurally different learning behaviour. For students learning independently, who are also responsible for their own learning, the five skills referred to above are seen in completely different

light, because they must be emphasised to a much greater extent. In this respect as well, students learning autonomously are an important result of the digitalising of learning.

- **Teachers**

Lecturers are also affected by the far-reaching structural changes. Teaching behaviour is determined by a displacement of the centre of gravity – away from presentation and towards moderating, counselling and tutorial support for students learning autonomously. Their main tasks will be

- developing non-linear hypertext and hypermedia learning systems (Laurillard, 1993; Tergan, Harms, Lechner & Wedekind, 1998; Wedekind, Lechner & Tergan, 1998; Tergan & Lechner, 2000), in which on the one hand the complexity of academic learning is expressed and on the other hand learning by exploring and discovering is enabled and supported,
- moderating virtual seminars (Salmon, 2000; cf. chap. 8),
- organising *support* (Ryan, 2001; Zawacki, 2002) as well as
- the design of »meta-learning environments« (Sumner & Taylor, 1998).

In future they will also have to be able to reuse standardised »granular objects« or »component based instructional units« from centralised content source repositories in order to save time and money (Porter, 2001; Wiley, 2000; Krämer & Schmidt, 2001).

New Categorical Accents

The extent to which learning in virtual learning spaces has altered can also be seen from a theoretical aspect. The change in the weighting of some pedagogical principles as against traditional learning springs to mind. Some examples are discussed below.

The *multimedia and multimodal nature* (i.e. the reception of information through several sensory channels) is continuously emphasised as a characteristic innovation. The *activation* of the students is given a higher rank, especially because they can learn with hypertexts or by discovery. The quantitatively and qualitatively improved *interactivity* of students plays a much greater role than in traditional learning, and is shown by the protagonists of digital learning environments to be the greatest advantage (cf. above all Haack, 1997). Basically, however, it is not a pedagogical goal in itself, at most in the sense of formal education, but a means to achieve defined learning goals, which are to be used to define its type and duration.

The *adaptability* of teaching programmes to the individual requirements of students and to changes in society can be very marked, e.g. in hypertexts and with autonomous learning. The *connectivity* is specific to work in a digital learning environment because it is based on the links to other teachers and students which are easy to establish and which rapidly bridge space and time. It is a counterweight to the isolation of students in the digital learning environment. This is a completely new pedagogical category. The *individualisation* of learning provides new and increased chances. *Communication* and *collaboration* are easier to establish and to realise than in traditional teaching and in this way they enter the foreground of pedagogical considerations. Above all, the model of the *autonomous student* no longer remains an illusion but now has much better chances of being realised.

In contrast, *a-synchronicity*, which is often put forward as a characteristic of learning in the field of multimedia (cf. Issing & Klimsa, 1997, p. 1) does not deserve the attention it is given because it is not specific to this type of learning alone. Since writing and printing came into use, learning has been a-synchronous. This category plays an increasingly greater role in preparing "homework" and in all systems for distance education.

In general, the invasion and take-over of many new technological terms from the fields of computer and communications science forces us to interpret them pedagogically and to link or fill them with pedagogical categories. This leads to focal points being displaced. Previously unused pedagogical models will probably play a part here, e.g. cognitive apprenticeship, communities of practice, reciprocal teaching, and knowledge building communities (cf. Schulmeister, 1997, p. 78).

- **Loss of Pedagogical Substance**

The fact that the important chances for a structural renovation and modernisation of teaching and learning are also faced with considerable educationally relevant losses should not be concealed. These are above all the following deficiencies:

Some of the specific and critical features of real learning spaces – mentioned in chapter 6 – have no effect on the learning process: For this reason, positive, negative or neutral feelings for virtual learning spaces are not developed. We cannot "feel at home" in them, or get used to them. A "feeling" or "consciousness" of space, or even a feeling of "belonging" and "security", cannot be experienced. The virtual learning space does not become a "stage" for the success or failure or pedagogical activities. The "abundance of significant events experienced in it" (Dürckheim, 1932) cannot be perceived. The memory of acquired knowledge is no longer, as with previous generations, linked to particular persons in particular buildings and at particular locations. The inter-dependence of all "simultaneous" facts in the learning field (Lewin, 1982), the "factor complexion in the pedagogical field" (Winnefeld, 1971), and the "dynamic processes of interaction of strict reciprocal dependence" in the "pedagogical reference field" (Heimann, 1976) are divided by the relationship to one another of real learning locations and virtual spaces, checked, weakened by a-synchronicity. In particular, the historical dimension is practically completely missing in the way in which it had an effect in traditional teaching and learning.

Because there is no real learning space, there are no physically real fellow students and teachers. This reduces the whole field of non-verbal communication, contact with people made of flesh and blood who are pursuing the same goals, as well as the dynamism of learning in groups, and, as a result, a considerable part of the socialisation effects achieved through direct personal contact. Students in the digital learning environment must work separately and in isolation. Sherry Turkle (1998, p. 382) asks: Does anyone really believe that this loss can be compensated for by virtual communication and virtual learning groups? Is it "really reasonable to assume that we can breathe new life into the idea of community by sitting alone in our rooms, entering messages into our networked computers and filling out lives with virtual friends?".

If repeated virtual social contacts do take place, my experience is that they are strangely sterile and artificial. This is above all the case with computer conferencing, but also with synchronous interaction with sound and pictures. The communication lacks spontaneity

and depth. It is susceptible to interference. The flow of subjective feeling is diluted and interrupted. All this can in fact be the case even if the participants allegedly like and approve of this form of communication.

Teaching and learning is no longer "experienced" globally as a unit consisting of space, time and ritualised social interaction. This is why learning experience cannot be "localised" and float, so to speak, in the indeterminate. The spatial and temporal contextualisation, which is so important for learning, is lost. The much-quoted expression "lost in hyperspace" (e.g. Klimsa, 1997, p. 15; Tergan, 1997, p. 133; Haack, 1997, p. 155) refers to this.

The original and the authentic are not experienced. People, objects, and often situations, are simply copies which can be repeated often. With their help we can only construct a secondary, derived teaching and learning reality. The "aura" is lost, as with technical reproductions of works of art.

These are serious losses. They reduce, surround, parcel out, spoil or destroy experiences gained at school or university. For this reason, it may be concluded, learning in virtual space will never be able to replace completely teaching in real spaces. Systems of teaching and learning will have to be designed in which the two methods complement and involve each other. To do this however, the forms of teaching and learning in real spaces will be forced to change in the sense of increased direct and personal communication and collaboration with reduced presentations of contents. In particular, emphasis will have to be placed on maintaining "social intercourse" (Casper, 1996, p. 25).

Losses of this nature are regretted by most people, in particular by those who are still more or less rooted in the bourgeois culture of our industrial age. However, we are at a turning-point: the world is going digital. People in the coming information era will differ from those in the industrial era in the same way that the latter differed from those in the agricultural era. Paradigm changes, changes in values and completely new experiences will bring about new insights, attitudes and habits. Essential activities will in any case take place increasingly in virtual space, including learning in higher and continuing education. Such people will probably regard these losses in a manner different to ours.

- **Gains of Pedagogical Substance**

When students grow up in the digital world, a new world will be opened up to them in learning, playing, working and dealing with many other, often unknown, persons, as Sherry Turkle (1998) has described so convincingly. They will live and learn alternately in real and virtual spaces. Both will have different effects on the formation, alteration and protection of their identity. Virtual spaces in fact offer possibilities which are not found in real spaces. According to Winfried Marotzki (1998), we will be faced with phenomena such as "disinhibition", gender swapping, the development of multiple identities, and with an experimental "construction and reconstruction of the self". Previously unexplored dimensions of the development of the person will open up. What the significance of these completely phenomena for cultural history may be is seen in Marotzki's assessment according to which the image of the "patchwork of one's own identity" which is occasionally used in the post-modern discourse has become "virtual reality" in the new spaces. There is no doubt that we are dealing here with important aspects of the new learning spaces.

Judged generally, the attempts taking place at present all over the world to gain experience in the new virtual learning spaces might be seen as a contribution to the preparation for coping with life in the global technical civilisation of the knowledge society. This would indeed be a genuine and extremely valuable pedagogical gain to be placed against the loss of pedagogical substance.

Evaluation

Although the process of digitalisation of pedagogical action has now been taking place for some years, seen from the whole aspect of the development of pedagogy we must speak of a breach with the traditional practice of teaching and learning. What has happened in a short period here is amazing, particularly if we consider how slow, protracted and laborious comparatively minor reforms of teaching and learning were in the past. Everything here has happened very quickly, because advances in information and communication technology have come hot on each other's heels, and were not only taken over in education, in particular in continuing vocational training, but also in politics, culture, society and work, all over the world. There has never been a breach of this size in the history of teaching and learning, not even after the discovery and use of writing, printing or the audio-visual media radio, film and television.

The change from real learning spaces to virtual learning spaces has caused this breach. It was not foreseen, let alone desired or aimed for, by any educationalist. Teachers and students are exposed by it to a situation which has a completely different structure and which offers a variety of new opportunities. We in higher and continuing education must also adapt to this situation, a process which will take years, if not decades, and which we may be unable to bring to an end.

The existence alone of virtual learning spaces should not by itself be regarded as an innovation or reform of teaching and learning, no matter how abundantly equipped with the technical appliances with whose help they can be constructed. Only when they have been educationally opened up, each one for itself and linked to others, will we find ourselves on the road to innovation and reform. This will need the initiative, intelligence, imagination and creativity of all participants, teachers and students, instructional designers, as well as educational and learning psychology researchers.

Many people regard the increased use of virtual learning spaces as a "Copernican turning-point" (e.g. Kleinschroth, 1996, p. 8), others as a revolutionary development (e.g. Perelman, 1992, p. 24). I regard it as the most fundamental pedagogical event of the present, and one which is of great cultural and historical significance.

8 Moderating a Virtual Seminar – Reflections on First Practical Experiences

The virtual seminar has become the main format of higher education in many online graduate and postgraduate courses. This chapter addresses the problem of how the new virtual learning space can be used to develop adequate learning behaviours. The experiences acquired in ten virtual master courses show that learning in virtual seminars differs markedly from traditional expository teaching and reception learning as it opens up new possibilities for the development of autonomous, self-regulated learning. Some methods are dealt with which help to facilitate this change to pedagogical paradigms.

A Pedagogical Approach

When teachers at colleges and universities decide to engage themselves in conducting virtual seminars they get into difficulties. All of them were educated and socialized at traditional schools and at campus universities. And all of them have acquired and internalized the conventional strategies and skills of face-to-face teaching, namely expository teaching and receptive learning. They believe that these strategies and skills are the most natural thing in the world. The great leap from real learning spaces to virtual learning spaces, however, teaches them otherwise. They find themselves in an entirely new pedagogical situation. Those lacking pedagogical sensitiveness might not become aware of the new prerequisites and conditions of learning in virtual seminars and try to continue in the traditional way. Others might try to adapt conventional ways of teaching to the new situation by replicating them. However, a growing number of teachers have come to the realization that virtual learning spaces require new approaches. At present they are in the process of exploring them. They see and understand that following well-trodden paths will never solve the educational problems ahead of us and that new pedagogical ground must be broken. They are starting to define or redefine learning and teaching methods as well as learning and teaching behaviours anew.

One of the dramatic discoveries is that virtual learning spaces lend themselves much more to autonomous and self-regulated learning than teaching in real conventional college classrooms. This means that the education of self-reliant students who learn independently from the teacher – which, by the way, is an old, but so far too often ignored educational goal – now has a real chance to become realized. Hence it would be wrong to plan and design learning in a virtual seminar without at least trying to reach this goal.

During the last five years I have moderated ten virtual seminars of four weeks each as a visiting expert. They are part of the *Foundations of Distance Education* course in the Master of Distance Education (MDE) program which is offered exclusively online by the University of Maryland University College and the Carl von Ossietzky University of Oldenburg. The content of the seminar I am involved in is on "Pedagogy of Distance Education and Theoretical Approaches to Distance Education". When developing a pedagogical model for this virtual seminar I decided from the beginning to make sure that many elements of independent learning were included, not only for reflecting on them but also for practicing them. I tried to convince the students that a

new learning *attitude* and new learning *activities* are required, especially with regard to how to learn in an autonomous way, how to develop suitable strategies, how to use and exploit the new communication facilities and how to develop habits of metacognition and self-evaluation.

Learning how to Learn Autonomously

It is true that certain elements of autonomous learning can also be found and developed in *real* seminars – at least in European continental universities: a decision by a student to contribute a paper, read it out in the seminar and defend it against critique in a discussion. But what takes place in these real seminars remains traditionally lecturer-oriented and lecturer-dominated in most cases. Compared with such isolated starting points of learner autonomy, virtual seminars offer many more such possibilities which can be developed further. Like most distance learners the students in their digitized learning environments may take the initiative and become active without being supervised or controlled by teachers and the other participants. They are driven by necessity. Without their initiatives and activities the learning process could not take place at all or would be seriously impaired. Their independence and self-regulation is, so to speak, an integral part of the system. This particular feature should be considered an important asset of online learning.

The pedagogical problem to be tackled is how autonomous learning can be evoked or elicited in a virtual seminar. Which measures are to be taken in order to enable dependent students to become autonomous? In order to characterize the relevance of this structural change we can state that this enabling process has become more important than the traditional process of presenting contents.

The *pedagogical model* to be developed in this particular case challenges the students in the following ways:

(1) The students are offered additionally to the required reading a number of scholarly articles and papers about fundamental theories of distance education and asked to *decide* which of them should be selected by themselves according to their personal interest, likes, predilection and vocational or professional experiences and perspectives. By doing so, they are involved in *defining the content* and partly also in *deciding about the specific goals* of their learning, which will be initiated by and take place on the basis of the chosen reading material. Thus, students must become active, their learning is already strictly learner-oriented and individualized, because they are expected to find, develop and follow a learning path of their own.

(2) The students are again engaged in activity when *searching for additional relevant information* about the chosen theme on the Net. This process is intellectually demanding because the required information has to be judged, evaluated, linked and integrated into the content chosen and into the respective knowledge structures.

(3) The students become active again when they *communicate* with others about their learning. This requires more initiative and skill than in a real seminar.

(4) They are encouraged to discuss relevant issues together with two or three fellow students. In this way their virtual *group work* may develop into *collaboration*.

(5) When the students are asked to write a paper for *evaluating* purposes it is up to them to decide which of the proposed topics would suit them. They may also be entirely free to decide on the topic themselves. In the last analysis autonomous learning should encourage and enable students to evaluate their learning themselves. But in this particular case institutional regulations have to be observed and the paper must be graded by the teacher.

(6) At the end of the virtual seminar the students are asked to do a comprehensive *self-evaluation*. Neither the teacher nor the other participants of the seminar are informed about the results.

This approach can be criticized on the ground that it is unwise and surely problematic to implant a model of this kind into a teaching and learning system which is closely regulated by a university government and shaped by tradition. The chances are that this will lead to an inevitable clash of pedagogical values and will require difficult negotiations with university officials. However, the difficulties are no longer insurmountable, because most universities are involved in a process of structural transition and are becoming more and more interested in online learning.

Learning how to Develop a Strategy of Self-Learning

Although distance learners have already developed a self-learning attitude and certain self-learning activities, the situation in online learning requires the intensification and enhancement of such pedagogical elements. The goal is to bring about real autonomous and self-regulated learning. Students used to expository teaching and receptive learning must become aware of the new learning model, which is much more demanding and means much more work but may be also much more rewarding. This means that a process of self-reflection must lead to a change of attitude. This is the precondition for a re-definition of learning online. This process is a radical one, because independent learning is the opposite of dependent learning. Consequently, many elements of the pedagogical structure have to be changed. It stands to reason that traditional students must be motivated and supported when they start learning in this way, although this appears to be a paradox. Furthermore, they can be challenged by tasks which do not induce them to receive, store and reproduce content matter, but to set and reach learning goals themselves, to search, find and evaluate information themselves which may be relevant for solving learning tasks. Active self-learning can develop in this way.

Learning how to Use Communication for Learning Purposes

It is important for students to realize that the possibilities of communicating differ from those in real seminars as they are manifold and basically a-synchronous. They are manifold because the students can profit from an increased number of technological vehicles and channels (as well as software) for this purpose (e.g. chat rooms, e-mails, mailing lists, newsgroups) and can also communicate with an increased number of partners. Of course, communicating with the moderator of the seminar and other individual class mates is in the foreground. But there are more possibilities and students must become aware of them and learn how to use them as a routine. They can communicate with a selected group of students or with all students in the seminar in a multilateral way. They can discuss a problem with a given student and know that all

other participants are "listening" and "witnessing" the dialogue. They can even contact people who are not participants of the seminar. Quite often the telephone is used in order to complement the discussion by synchronous oral dialogues. However, not all students enjoy being involved in dialogues. Jacqueline M. Timoney explains her own reluctance in this way: "I do not think of myself as either an introvert or an extrovert, but I feel more comfortable digesting the conversation, internalizing it and then responding. Actually, by the end of the two weeks, when I did feel comfortable enough to speak, I found that the professor had pretty much counted me out (for classroom discussion)." Cases like this one can be found in many virtual seminars. These students need special attention.

Communication can also be the medium of *collaboration*. Two students might solve a problem they cannot master alone. Students might establish working groups in order to discuss a problem in depth. These groups can be enhanced to regular knowledge building communities which store the learning results which they have achieved together. Communication and collaboration are facilitated if the students and the moderator are provided with brief biographies with photographs of each participant. However, a recent tendency is that some students do not like to provide this information including photographs.

The *Foundations of Distance Education* course is the beginners' course in the MDE program. Hence the pedagogical task was a difficult one. My task was to motivate the students to engage themselves in a radical structural change of their learning processes; to convince them that they have to work in an entirely different frame of references; to get the participants into a new frame of mind and to acquaint them with the new possibilities of online learning. How could this be done with distributed participants in a virtual seminar? I "talked" to them in a long introductory e-mail (cf. appendix 1).

Learning how to Develop a Habit of Metacognition

The more students learn how to learn independently from their teachers in order to become autonomous, the more they perform tasks which have traditionally been tasks of these teachers. Above all, they must acquire the skill and habit of observing and evaluating their own learning. Learning psychologists call this »metacognition«. With regard to autonomous learning, this term refers to knowledge, which is used to regulate or control cognition in a learning process. In online learning, this activity has a high priority.

The task is a critical one. It presupposes that the self-learner finds, acquires and integrates new knowledge and at the same time observes and controls this process in order to avoid false starting points, mistakes, errors and possibly misleading interpretations. This process is similar to the evaluation of instructional designers. In this case, we can distinguish formative and summative metacognition.

The students were advised to establish this second level of their learning activity. They were asked to observe themselves during their learning. And in order to prepare them for metacognitive considerations they were involved in continued reflections on the nature of learning in virtual seminars in the light of their own experiences. Their

observations focussed on the differences between real and virtual seminars and on the problem of whether the virtual seminar can be substitute for a real seminar.

Differences Between Real and Virtual Seminars

The students of section A (n = 31) and section B (n = 32) of the virtual seminars, which took place in October 2000, discussed the advantages and deficits of both formats and displayed their judgements, comments and observations. All students referred to in this chapter were participants of this seminar. The intensive discussion period lasted from 17th to 26th October. The following are some of the results:

Advantages

Seven students referred to the quality of their learning. Some students appreciated that they have time for reading and writing, for thinking and editing, for reflecting on their thoughts before they write them down. Brenda Lee James-White, for instance said: "I take time before I utter a word and for some that is a blessing." The same student felt the peculiar "joy of formulating well thought out questions". Others enjoyed taking time to complete their thought processes. Gary B. Double believed that this way of learning "forces the learner to think and rethink and to internalize the concepts". Some liked the fact that they were able to think about the contributions of other participants, which assumed more importance for them in this way. And Gerald Thompson thought, "The depth of thought is much greater, but fragmented".

Four students were impressed by some of the new possibilities for communication and interaction: the combination of a-synchronous dialogue with synchronous group chats, the participation in multiple conversations, and the written record of the dialogues, which is so invaluable for organizing and reorganizing the contents, for finding quotations and establishing cross references, intensified study and for research. The value of communication was generally recognized. Caroline Mullenholz observed: "When a student submits his/her comments to the discussion, it is as if he/she has visited the instructor in their office and is having a conservation between the two of them." Small wonder that another student went even so far as to believe that the electronic interaction could adequately substitute face-to-face interactions of real seminars.

Three students experienced and liked the relaxed atmosphere in the virtual seminar as compared to the often rather strained learning climate in real seminars, where they are under the supervision and control of a teacher and have to withstand group pressure. They did not feel intimidated and were not inhibited to put or answer questions.

Two students enjoyed the absence of disturbing factors and argued that it was possible to develop your thoughts without being interrupted. Two students liked the fact that there is no waiting list for students who want to contribute to the discussion: all students could talk at the same time. One student praised the possibility of jointly creating and editing documents and sharing assignments.

Advantages of Virtual Seminars in the Opinion of Participants

Section A of the "Foundations of Distance Education" course in Fall 2000

Relaxed atmosphere: "Students are not intimidated about speaking up in a room full of people" (Paula J. Hubble).

Relaxed atmosphere: "I do not feel put on the spot to speak up in class".

Undisturbed performance: "We can talk without being interrupted" (Kathleen H. Beckman).

Absence of disturbing factors: "You cannot be "dismissed with just one look", disregarded because of your color, dress, or slight stutter" (Gerald Thompson).

No restriction of participation: "In a classroom only a few students may be able to ask questions. In a virtual seminar students and instructors can comment on each others´ ideas" (Paula J. Hubble).

No waiting list: "We can all talk at the same time" (Kathleen H. Beckman).

Thoughtfulness: "I can reflect on my readings and thoughts and comments of the others (Jacqueline M. Timoney).

Thoroughness: "The depth of thought is much greater, but fragmented" (Gerald Thompson).

Contributions of other participants assume more importance: "I am gaining much from my fellow students´ responses" (Ronald G. Brown).

Unique feature: "We can participate in multiple conversations simultaneously" (Kathleen H. Beckman).

Documentation: "We have a written record of our dialogues" (Kathleen H. Beckman).

Future developments: "Bringing to bear the full power of modern electronic capabilities overcomes these limitations (caused by a-synchronism) when communication is synchronous" (Leonard M. Giambra).

Section B of the "Foundations of Distance Education" course in Fall 2000

Reflectiveness: "It forces the learner to think and to rethink and to internalize the concepts" (Gary B. Double).

Atmosphere: "No inhibition, you feel less intimidated" (Caroline Mullenholz).

Reflectiveness: "You have time to think. Allowing the student time to ponder the answer to their own questions gives rise to autonomous learning" (Brenda Lee James-White).

Creativity: "The '*Relaxed* beauty' of eliciting well thought out questions". (Brenda Lee James-White).

Thoroughness: "You have time for writing, reading, editing the contributions." (Caroline Mullenholz).

Thoroughness: "I have discovered that I make a conscious effort to complete my thought process on an issue and to absorb new ideas from other comments. I take time before I utter a word and for some that is a blessing." (Brenda Lee James-White).

Unique structure: "The possibility of combining a-synchronic communication with group chats".

*Sharing assignments: "*Computer conferencing and on-line editing capability permits students to jointly create and edit documents and share assignments" (Rita Owen).

More opportunities for dialogue: "If a student wasn't involved much in classroom dialogue, would he/she really lose by attending an electronic classroom? ... Students could actually gain in their experience in the latter" (Gwendolyn A. Burt).

Parity: "I would contend that from my experience as a DE student that the electronic interactions have adequately substituted for face-to-face interactions" (Linda A. Monzo).

Disadvantages

Five students were concerned about the particular learning mode required in virtual seminars. Some of them believed that the exchange of written statements is more difficult than the respective oral communication. According to them, this holds true especially for those who prefer to "talk their ideas out", and even more so for those "lacking good writing skills".

Further difficulties arise when learning in virtual seminars is being performed. Some students were disappointed that it takes more time than learning in real seminars. Because of the a-synchronism of the dialogues there is a lack of progression and interactiveness. Leonard M. Giambra said: "It is difficult to establish the sense, the meaning and the thread of the dialogue". And Soultana Chanikian believed that "dialogues cannot really expand on issues of personal interest, requests for clarification or elaboration". Sandra A. Gammons missed spontaneous contributions, passion and intensity, the "good old-fashioned heated discussion". According to Linda A. Monzo, these discussions were "more dissertation driven than dialogue driven". And Stephen Wadington insisted that "spontaneous contributions are lacking" and that "real dialogues can never be achieved".

Some students were not happy with the »social presence« of the distributed participants. According to Kenda Layne, there is "a sense of anonymity". The students felt themselves isolated and detached and had no idea who is taking part in the discussion. Kathleen Beckman told her fellow students: "I am not a visual learner, so I don't have a clear picture of any of you." These students felt that they were talking to an empty space. One reason given is that expressions of body language are missing, for instance physical gestures, eye contact, non-verbal language, the tone, volume, timbre of voice, shaking heads or nodding, and, as Gerald Thompson observed, the "grunts and groans as comments" as well. Information and emotion are no longer combined. Small wonder that one student deplored the fact that she was not able to become aware of "a person's essence" and another one missed "the energy that is present in a learning environment shared by a few or many people".

Disadvantages of Virtual Seminars in the Opinion of Participants

Section A of the "Foundations of Distance Education" course in Fall 2000

Articulation: Lack of progression.

Articulation: Lack of interactivity.

Presence: Absence of a person's essence.

Situation of students and teachers: detached, isolated.

Lack of clues: "No body language, e.g. physical gestures, eye contacts, no verbal language" (Sharyn Lee Hearn).

Form of interaction: "I don't really feel that anything truly substitutes face-to-face interaction. How do you replace factors like body language, tone of voice or even the *energy that is prevent in a learning environment shared by a few or many people?*" (Shanta D. Robertson).

Learning behavior: "In face-to-face dialogue one does not have the problem of re-establishing the sense, meaning and the thread of dialogue" (Leonard M. Giambra).

Learning behavior: "I miss the immediate feedback".– "I miss the immediacy of response (Paula J. Hubble)

Learning behavior: "I am more comfortable talking my ideas out" (Paula Hubble).

Learning mode: "It is a tough process to communicate through texts. It is difficult for those "who have trouble talking through written words" (Gerald Thompson).

Learning mode: "I have only a sense of those who response. In a verbal classroom I would have a sense of what the non-talkers were thinking. By nodding of heads, shaking, grunts and groans as comments pass one would have a sense of the entire class relations; not just the reaction of those who speak up." (Gerald Thompson).

Learning mode: "Virtual information is only partial information. It suffers from a-synchronism. This reduces severely the benefit of dialogue" (Leonard M. Giambra).

Learning mode: "In the small class lecture or seminar the face-to-face situation provides information and emotion, which would be difficult, but not impossible to convey by electronic interactions" (Leonard M. Giambra).

Prerequisite: "The "students have to have good writing skills" (Paula J. Hubble).

Re-orientation: "I have trouble in figuring out what is new stuff" (Paula J. Hubble).

Learning time: "You need more time than in class" (Kathleen H. Beckman).

Audio stimuli: Virtual seminars are lacking sufficient details regarding audio "in terms of tone, volume, timber and variations and juxtapositions of them" (Leonard M. Giambra).

Experience of virtuality: "I did not know who was at the other side of my computer. I felt myself as if talking to empty space, dreaming something. I had never felt such a feeling at traditional classes" (Eric Jeon).

Experience of virtuality: "I do miss the face-to-face dialogue that I have received in other classes" (Paula J Hubble).

Can the Virtual Seminar be a Substitute for a Real Seminar?

The students were asked to reflect on this question in the light of their actual experiences and to voice their opinions. Here are some of their reactions:

Some students felt that the virtual seminar is "practically the same" as a real seminar. Exactly these words are used by Teresa I Radi, Hada Flowers and Jeffry Rand. And Rhonda L. Black maintained that there are "no real differences" between the two.

It is possible to interpret these statements in a positive way by assuming that these students did in fact accept this particular form of online learning, although the words "practically" and "real" also signify slight reservations and the idea that the two forms of learning are *not* really the same. Their positive judgements might also be influenced by the enthusiasm about being among the first to try out a new format of higher education, as well as by the »novelty effect«.

Susan Pollack does not share this opinion. She was convinced that the two forms are "similar, but not the same" on the ground that "there is a different kind of rhetoric in the virtual seminar as the dialogues are modified to the medium". Gwendolyn A. Burt was more outspoken. She maintained that the two formats are markedly different by reminding us that you cannot "substitute an apple for an orange". However, she qualified this statement by referring to an exception. According to her, one interesting and relevant precondition is important: "If the student's goal is to learn and the student is able to

learn autonomously, he/she could surely substitute the electronic means for the face-to-face means." If we generalize this statement, we could say that the autonomous learner is not only a valuable pedagogical goal and perspective of online learning, but also a relevant precondition for substituting a virtual seminar for a real seminar. Finally, Gwendolyn even said: "If the basic goal is the same, even though the means are not, substituting one for the other seems possible."

Sharyn Lee Hearn gave a similar interpretation by referring to an important and obvious difference in the learner. "If you take interest and are engaged in a meaningful dialogue with educators and peers – then there is no longer a distance between them." And Charles Kalnbach focused the discussion on the different pedagogical structure of the two formats of a seminar by observing: "We are not replacing (substituting) what teachers are doing in class: we are trying to expand the interaction, the depth of the conversation and the ability of the student to find other sources of information."

These three statements are telling. They imply that virtual seminars can be substitutes for real seminars but only on condition that the students are autonomous and committed learners who are able to exploit the learning potential of online learning. Here we can see again why distance teaching universities have a special affinity to online learning – and one which is much greater than that of campus-based universities. Distance students have become well known as independent, self-reliant and self-regulating learners. They meet most of the conditions referred to by Gwendolyn and Sharyn.

Several times students admit that a virtual seminar can be a substitute for a real seminar – but they still missed the spoken word and the spontaneity of the spoken dialogue. These students preferred spoken dialogue to written dialogue. The reason for this is quite often simply that they have difficulties in expressing their ideas in writing. Some students report how difficult it is "to communicate through texts", especially for those who have trouble talking through written words (Gerald Thompson). This obvious handicap is discussed by participants with regard to future possibilities. Hada Flowers believes that face-to-face dialogues can only be substituted by electronic interactions "when the technology allows for oral conversations" in the virtual environment. And she foresees that we might have voice recognition software. Those who have trouble talking through written words could then also speak in a virtual seminar and the software would print the spoken contribution. Furthermore, Susan Pollack suggests that the participants could record their voices, upload their voices and have the other students listen to the recordings.

I have reported these suggestions only in order to show that not all the students were really content with the present virtual dialogue, which is a dialogue reduced to the exchange of written messages only.

The Survey

The issue was dealt with again when one of the students, Kathleen H. Beckman, took the initiative in further explorations. She decided that a brief survey should be carried out of the participants in order to learn the way in which this virtual seminar is experienced and how far these experiences differ from those in real seminars. She focused on three aspects: group cohesion, mutual respect, and learning value. She

formulated these three questions accordingly and asked the participants to answer them:

Membership

A. The dialogues (conferences) help me feel like I am a member of this group seminar.

B. The dialogues (conferences) do not help me feel like I am a member of this group seminar.

Mutual Respect

See Paula's quote from Dr. Peters´ book, p. 33: "Dialogical learning demands from participants 'partnership, respect, warmth, consideration, elementary under-standing, honesty and sincerity" (Reinhard & Annemarie Tausch).

A. I experience the qualities quoted above in our dialogue (conferences).

B. I do not experience the qualities quoted above in our dialogue (conferences).

Learning Value

A. So far, I have experienced the same learning value as I would expect from a face-to-face seminar dialogue.

B. So far, I have experienced less learning value from the virtual dialogue (conferences) than I would expect from a face-to-face seminar dialogue.

C. So far, I have experienced more learning value from the virtual dialogue (conferences) than I would expect from a face-to-face seminar dialogue.

Quite a number of students reacted more or less informally in their postings by mentioning only single aspects with regard to advantages and disadvantages. However, eight class members took pains to complete in this questionnaire. The result: almost all of these students felt themselves to be like members of a group although they were spread all over the United States and several other countries in the world; and nearly all of them experienced "mutual respect". Five students felt that the learning value is the same as in face-to-face seminars and three students thought that it is reduced. However, three students experienced even more learning value (see appendix 2).

Learning how to Acquire a Habit of Self-Evaluation

This final part of the virtual seminar is not meant to submit the students in any way to control, assessment or review by the moderator. Rather, it is still a relevant part of the process of self-learning – an exercise. It is suggested by the moderator as part of a farewell letter, the aim of which is to make the students ponder about what has happened to them, what they have experienced, what they have learned during the last three weeks. The students are asked to recall their self-learning activities, for instance, their reading, reflecting, navigating and searching in the Internet; writing messages; engaging in dialogues and "listening" to contributions from other participants; discussing as members of different groups; solving problems alone or together with others; arriving at decisions about learning paths; trying to relate relevant contributions of participants; and finally, composing an essay that was to mirror their intellectual development and the growth of their cognitive structure during this period.

If students involve themselves in this process of recalling and self-assessing they become acquainted with a new concept of "learning result". Traditionally these learning

results are tested more or less quantitatively and graded with the help of numbers and decimal fractions. Here the students are asked to consider the increase in their knowledge and skills in qualitative terms and in a highly complex and differentiated way. Consequently, they become acquainted with a different concept of »learning result« which will also modify and even change their idea of »learning«. It refers not only to the construction of new knowledge and skills, but also to the application of methodological approaches; to the reflection of their chosen learning paths, their individual way of self-learning, and their way of collaboration; to their adoption of new attitudes, their arriving at judgements; and, of course, to a critical evaluation of online learning in their virtual seminar (cf. appendix 3).

Discussion

The opinions of the students about their learning experiences in virtual seminars, as presented in this chapter, cannot be generalized in any empirical way. However, they indicate what students have experienced as individuals who have studied online for several months and draw our attention to a number of their reactions to this new form of higher learning. In a small way, their opinions confront us with the reality of learning in virtual seminars. This is a significant fact. It assumes even more importance because in this case the virtual seminars are not a complementary pedagogical format, merely added to face-to-face instruction on a campus (blended learning), but constitute the main and basic format of learning. Insofar, it is certainly worthwhile to analyze these findings and to reflect on them.

Underestimation of Great and Significant Differences

Many students believe that virtual and real seminars do not differ very much. This is the most striking impression when reading this chapter. According to them, the dialogues in our virtual seminars make you feel as if you were a member of the group, the group members pay respect to each other and the learning value is about the same or even higher. A few students even believe that the two formats are practically the same. Seemingly, the virtual seminar meets widespread acceptance among the students involved, more so than experts are inclined to assume. The distance between the participants and their relative anonymity are quite often not considered as negative factors. The opinions reported cannot be harmonized with the great and significant differences in virtual seminars caused by a number of attributes: a-synchronism, distribution of the participants, primarily text-based communication, and changed learning and teaching behaviors. Why are quite a number of these students not aware of these factual differences and their far-reaching consequences for the learning situation?

There are several ways of interpreting this remarkable phenomenon. Firstly, I should like to point to similar findings that were revealed in an empirical study. Heide Schmidtmann and Sonja Grothe (2001) compared both seminar formats with regard to the emotions of the students about perceived norms. They found that the mean values were very similar indeed. Positive and negative feelings, and feelings of security, could be clearly identified in both groups. But the authors did not believe in their data. They raised the question whether this remarkable correspondence between the two formats of seminars means that they are really similar, or whether the students experienced and

judged their learning in virtual seminars simply by using the same frame of reference as in real seminars.

Another explanation following the same line might be the power of the metaphor »seminar«. This would mean that teacher and students use the metaphor of the real seminar and imagine that they are really part of it. According to Friedrich H. Hesse and Stephan Schwan (1996, p. 247), adequately selected metaphors can "enhance the feeling of being present in a social (not technical) setting and facilitate processes of orientation and coordination between the learners".

Perhaps the phenomenon can also be explained by interpreting it theoretically. We could apply the »evocation model« (Döring, 1997, p. 325). This would mean that the missing background variables induce the students to develop their imagination in order to restore the learning situation they are used to in real seminars.

Obviously, the phenomenon has not yet been fully explained and calls for further investigation.

Concurrent Awareness of Advantages and Disadvantages

Many students bring forward relatively isolated aspects of their experiences in a virtual seminar. They show how varied and specific their observations are after an experience of some months only. Summarizing we can say that they refer to some distinct properties in which virtual seminars differ from face-to-face seminars: the relaxed atmosphere, the undisturbed performance, the absence of negative sanctions of personal appearance, no waiting list for students who wish to contribute, more time for reflection, the written protocol of all interventions, the possibility of multiple conversations, no inhibition, no intimidation, more reflection, thoroughness of learning activity, more dialogues, future possibilities of synchronous dialogues. These are close observations, which show a high degree of understanding. Overall, they help to characterize the virtual seminar in a unique way.

However, one student reacted quite differently and on a higher level of reflection. His contribution shows that the totality of the issue and its far-reaching consequences has been fully understood. He hits the nail on the head by maintaining that we "are not replacing (substituting) what teachers are doing in class" (Charles Kalnbach). This statement rules out all temptations to imitate and replicate traditional teaching. According to him, we are challenged to start something new, namely to expand the virtual interaction, the depth of the virtual conversation and the ability of the learner to find and use other sources of information. Furthermore, this remark suggests that a comparison between the two formats does not lead very far. Here, a clear vision of the new pedagogical approach in virtual seminars is exhibited.

The statement that real and virtual seminars are about the same with regard to social presence, respect and learning value does not mean that the students do not see and sense drawbacks and deficits as well. The rather positive reactions to the questionnaire are by no means an expression of full acceptance of, or even of enthusiasm for, the new mode of learning. In no way are the students blind to inadequacies of the virtual seminar they experience. There are certainly critical observations as well. In fact, negative opinions outweigh the positive ones.

Among the negative statements, there are some that help to clarify the issue. Students deplore the "lack of progression" which is the consequence of a-synchronism, individualized autonomous learning and network approaches. They miss the "essence" of the persons involved in the seminar, which cannot be sensed or felt because of the electronic transmission. They would like to become aware of the "energy" that is present in learning environments shared by a few or many people. They want to experience "real" discussions. These remarkable statements are based on deeper insights.

To sum up, we can say that it is interesting to see how quite a number of students manages to praise and to criticize the virtual seminar at the same time. This means that they sense the complexity of the new format, and this prevents them from providing clear-cut answers. The following posting shows clearly how the thinking process comprises negative and positive aspects as well.

> Response Title: 10/23 Dialogue in electronic communication
>
> Author: Susan M Thomas
>
> Date: Monday, 10/23/2000 9:55 PM EDT
>
> Dr. Peters, Thomas, and class,
>
> Is it dialogue when a student poses a question to a professor and receives a response through conference or an email? Has dialogue taken place when a student makes a comment to another student's post and no further interaction occurs? To me, such communications seem more characteristic of reciprocal, answering behavior than of an actual dialogue.
>
> A dialogue has movement; it has impetus – where the participants actively contribute to the progress of the conversation in the course of asking questions, expressing opinions, reflecting, and evaluating. A dialogue cannot progress if it is subject to frequent interruptions by new students entering the discussion with different thoughts. It is this lack of progression and interactivity, as well as the absence of a person's essence that I feel characterize the asynchronous conference as detached and isolated and not really a true form of dialogue.
>
> Communication transmitted through electronic media can never replace the genuineness of face-to-face communication. But, there are approaches that have been brought to light during this course that may be applied to electronic communication to reduce student isolation and facilitate learning through dialogue. Holmberg has shown that guided didactic conversations can lead to development of a personal rapport between teacher and student. On pages 36–37, Peters identifies skills that a student can develop by active participation in a dialogue. Thomas suggested the possibility of roles for students to stimulate debate, critical analysis and evaluation in a conference discussion. These approaches can certainly intensify meaningful, academic dialogue in electronic communications.
>
> If universities intend to use electronic interactions as a substitute for face-to-face communication, they must be prepared to educate both students and teachers in the practice of academic dialogue and its importance in teaching and learning in distance education. Regards, Susan Thomas.

Randy Sweeting was also impressed by the complexity of the issue. This student made it clear that there are no "simple yes and no answers" when comparing the two formats of the seminar. "Moderation and balance to me are more suitable answers than yes and no. The freedom of autonomy, the exchange of dialogue and the construction of structure may vary from person to person. One may be presented as strength, while the other(s) may be considered a weak area. The idea is to balance."

We may consider it an achievement of the continued pedagogical metacognition during the seminar when Randy finishes his intervention by saying: "Two months ago, the questions (of the survey) would have been simply answered, now they require thought." This is more than adequate feedback for the organizers of this seminar.

Structure of Discussions

One of the consequences of the a-synchronism of virtual seminars is that discussions cannot be conducted in the same way as in real world learning settings. In fact, they differ extremely. First of all, continued target-oriented debates are subdivided into many short discussion phases. Spontaneous contributions are not possible. Because every participant can express his or her views on the issue under consideration at different times and in different sections of the seminar, too many contributions accumulate. The format of the messages and the necessity to formulate and edit the contributions allow for relatively brief statements only when the students are pressed for time. The students cannot really expand on issues of personal interest or requests for further elaboration. If the debate of a given issue is resumed after some days, it is difficult to position the contribution, refer it to earlier statements and to re-establish the context. The systematic investigation of a theme, the step-by-step dealing with sub-questions, the consideration of several aspects brought forward by several participants, the justification and evaluation of arguments and full summaries are difficult to achieve. One student characterized the discussion in a virtual seminar by saying that it consists of a cosmos of kaleidoscopic mini-dialogues. Because of the importance of the scholarly discourse for the development of scientific understanding and communication, the dissolution of the discussion, so typical of a real seminar, must be considered a grave loss and be deplored.

Can this loss be compensated? Before answering this question, I should like to refer again to the fact that virtual learning spaces differ radically from real learning spaces. This means that we have to adapt to new pedagogical circumstances and possibilities. We must be open to changes, even drastic ones. One of them is to become acquainted with an entirely new structure for discussions and the appropriate new learning activities – which are possible only in virtual seminars. Here students have to deal with and cope with a growing volume of varied and multi-faceted messages. In order to be successful they have to develop skills that differ decisively from listening to oral contributions and to enter the discussion now and then. Their main task is now »reading« and »structuring«. They have to relate new written information to previous written information of the same kind, assemble clusters of information and become familiar with the threading of discussions. This process can be an individual one according to interests, predilection, and experiences. Thus, their participation in the discussion takes the form of working with, working through and structuring growing accumulations of information. Linearity is substituted by complexity.

Performing this task requires special intellectual flexibility and an overall view of the processes going on in order not to lose track of the discussion in various threads. It demands even some amount of creativity. The students are not only supposed to distinguish themselves by writing relevant contributions, but much more so by

administering the contributions of all participants, which can be a preparatory exercise for the performance of the »knowledge management« so often referred to at present.

Who is able and ready to judge which of the two forms of participation in a scholarly discourse is more sophisticated and demanding and brings about better learning: a guided and spontaneous oral dialogue in a real seminar, or a thoroughly considered and well-formulated literate dialogue, plus painstaking and never-ending work with a growing collection of pertinent e-mails and the development of a network of information and a structured personal database?

"Inactive" Students

In real seminars, it is generally understood and more or less accepted that not all participants contribute to the discussions going on. In virtual seminars, however, students who do not log on at all are considered problematic cases. Concern about their learning is voiced. Why is this so?

In real seminars we can see those students and observe their body language, which could indicate whether or not they are actively following the discussion. This is not possible in virtual seminars. Here, students who do not send in e-mails carrying their comments or arguments are simply not present. Neither the other students nor the moderator learn anything about their learning behavior. The other students may be interested in the opinions of the missing students and moderators may wish to ascertain whether they are still participating in the course and proceeding in their learning. It is interesting that in one of the virtual seminars several students suggested that each participant should be forced by study regulations to post at least one or two comments per module. This shows that there was a group feeling, which included the "inactive" students as well. However, the majority of the students rejected this idea on the ground that such a measure would be educationally problematic.

In the literature, inactive online students have quite often been called »lurkers« which suggests that they are seen as hiding somewhere and waiting secretly because they intend something bad. The choice of this expression shows that the refusal to participate in online discussion was not approved.

Such disapproval is not justified. First of all, the so-called inactive students may be very active in their ways. Secondly, autonomous students and even more so adult mid-career students have a right to decide about their learning behavior themselves. The traditional guardian functions and the authoritarian control of the teacher is no longer necessary and may even be counterproductive. And finally, reading by itself may lead to the acquisition of large amounts of knowledge. The assertion that active participation in discussions is a pre-condition of successful learning cannot be supported. On the contrary, it may well be that these students follow the discussion of the other participants more carefully and meticulously than in real seminars and may learn even more than those who take part actively by posting one comment after another. In fact, some of them do quite well academically; several have even produced the best papers for the final test.

For this reason it is better not to refer to them as "lurkers" but as »learning witnesses« (cf. Fritsch, 1999, p. 357) or »invisible students« (cf. Beaudoin, 2001). These more neutral designations mean that they can be engaged in the learning process simply by

observing the written exchanges of the active participants and that they might be learning actively in spite of remaining "invisible". Moderators should not be concerned about their learning, but about their lack of interaction with their fellow students in the learning group.

Biographies

Usually, online students present their biographies, sometimes even with a photograph. These biographies contain a short introduction of the person with regard to age, vocational and family status, place of residence. Students give reasons for taking this particular course and mention hobbies. Quite often, they describe where they live as well.

Biographical notes are critical pedagogical elements of any virtual seminar. They are shared with the other participants and with the moderator, enabling them to create their virtual awareness and increase their virtual »social presence«. This is invaluable, because all visual clues and oral stimuli of the participants are missing during the written online exchanges. The participants and the moderator have to deal with persons who are reduced to a symbolic representation by letters of the alphabet. Important psychosocial information cannot be transmitted in this way.

Small wonder that these biographies are actually read by the majority of the students, as the evaluation of the first virtual seminar shows (Fritsch, 1999, p. 376). Nearly 97 per cent of the participants went through the biographies at the beginning of the seminar. About 82 per cent referred to them during the seminar, and about 53 per cent read them when dealing with specific messages. All participants think that photos and biographies are a general enrichment of any distance education course.

In addition, moderators and faculty need to know more about the participants, who do not form a relatively homogeneous group with regard to age and previous schooling, but differ considerably in their academic careers, vocational experiences and personal circumstances. When reading their messages, marking their papers and moderating the discussion, moderators and faculty may find that this biographical information can become very significant. For instance, it is helpful to know whether the students write in their native language, whether their way of thinking is patterned by a natural science or by a discipline of the humanities, whether they are more qualified than might be expected, or whether they have to cope with professional problems. The biographies can be of further use when moderators try to address individual students and to motivate them by attempting to strengthen their self-confidence and identity. In such cases, we have to know something about their way of life. If the moderators and faculty refer to details of their biography, the students may feel that they are being addressed personally. In this way, elements of a personal relationship can be established.

In some of the virtual seminars I apply a special »postscript method«. After answering the queries of a student and presenting some of my ideas, I draw a line and write short postscripts in which I refer to such personal information in the biography. "How is your cat Suzie? We have a cat that is already 20 years old. Her name is Mauzie." –"I am sorry to learn that you have lost your position as an instructional designer." – "Congratulation on completing your second BA course at UMUC." – "As a Japanese

lady studying at a Japanese college what do you think about the concept of the autonomous learner?" "I am glad that you have found a new position, hopefully a better one." "I envy you because of your house on the beach." Such remarks are not at all banal ones. They can alter the atmosphere. The participants feel that they are accepted not only as students when talking about academic matters but also as distinctive individual persons. This must be considered a pedagogical achievement. We could imagine that communication in virtual seminars can ideally take place on two levels – an official and an unofficial one.

Evaluation

At the end of the virtual seminar that was described and dealt with here, the question must be asked whether this specific pedagogical approach towards autonomous learning on the Internet has been successful. We cannot answer this question before the criteria for "success" are established for this particular case. Naturally, we cannot expect proof that well-defined kinds of knowledge have been acquired and adequately reproduced in the same way by most of the students involved. We cannot compare these learning results and express the findings in quantitative terms. The goals of this module are structurally different. Students are to become motivated and interested in theoretical interpretations of distance education and online learning in general. They are to develop a reflective attitude, which stimulates them to analyze their learning and teaching with the help of theoretical concepts. They are to recognize the specific potentials of online learning for autonomous, self-regulated learning. They are to gather first experiences in this mode of learning. They are to become acquainted with theoretical positions in the field of distance education and online learning and possibly adopt one or the other. They are to broaden their horizons and learn about and evaluate models in distance education in other parts of the world. Overall, they are to learn how to deal with the phenomenon of distance education in a professional way.

In how far can these goals be reached? It stands to reason that each individual student will achieve this in a different, personal way. The elementary school teacher deals with the contents offered in a different way to the training specialist at a big chain of hotels, or a Fleet Liaison Officer in the Navy, or the 59 year old Ph.D. in psychology, or the program manager in the IT department with a private engineering university – to refer only to some of them. They assimilate different information, aspects and points of view.

The diversity of different approaches can be seen by reading the essays the students have to write at the end of the module. They show clearly how far they have become familiar with this previously unknown way of thinking and talking about distance education. We can see that they have increased their knowledge about theories of distance education. And even more, we can also sense how they are assuming a new attitude, the attitude of persons on their way to becoming experts in distance education.

The main advantage of the essay as an evaluation instrument is that the teacher can see how independent the students have already become in their thinking about the themes under discussion. The papers show whether the students stick to texts recommended for reading or whether they report on them in their own words, presenting ideas and critical judgements of their own in unorthodox sequences, showing the relevance to their vocational experiences and reporting about how the new knowledge can be applied in

the practice of distance education. The finest moments are experienced when the moderator sees how a scholarly consciousness is developing, when progress is made in assuming a theoretical attitude and in defending theoretical positions more or less skillfully. And, of course, the ultimate feeling of success can be experienced when students show in their essays that they are theorizing about distance education themselves.

A second instrument of evaluation is the posted comments and reports of the students during the seminar. Here we can see how some students are struggling with the new concepts, especially with the idea of self-regulated learning. We become aware of how difficult it is to change pedagogical paradigms. On the other hand, we can also see that some students are already accepting, assimilating and integrating this idea. The following statements by Rita Owen are a convincing example:

"I do not believe I am atypical of other students taking this course. At the time of posting assignments ... I felt I had put into practice the concept of the autonomous learner. The key was the fact that I chose a direction for my own personal learning and pursued that avenue with reading, research and reflection based on my own volition as an autonomous learner".

Feedbacks like this one show that the goals of the virtual seminar may have been reached. Other students appreciate that they are not only, »informed« about theories of distance education, that they are not only asked, to »learn« them, but that they are also expected to explore, analyze and practice them actively and relatively independently. They have understood the new pedagogical approach.

Appendix 1

Introductory Letter to Participants of the Virtual Seminar 9040/9041, Module 3b, September/October 2000

Dear Class Members,

I should like to welcome you to this section of our virtual seminar and to tell you that I am looking forward to our discussions. It will certainly be a great pleasure to communicate with you about theoretical approaches to distance education and distributed learning.

Let me start with two casual observations: Although we will be using the latest electronic media such as personal computers and data highways we shall still have to rely on one of the earliest means of technical communication: the written word. When we exchange written statements we are returning to the very roots of distance education, which basically means teaching and learning by writing and reading. We should keep this in mind as there are close relations between distance education and online learning.

When a discussion is being simulated by writing and reading the sequence of the contributions is necessarily a-synchronous. This may be a draw-back with regard to the liveliness and spontaneity of the discussion, but it may be also a decisive advantage for you and for me, if we like to ponder about a problem first for a time before we are ready to express what we think about the issue under consideration. This may, hopefully, raise the general intellectual level of what we will have to tell each other far above the mere conversational level in an ordinary discussion.

Some introductory remarks for our seminar sessions this week:

1. Learning strategy

While you and I know very well that the pedagogical structure of online learning in a virtual seminar differs fundamentally from the pedagogical structure of conventional seminars in classrooms we must also admit that it is difficult to adjust to the new conditions and possibilities of learning in virtual learning environments. We are all still in the process of exploring them. It is a relevant goal of this seminar not only to start thinking about theories of distance education but also to develop and shape a new and adequate strategy of learning. Therefore, it might be useful to draw up an outline of an "ideal" learning behavior. We will not be able to realize it, but it is important to know the direction in which we should go.

In our seminar you will be asked to change from receptive learning to active learning. Do not expect your moderators to present subject matter and to suggest or even to prescribe methods of dealing with it. You should know and experience a *resource*-based learning approach.

You will be asked to dig up, find, collect and store information by exploiting

- recommended texts
- Web resources
- messages from members of the seminar
- set books
- additional scientific literature (journal articles)

and to establish and alter your personal knowledge structure by integrating these activities.

You should be committed to working in groups and to collaborating actively. This means that you will communicate by e-mails with the seminar, with individual members of the seminar as well as with members of small working groups. Commenting on the contributions of others has a high priority. Remember that learning is basically a "social construction of knowledge" (Goodfellow, 2000, p. 4).

When you are to write the essays at the end of this module be sure that it mirrors your new learning activities in our virtual seminar. It should not be written in a literary style. It should not only show the knowledge you have acquired, but also the progress you have made in learning online. You might achieve this by making references to

- your sources,
- your collaborative activities,
- relevant messages of group members,
- pertinent experiences which you might have acquired in your professional life,
- opinions of your own about the problems discussed, and
- the way in which you have experienced your learning process (metacognition).

If you try to follow this advice you will be introduced into theorizing about the new pedagogical form of distance education in an *active* way which is much more important than memorizing and will result in much better learning.

2. The necessity to become an autonomous learner

This recommendation may be somewhat unusual for some of you. When working through this module try to make a conscious effort to observe your own study behavior. As you may have read on pages 46 and 84 ff. of *"Learning and Teaching in Distance Education"* learner autonomy is an important constitutive element of distance education and will become even more significant in the developing net-based learning in the »information and learning society«. My idea is that it is no longer enough to *learn* all about autonomous and self-regulated learning. We should *practice* it and by doing so become more and more independent and self-regulated ourselves. This means that the learner should make it a habit to reflect not only on the contents being presented but at the same time also on her or his learning process. Cognition should be accompanied by (pedagogical) meta-cognition. It would be very nice if at least some of the participants of this virtual seminar become conscious of this ultimate, and now no longer hidden, objective of this module and act accordingly.

3. How to acquire a professional reading habit

I am aware that you will have read some, and possibly even the greater part, of the literature recommended to you for this module. May I suggest that you go on reading and rereading those articles and sections of books during the coming weeks as this is an important feature of your behavior as an autonomous and self-regulated learner. Study especially those pieces which arouse your *personal interest* as this will help you to become motivated to participate actively in our discourses. It is much better to study intensely and in depth *one* subject that you are really interested in than to skim through *every* article and book section presented to you. In this way you will become able to build up your *personal knowledge structure,* which will differ from the knowledge structure of other class members. Knowledge cannot be measured in quantitative terms. One of the hidden goals of this module is to help you to acquire a *habit of reading and thinking about theoretical problems of distance education* even after you have finished this course. It is simply a characteristic feature of professionals in our field as well as in other professional fields.

4. Discussion problems

As to the nature of our discussions we must be careful not to misunderstand their *function*. It will differ from the face-to-face situation in ordinary college class situations in which you have gained experiences for years. Basically, the teacher is *not* supposed to offer new contents, nor does he or she wish to check on what you have read. The responsibility for your study rests mainly with yourself. However, what we are aiming at is your co-operation in isolating major problems and clarifying their preconditions and circumstances. This will enhance your understanding of distance education in a special way. It will enable you to pass judgements based on your own thinking and on your reflected convictions. The discussions will mainly take three forms, namely

- between yourself and individual class members,
- between yourself and the group of fellow students,
- between yourself and the moderator, and
- between the class as a bigger group and the moderator.

It might be interesting for you to find out whether the discussions will differ in these four distinctive formats, e.g. with regard to contents, direction and tone.

It is certainly useful to be aware that these discussions consist of sequences of »*interactions*« and »*communications*« *(have you ever tried to distinguish between these two activities?).* While it is true that these discussions can be dominated by one person or one side it is equally true that they can be balanced and that you are able to be autonomous in the sense that you are not merely a passive "listener" but also an *active* student who takes the initiative to discuss problems which are important for your understanding of distance education.

When reading and rereading the texts recommended to you in the chapter on "Course Materials" it might be useful to think about and formulate your reactions: statements, questions, recommendations, experiences and ideas. But bear in mind: do not use all of them as contributions to the discourse in the seminar. Try to select them according to the criterion whether or not they will also be interesting and informative for the *other* participants, and whether your contribution will *advance* the discussion. You might think that these recommendations are unnecessary as you are used to these seminar techniques, but experience of former virtual seminars shows that the discussions can become often critical if there are too many "trivial" questions to be dealt with which disregard and miss the objectives of the discourse. Do not put a question unless you have tried to answer it yourself twice.

Every good wish for your studies!

Kind regards, yours

Otto

Appendix 2:

Differences Between Face-to-Face Seminars and Virtual Seminars

In the review the following questions are to be answered:

Membership

A. The dialogues (conferences) help me feel like I am a member of this group seminar.
B. The dialogues (conferences) do not help me feel like I am a member of this group seminar.

Mutual Respect

See Paula's quote from Dr. Peters' book: "Dialogical learning demands from participants 'partnership, respect, warmth, consideration, elementary understanding, honesty and sincerity'. (Peters 1998, 2001, p. 33)

A. I experience the qualities quoted above in our dialogue (conferences).
B. I do not experience the qualities quoted above in our dialogue (conferences).

Learning Value

A. So far, I have experienced the same learning value from the virtual dialogue (conferences) as I would expect from a face-to-face seminar dialogue.
B. So far, I have experienced less learning value from the virtual dialogue (conferences) than I would expect from a face-to-face seminar dialogue.
C. So far, I have experienced more learning value from the virtual dialogue (conferences) than I would expect from a face-to-face seminar dialogue.

Findings

Name	Member-ship A (yes)	Member-ship B (no)	Mutual respect A (yes)	Mutual respect B (no)	Learning value A (same)	Learning value B (less)	Learning value C (more)
Kathleen Beckman	***X***						
Steven H. Arnold	X		X		X	X	X
Rhonda L. Black	X		X		X	X	
Ronald Brown	X		X		X		
Paula J. Hubble	X		X			X	
Randy Sweeting	X		X		X		
Susan M. Thomas	X	X					X
Gerald Thompson	X						
Jacqueline Timoney	X				X		X

Appendix 3:

A Questionnaire for Eliciting an Attitude of Self-Evaluation

Dear class members,

Finally, I would like to ask you to *evaluate* yourself as this is the most important element in your autonomous learning process. It is an experiment in metacognition. You should be able to ask yourself: Have I profited from module 3? And if so – how far? These are some of the possible answers. You may check whether they apply to you.

- I have become convinced – or I am now more convinced than ever before – that theorizing about distance education is very important for becoming an expert in distance education.
- I have been introduced to three key areas of theoretical thinking in distance education and what is more, I know where to find more information about them and others, I know the names of some of the more important theorists in distance education and already have some idea about what they stand for.
- I have become familiar with definitions, criteria and theoretical approaches in distance education which help me in expressing my ideas about distance education and in analyzing distance education practice.
- I have become aware of several theoretical issues. They help me in developing thoughts of my own about distance education.
- I have broadened my horizons. I have learnt that there are many theoretical approaches to distance education in other parts of the world which differ because of very particular cultural backgrounds.
- I have experienced how important pedagogical approaches are in distance education as well as in net-based distance education. If you go the distance education way hitherto unconscious pedagogical processes practiced in face-to-face teaching have to be revealed, described and adapted to entirely different circumstances. Learning by doing is not possible here any longer. We have to develop new pedagogical systems and this task requires theoretical knowledge and insights. I have internalised that technological investments alone cannot improve education. What is important are educational goals, pedagogical strategies, student-oriented teaching, awareness of the societal context, etc. Equal investments must be made into the training and permanent retraining of teachers and other personnel involved in this process and not only in handling technology.
- I have developed clear insights into the decisive differences between expository teaching and receptive learning on the one hand and autonomous self-regulated learning on the other hand. I am inclined to believe that the more electronic technology is used in education, the more chances and possibilities will emerge for autonomous learners.
- I have resolved to go on reading relevant literature about the changes and transformations taking place presently in the concepts of distance education and to participate in theoretical discussion on this subject.

Kind regards,

Otto

9 "Information" and "Knowledge" – On the Semantic Transformation of Two Central Terms

Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?
(T. S. Eliot: Chorus from "The Rock" (1963, p. 161)

That great book which reported on the profane forces which hold the modern world together deep inside is "Das Kapital." If someone wanted to carry out something similar today, the book would have to be called "knowledge".
(Norbert Bolz, 1997, p. 677)

Digitalisation and computerisation are changing teaching and learning in multiple ways, if we just call to mind the progress of on-line learning in schools, institutes of higher education and continuing education. In on-line learning, we might be tempted to think the change is taking place with regard to new pedagogical scenarios, organisational forms, strategies and methods of teaching and learning. In reality, however, content is also affected, namely the knowledge that is to be imparted or acquired. The change is much more fundamental here and affects the core of the pedagogical process. The knowledge that is developed at the computer with the help of an unimaginable abundance of easily accessible information differs structurally from classical knowledge. By concentrating on this fact we hit a nerve which radiates out to other areas of learning and changes them. But there is more to it: even our thinking, the way in which we gather knowledge and deal with it, in fact our whole intellectual life, is affected by this process. An external sign of the changes taking place here is the almost inflationary use of the terms "information" and "knowledge" and we will be examining this phenomenon here. The following paper will deal with the consequences that this change has for teaching and learning for continuing education.

Introduction

Ever since instructional designers discovered the extraordinary innovative power of the digital learning environment and started to experiment with it, their specialist language has been flooded and permeated by terms from other disciplines. These terms all stem from information and communication technology and originally were not meant pedagogically, so that they in fact did initially not have any significance for instructional design or pedagogy. Those who work daily with them in digital learning environments, who have become familiar with their use, are often unaware of the massive penetration of terms from other fields into their own specialist language. We are dealing here with a silent, hardly noticeable process, which is why the use of these different terms has been accepted without comments. Have we ever heard objections to the use of terms such as the following?

> Animation, browser, browsing, bulletin-board, buttons, chat-room, computer conference, expert system, forum, groupware, guided tour, home-page, hot words, hyperspace, hypertext, hypermedia, interface, Internet, knots, knowledge bases, knowledge building, link, log in, multimedia, navigating, network, newsgroup, password, retrieval, simulation, software, teleconference, virtual conference, virtual reality, world wide web.

The actual number of terms that are now commonly found in instructional design and pedagogy, but are still new, is very much greater. Using terms from other disciplines is

nothing new for pedagogy. For example, many terms that most definitely come from the fields of psychology or sociology have been taken over and found a new home in pedagogy. We only need to remember the behaviourist terminology which turned up in the context of programmed instruction, the "autocratic and socially integrative behavioural forms" of teachers according to Reinhard and Anne-Marie Tausch (1979) and the term "socialisation". However, these were in each case individual terms which were related to processes of education or learning from the start; with the digital learning environment we have an incalculable abundance of alien terms which do not have any such reference of themselves. Pedagogues and instructional designers are forced to adopt them if they want to use the potential of the digital learning environment for their purposes. The alien terms are, it is true, interpreted pedagogically and given new meanings, a procedure which usually takes place unconsciously or at least semi-consciously, and is hardly ever reflected on.

In this situation of linguistic reorientation and semantic adjustment the particularly frequent use of the terms "information" and "knowledge" is striking. In the period before the digitalising of learning neither term played a particular role in pedagogy and didactics[3]. Today, in contrast, they are in current use and can be found in many books, papers and lectures. We can see through this just how much the pedagogical situation has changed in a few years.

It is obvious that the term "information" is preferred. It appears much more frequently in the literature. It is possible that this is supposed to signal open-mindedness to the dramatic advances made by information and communication technology, to appear innovative and progressive, or to demonstrate conformity with the *zeitgeist*. Its increasing use irritates pedagogues who are sceptical of innovations, because they see in it a "de-pedagogisation" and "technological third-party determination" of their own specialist language.

Information and knowledge are frequently mentioned together. They often stand together as a terminological pair or are even used as if they were interchangeable. This leads to terminological fuzziness. In this situation it is necessary to demonstrate precisely what these two terms actually mean and how they differ from each other in principle and pedagogical practice. Only on the basis of the criteria that are acquired here can we decide whether we live at present in an »information society« or in a »knowledge society«, and whether the complaint by T.S. Eliot quoted at the beginning of this article refers also to our current consciousness and is therefore justified.

Information

"Information" is derived from the Latin *informatio* meaning "conception, instruction, admonition." The corresponding verb *informare* means "to educate, conceive something, explain, teach something" (Heinichen, 1947). The use of the borrowed word includes both the process and the object components. In the analysis of this term we must keep

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[3] Significantly, these terms are not found in older German pedagogical lexica, e.g. Groothoff & Stallmann (1968), Rombach (1970) and Wulf (1974) or in more modern pedagogical lexica, e.g. Böhm (1994), Reinhold, Pollak and Heim (1999). There are no separate articles dedicated to the subject of "knowledge" in more modern German handbooks on adult education (Nolda, 2001, p. 101).

two meanings separate from each other from the very start: the traditional meaning and the communication technology meaning.

Traditional Meaning

According to the Oxford English Dictionary (1998) the word was first seen in English in mediaeval scholasticism and meant "the action of informing matter" (OED, 1998, p. 944). The earliest source is from the year 1387: "there is i-write that fyve bokes com doun from heven for *informatioun* of mankynde". At that time the meaning of the word was much broader than the one we are accustomed to today. It was also understood to mean the "formation or moulding of the mind or character, training, instruction, teaching, communication of instructive knowledge" (OED, 1998, p. 944). A pedagogical focus is obvious here. Parallel to this there were always restricted meanings, which have established themselves in the course of the history of words: "The action of informing, communication of the knowledge or news of some fact or occurrence; the action of telling or fact of being told of something". And "knowledge communicated concerning some particular fact, subject or event; that one is apprised or told; intelligence, news" (OED, 1998, p. 944).

The partition into process and object elements, which can be seen from the last reference, can also be detected in German. For example, under "information" the *Große Wörterbuch der deutschen Sprache* by Duden understands both the process of informing and instructing about a defined matter and the content of the information: the information, expression or reference (Duden, 1999, p. 1355). However, in general everyday language the range of meanings is greater. The word is used here to mean "news", "advice", "knowledge", the "quantity of what is known", as well as facts that are passed on by media (e.g. newspapers, radio, TV).

With all these words what is always important is the *meaning* which the transmitter and receiver of the respective information attach to it. In journalism, for example, the *contents* are always in the foreground with "news" and are transmitted in coded form by the originators with a defined intention and interpreted by recipients from their own consciousness. The information acts here basically as the carrier of meaning. For this reason the following definition makes sense: information is "transmitted news with factual meaning for transmitter and receiver" (Encarta, 1999).

This is the meaning when the word "information" is used in general everyday language with the usual frequency.

Communication Technology Meaning

In contrast to the above, the meaning of "information" in the context of electronic information and communication appears to be completely different. Everyone can see the inflationary use. Some contemporaries even talk of an "information explosion" (e.g. Chargaff, 1995, p. 11) because they can feel the enormous effect of the constantly increasing abundance of this information and its proliferation in all directions. Those who, like Paul Virilio (1998), see in greater depth, even diagnose its unusual social explosive force. One of his books carries the significant title *"La bombe informatique."* In this book he places the "information bomb" in a series with the atom bomb and the

demographic time bomb (Virilio, 2000, p. 123) and points accordingly to their share in provoking an apocalyptic end to human civilisation.

Those who want to understand the inflationary use and enormous force of this second version of the term "information" have to become familiar with those different meanings which it only acquired in the context of the reception of the American theory of information, information and communication science and informatics. The English word (*"information"*) was placed alongside the Latin word (*"informatio")*. In these research fields information is naturally the central term, which is in fact signalled through the names of the disciplines. However, its meaning is decisively *different* from the ones sketched in here. "Information" here is something that is derived from *transmitted data, signals or signal consequences*.

How did it come to this difference in meaning? In *information theory* the term "information" is defined purely *formally*. The basis for this is the mathematical theory of the transmission of information from Claude Elwood Shannon and Warren Weaver (1978): for them, information becomes a mathematically describable technical term which deviates considerably from general use because the "sense" and "meaning" of the information is not important.[4] With its help attempts are made to explore empirically the *quantitative* regularities of the transmission of information and to show them in formal theory. This deals, for example, with the ordering characteristics of the signals, channels and their capacity, the efficiency of encoding, the calculation of information quantities or of transmission faults, in other words, with the fundamental conditions of productive information work, which is understood to be "working out, processing and managing items of information" (Kuhlen, 1991, p. 334). These circumstances are extremely important for pedagogues, because learning is primarily a matter of understanding the "meaning" of information.

The information theory paradigm was taken over by *informatics,* the science of automatic knowledge processing. Here it is important above all to enable the above-mentioned information work *technically*, in other words, for example, searching, finding, recording, storing, retrieving, transmitting, converting and arranging items of information. In order to be able to develop the appropriate technologies, the information was subdivided empirically into its components or elements. These are referred to as "signals" and "data".

Signals are signs that are given through technical means, sent over a distance and whose meaning is agreed beforehand by the sender and the addressee. In cybernetics this is an energy-laden physical process. An attempt is made above all to detect and reconstruct the formal and technical sequences of this process. The technically skilled interpret a series of signals, which bring about something definite in defined situations, as modules for the creation of information. The signals that come from the letters of the text can take on the character of images through multimedia and simulations, through which a new tape of encoding of information is created. This consists of a type of "pictorial

[4] This research discipline was able, however, to use the help of empirical means to say something about the "content" of information. it measures the information content with the degree of uncertainty that is caused by the lack of the information. The value of an item of information is determined by the significance that it has for the addressee. It is great, if the information is completely unexpected, and low if the content is more or less known beforehand. In other words, this is simply a *formal* characterisation of the content of the information.

language", through which an information paradigm change, the so-called *"pictorial turn"* (Mohr, 1999, p. 18) is announced.

Data are signals or signs that have characteristic parameters that provide information on their features, processes and sequences in technical procedures and appliances, but that do not provide any information on the meaning of the contents. We differentiate between seven groups of data types: formatted data (e.g. characters or chains of characters), text, vector graphs, pictures, sounds, film or animation (Weigend, 2002, p. 2). Data are, so to speak, the raw material that can be worked and processed in data processing installations, even if they are found in large quantities. These installations do amazing work, because they can in fact gather, enter, transmit, process, store, link and output the (encoded) data. But all these various operations are of a strictly formal nature: input data are processed in accordance with strict rules, so that output data can be gained from them.

Information is created through the interpretation of data. Data are in fact transmitted and brought to individuals, but they do not become information until these individuals have made a selection and processed them through interpretation. It is therefore possible to have large amounts of data without acquiring any information. The appropriate interpretation takes place in a different way with each individual and also leads to different results, because the whole individual life history of the individuals concerned influences the process: their needs and emotions, their knowledge, interests and socialisation, but also their imagination and their ideologies (cf. Weizenbaum, 1998). We are dealing here with cognitive processes, even if they in fact mainly remain unconscious.

The rapid and overwhelming advances in IT and communication technology are the real reason for the actuality, great significance and broad spread of this information term. PCs with multimedia have penetrated most areas of work and life and their use is now routine. In the USA people speak of "information highways", which link people globally and provide ever-faster access to ever more information. Throughout the history of mankind there has never been such quantity of rapidly accessible information. Cultural critics even speak of a "flood of information" and describe the abundance of "unusable" information rather derogatorily or disparagingly as "information garbage."

However, if we follow the arguments of Joseph Weizenbaum (1998), these designations are in fact misleading. The monitor of a PC simply displays signals and data, mainly in the form of letters, figures and graphics which are without meaning to those who have not learnt to interpret them. Items of information of various kinds and at various levels are only created through the process of interpretation. To be more exact we should not refer to "information highways", "floods of information" and "information garbage", but to "data highways", "floods of data" and "data garbage", because the information itself is created in the minds of the individual users, and their capacities are limited.

Notwithstanding all formal operations that may still be important during compiling, working and processing, information gained through interpretation can also transport meaning in that it is usually "pre-interpreted" before being encoded, whereby individual, societal and cultural contents have an effect here as well. In addition, there is the context of the individuals who convert the data into the actual information. The information that is created in this way is therefore the product of *double* interpretation. Can we say because of the above circumstances that this information is already knowledge?

Knowledge

The term "knowledge" is also in use as never before. It is used extremely frequently and in recent years has been found in composite terms, such as "knowledge base", "knowledge design", "knowledge capital", "knowledge economy", "knowledge marketing", "knowledge worker" and above all "knowledge society". Experts speak of the "knowledge-based society" and "knowledge-based management" (Castells, 2001, p. 107). With this term as well we must separate the traditional meaning from the meaning that it has acquired in our post-modern, computerised present. Its current popularity and the composite terms referred to above stem from this.

Traditional Meaning

In contrast to "information", "knowledge" is not a loan word. It was already in use in Middle English in the forms *knowlage, knowledge, knowleche*. The verb *to know* can be traced back even further and was written *cnawan* in Old English. It is therefore an indigenous word and has deeper roots in everyday language.

The Oxford English Dictionary (1998, p. 515) derives the following variations in meaning, among others, from the history of the language.

- "The fact of knowing a thing, state, etc., or (in general sense) a person: acquaintance; familiarity gained by experience."
- "Acquaintance with a fact; perception, or certain information of, a fact or matter; state of being aware or informed; consciousness (of anything)".
- "Intellectual acquaintance with, or perception of, fact or truth; clear and certain apprehension; the fact, state, or condition of understanding, intelligence, intellect."
- "Acquaintance with a branch of learning, a language, or the like; theoretical or practical understanding of an art, science, industry, etc.".

And Webster (1953, p. 1373) differentiates the following meanings in modern usage:

- Familiarity gained by actual experience, practical skill, technical acquaintance.
- The act or state of understanding; clear perception of fact or truth.
- That which is gained and preserved by knowing; instruction, enlightenment, learning.
- A thing that is or may be known, a subject to which a knowledge relates.

What is significant is his indication that there is knowledge "acquired by the senses or by feeling or intuition (or the internal sense)" to which expressions such as *"knowledge of acquaintance, immediate knowledge, intuitive knowledge, sensitive knowledge"* refer.

We can acquire a deeper insight through the analysis of the basic verb *to know*. This is related etymologically to the Greek *gignoscein* and the Latin *(g)noscere, cognoscere*. The basic meaning is *"known by the senses".* This explains the relationship of the word "know" with "see". In everyday language "I see" means something like "I understand". Webster (1953, p. 2265) indicates a variation in meaning of this word: "to perceive by mental insight, to form an idea or conception of, understand, comprehend; and to see the truth". What is above all important here is that knowledge is the result of an *activity* of the human mind.

The same findings can be seen in the German word for knowledge, namely "Wissen". "Wissen" originally meant something like "having seen". In the Germanic language **wait* does in fact mean "to know", but describes a condition which is achieved through activities such as "finding, recognising, seeing".

The Latin verb *videre* corresponds to this. Knowledge is therefore not a thing, an object from the outside world. It presupposes certain mental activities on the part of a *subject*. The searching, finding, seeing, detecting of a person are all upstream activities. This corresponds to the meaning given to "knowledge" in Grimms' dictionary for the 17th century. According to this, "knowledge" is connotated *"subjectively as personal mental possessions"* (1934, p. 746).

If we start from the current linguistic use the word means (in German) above all the "totality of information" that someone has (in a defined field) (Duden, 1999, p. 4538). In the broadest sense this is acquired through personal experience. This led to Dolf Sternberger (1970, p. 153) characterising knowledge as "past and filtered experience."

This general understanding divides up into several dimensions of meaning. For example, "knowledge" can mean traditional knowledge that is handed down, understanding something on the basis of sensory impressions and intuition, being conscious of something and familiarity with things or facts that we can acquire through experience, special capabilities skills or even technical skills. On the other hand there is also "latent" knowledge (Klix & Spada, 1998, p. 1), also known as "tacit" knowledge (Lundvall, 1992), which is imparted by interaction. Here, too, it may mean understanding on the basis of cognitive processes, intellectual permeation and abstractions. In addition, the term covers knowledge that is acquired through learning and studying, and scientific knowledge. This is knowledge that can be substantiated logically and checked methodically and is clearly differentiated from mere opinion and belief. It is acquired through theoretical reflection and empirical experiments and is intensified in theories. Its validity can be verified by means of generally accepted criteria.

The word "knowledge" has therefore a differentiated, layered range of meanings. The following characteristics must be highlighted:

1. *Demarcation:* Knowledge must be differentiated from mere perception, susceptivity, opinion, belief and conviction.
2. *Binding to the subject:* All nuances of meaning show that it is acquired in each case through the cognitive activity of a *subject*. This activity may still consist of looking at something (exactly), observing, recognising, and understanding. It is also based on the output of memory, the power of remembering and reflection. However, it may also take on the character of a mental dispute with the object perceived
3. *Integration*: If information "is linked to subjective knowledge through processes of construction and integration, the knowledge structure that is created is evaluated as acquired knowledge and described as *integrative knowledge*" (Wirth, 1997, p. 150).
4. *Content dimension:* The contents of knowledge can be categorised in various ways. A division in accordance with areas of application is common, for example theoretical, practical, political, mathematical or "human" knowledge. On the basis of the function of knowledge we speak of knowledge of facts, rules, principles, action or of communicative knowledge (Meder, 2000, p. 34).

5. *Exploitability:* Christian Schucan (1999, p. 26) restricts the last description by including the *exploitability* of those types of knowledge and the *time factor*. Under "knowledge" he understands "the totality of abstract structures that are usable *now* and understood as *useful*."
6. *Relation to action*: Knowledge finds "its external shape" (Klix & Spada, 1998, p. 3) in ability and action. Nico Stehr (1994, p. 209) even interprets knowledge as a "stratifying phenomenon of social action."
7. *Medial dimension:* Media influence both the production and the nature of knowledge. For example, Michael Giesecke (1992, p. 93) has described how the structure of knowledge was changed considerably in early modern times as a result of being written down: visual forms of perceptions became more important than ever before, linguistically understandable messages came to the fore, existing knowledge became increasingly socialised and its dissemination accelerated.
8. *Evolution theory dimension:* The relationship of knowledge to the subjectivity of individuals may also be substantiated by its link to circumstances caused by evolution. Knowledge runs through three phases in the development of humans and the individual: magical knowledge, ritually mythical knowledge and reflected cognitive knowledge, which are located biologically in the reticular system, the limbic system and the neocortex (cf. Bühl, 1984, p. 18; quoted in Degele, 2000, p. 41). In his book *"Zur Biologie der Kognition"* (1993, p. 163) Wolfram K. Köck comes to the conclusion that because of our biological determinacy we do not have any direct access to reality "as such."
9. *Socio-historical dimension:* Knowledge should not be seen simply as an interwoven relationship of terms that is, so to speak, valid for all time in its abstractness and objectivity. It is more the case that current knowledge is influenced and in part even marked by the way it has developed through the centuries or even millennia in different societies. Knowledge was added to knowledge and built on this. However, this is not an additive but a structural process. Every "individual is confronted emotionally and cognitively at birth with the most developed level of the store of knowledge that has been developed and handed down through society and mankind" (Bracht, 1997, p. 91). The knowledge that is acquired in dealing with this store of knowledge is given its own unique character at all times, in each society and in the mind of each individual. In the course of time, the "whole structure of human knowledge" and the "whole way of thinking" (Elias, 1983, p. 92; Bracht, 1997, p. 91) change. Because of its socio-historical genesis, knowledge is a social phenomenon and, according to Elias, includes "experiences and feelings, acting and behaving." Michael Giesecke (1992, p. 81) provides another insight into this socio-historical process. He describes the nature of traditional knowledge by examining the authors of specialist prose from early modern history and their ideas on the sources of their knowledge. According to this, their knowledge was acquired "with *different* reflections": in "manifest dealing with the objects", through "visual experience", "acoustic perception" of spoken language and by reading hand-written and printed texts.
10. *Emotions:* We do not store our knowledge without any emotion and we react to changes to our knowledge with feelings. People are not intelligent expert systems. They gain certain attitudes to their knowledge and develop individual habits.

"Knowledge and the attitude towards knowledge form a dialectical unit." (Bracht, 1997, p. 92).

The subjectivity of knowledge becomes particularly clear when we turn to the highest form of knowledge, namely *wisdom*. Staudinger and Baltes (1996, p. 57) define this as

> "Professionalism in the fundamental pragmatics of life that is displayed in the greatest knowledge and the greatest discernment in dealing with difficult problems of planning, shaping and interpreting life."

Wisdom is fed equally from practical, theoretical and ethical knowledge and from a large quantity of reflected experience. It is expressed as knowledge of life and cannot be stored. It is lived and experienced by those who possess it.

Excursus: Points of View of Other Disciplines

Some dimensions of the meaning of the term "knowledge" become clearer if we refer to selected sociological, psychological, epistemological and philosophical concepts.

Sociological aspects

Impulses for a more complex understanding of knowledge have come from the sociology of knowledge since the 1920s. This examines above all the social conditionality of knowledge by drawing attention to societal impartibility of human thinking. Karl Mannheim (1929) spoke of the "binding to the existence" *(Seinsverbundenheit)* of human recognition. The societal structures have the effect of a filter for thought. The results of this thought cannot therefore be analysed and understood adequately without them.

Today, examinations with this in mind are made of "the relationships between knowledge, consciousness or the concepts of material and social interconnections on the one hand and the social structures and processes in which this knowledge is created on the other" (Hillmann, 1994, p. 945). The effects of ideologies and *Weltanschauungen* play a special role here.

For Gernot Böhme (1981, p. 446), all knowledge contents must be reproduced socially. In his opinion, forms of knowledge are not determined only by cognitive structures but also be the bearer of the knowledge, of the respective social category, group, community or sub-society. The type of generation and reproduction, of the way of imparting and the application context of the knowledge and the forms of its legitimation are also important (cf. Namer, 1981).

Böhme (1981, p. 445) therefore arrives at the following definition:

> The "ideal stocks of a society are ... the self-produced forms of human generic life and also the products of intellectual appropriation of nature. These ideal stocks of society are to be referred to as knowledge *contents*, as *knowledge* in the sociology of knowledge sense of participation in these stocks of knowledge."

Psychological aspects

As with pedagogy, "knowledge" was not a common scientific term in German *psychology* right up to the 1970s. It was not until the influence of research into artificial intelligence was felt that this object was discussed (Aebli, 1983, p. 33). Since then, relevant research has expanded to such an extent that it appeared necessary to show their results in a large separate volume of the "Enzyklopädie der Psychologie" (Klix & Spada, 1998).

In the introduction (1998, p. 1) the authors define knowledge as follows:

> " 'Knowledge' refers originally to the way things, or correlations, in the environment appear, whether this environment was experienced directly, or whether it was mediated through language and images, for example through the media. In the results of mental processes this knowledge is extended to derived correlations, as they are acquired in logical thought or when solving problems. People process information to "acquire knowledge, to extend beyond this knowledge by thought, to gain new insights and to solve difficult problems." (Weinert, 1997, p. 170).

As a "material goal" of the psychology of knowledge Klix and Spada refer to exploring how human knowledge is designed so that "its contents are available if required and remain latent and ineffective when they are not required" (Klix & Spada, 1998). In addition, the following studies are relevant for this subject:

- Encoding and storing "information" in the neural system. According to this, psychologists also see cognitive performances as phenomena of information processing. The proximity to epistemology, informatics and to work on AI becomes clear here.
- The life-history interpretation of knowledge. According to this we can see the acquisition and correction of knowledge as a never-ending process which runs through in every individual.
- The historical development of knowledge. Eight stages of the change are detected, described and examined – from early cultures without writing through to the present computer age.
- The comparison of the knowledge of novices and experts.
- Processes of the acquisition of knowledge. Acquisition of knowledge is understood as the "acquisition of the world." It has been recognised that knowledge contents influence the world picture.

What knowledge is depends naturally on the epistemological orientation of the respective psychologist. *Cognition researchers* assume that knowledge is imparted to an individual from outside, transported so to speak from the "warehouse" into the heads of individuals (cf. quotation by Mandl, Gruber & Renkl, 1997, p. 167). A contrary conception is held by *constructivists*, who claim that individuals always construct knowledge from inside, whereby factors of the respective person, the respective environment and the respective special situation all interplay. Knowledge is therefore understood as an individual, situation-linked process.

> Knowledge is "a collection of internal operations that an individual generates and refines though his constant efforts to stabilise the perturbations of the environment". (Goorhuis, 1998, p. 1).

E. Kahle (1995, p. 10) also defines knowledge in this way.

> Knowledge is "a subjective, self-referring, experience-guided construction of the brain".

A *psychological* subdivision can be developed if we apply the categorisation of Lee J. Cronbach (1963, p. 65). He differentiates "pre-verbal knowledge" from "verbal knowledge" and then differentiates four types of knowledge in different stages of complexity: *description, prescription, principles,* and *systematicized knowledge*. For him, "knowledge" is *"a storehouse of possible solutions and of materials from which solutions can be created".* The image of a storehouse indicates a concept of cognition research in which an objective, abstract stock of knowledge is assumed that consists of facts and rules.

The concept of "inert" knowledge should be referred to here as well. This apparently exists but is not applied to solve specific problems because the meta-knowledge required for this has not been developed sufficiently, its structure does not "fit" correctly or is too bound to a situation (Renkl, 1996). A further indication of how heavily the type of knowledge is dependent on the individuality of the respective subject.

Cognition science aspects

In this interdisciplinary field knowledge is examined with regard to AI, informatics, cybernetics, linguistics, neuropsychology and cognitive psychology. In the foreground are the "mental representation", the model functions of the computer and the process of information processing. In contrast emotional, historical and cultural factors and the respective context are neglected. Accordingly, Karl-Heinz Mandl, Hans Gruber and Alexander Renkl (1997) refer as follows to this attitude towards knowledge that is typical for this approach:

> Knowledge is "a collection of facts (declarative knowledge) and rules (procedural knowledge) which exist objectively independently of individual individuals".

Philosophical aspects

In antiquity, Plato (427–346 BC) developed a general theory of knowledge. For him, real objects and social and political reality were changing constantly. Knowledge of them was therefore uncertain, apparent knowledge. Secure knowledge ("episteme") was only possible in the realm of ideas, which he saw as the original images of what can be grasped empirically. These were unchangeable and therefore valid forever. The idea of what was good was a regulating meta-idea in this case. To Plato's way of thinking knowledge was not power but a commitment and an obligation: people should observe things in order to recognise their own true being and should answer for the truth of things. The theory of ideas enables a connection of the striving for truth and beauty.

In contrast, in the 17th century knowledge was understood differently, a change which was to have an effect through to our own times. Francis Bacon (1561–1626), the founder of English empiricism, interpreted knowledge pragmatically. For him, knowledge and

ability were one and the same. Knowledge enabled man to control and dominate nature. For him, knowledge was power: tantum possumus quantum scimus.

In his "Phenomenology of the Mind" (1949, p. 549), Georg Wilhelm Friedrich Hegel (1770–1834) describes how "pure thought" achieves a highest level, namely the "last guise of the spirit", which he calls "absolute knowledge".

In our own times, Georgy Schischkoff (1991, p. 785) interprets knowledge as follows: knowledge presupposes that people have insights and experiences that are subjectively and objectively "certain" and from which they can form judgements and conclusions which themselves are secure enough to be seen as knowledge. The certainty about our own knowledge can be acquired through questions and research and well-founded recognition. Philosophy provides epistemological and critical contributions as well as substantiation and justification processes.

Post-Industrial Meaning

When today representatives of industry, politics and the media refer to knowledge in a pointed and demanding way they do not mean knowledge in its traditional meaning but something completely different. This different meaning is not even related to the traditional meaning of knowledge but fundamentally changes not only its semantic meaning but also its social function.

This new meaning came about during the last forty years. It was announced in social analyses by US and Japanese economists. For example, Fritz Machlup (1962) published a work on *The Production and Distribution of Knowledge in the United States*, in which he diagnosed the beginning of a "knowledge economy." And in 1963 in his "The Industrialisation of the Mind" Tadao Umesao saw the start of an era which would take the place of agriculture and industry (cf. Kleinsteuber, 1996, p. 33).

The new interpretation of knowledge was underpinned in 1973 by the American sociologist Daniel Bell (1985). He saw at a very early stage how the industrial society was gradually changing into a "post-industrial society", whose main characteristic was the significance of theoretical knowledge and of technology. Whereas in the industrial society three sectors determined the economy of a country, namely agriculture, industrial production and services, "theoretical knowledge" was now added as a further sector of comparable importance. For Bell the acquisition and codification of theoretical knowledge was a new axial principle. The knowledge-based technologies for controlling society became increasingly important for him. He forecast the emergence of a new social group, a "class of professional and technically qualified occupations with engineers, technicians and scientists" (Bell, 1973, p. 258; Degele, 2000, p. 24). This was defined through knowledge and was to be demarcated from business and politics. It would enable the development of a new industry, which was mainly based on scientific foundations.

The development of industry and society that has actually taken place has confirmed these forecasts. Digitalisation has in fact reached wide areas of occupational, scientific and even everyday life. In conjunction with this unique technical development knowledge has achieved significance never before experienced. It has become a "resource" (Rode, 2001, p. 59), even the "most important resource in society in the 21st century " (Krempl, 1998, p. 1), a "new force for productivity" (Müller 2001, p. 1119), "capital that takes its place alongside capital equipment, human resources and social capital" (Poltermann,

2001, p. 2) and to the central category of economic life, a "value-added factor of the first order " (Degele, 2000, p. 23).

In his references to new developments Nico Stehr (1994, p. 36) demonstrated just how far this knowledge has transformed society: " 'Scientification' as the scientific penetration of all areas of life and field of action, professionalisation (of occupations) as the crowding out of other forms of knowledge through science, the development of science as a direct productive force, science and education policies as the creation of a special sector of politics, the production of knowledge as the formation of a new production sector, the technocracy debate as a change in hierarchical structures, the power of experts as a transformation of the basis for legitimation of a hierarchy through to special knowledge, the development of knowledge as the foundation of social inequality and social solidarity and the transformation of the dominant sources of social conflicts."

For this reason, the term "knowledge society" has been a key word since the 1980s alongside the term "information society".

"Informed" Knowledge

When we have experienced from the history of knowledge just how fundamentally new media have structurally altered the knowledge that they impart[5], we must expect this to be the case with knowledge that is acquired with the help of computers. The assumption that "our" knowledge changes will be strange for many people because scientific knowledge in particular has long appeared to be beyond doubt. In the second half of the 19th century scientific knowledge in particular was sacrosanct (Gerhardt, 1999, p. 95). We are still today under the impression made by the part played by knowledge in the industrialised world of work and everyday life and as laypersons have made a firmly outlined image for ourselves which still contains the concept that knowledge survives time, because it is traditional and in its fundamentals (the cognitive universals) is actually unchangeable.

This makes it all the more important that we understand why knowledge that is produced with the help of networked computers has now changed so much that we have to speak of "another" knowledge. Michael Gibbons et al. referred to this other knowledge in 1994 in their book *"The new production of knowledge"* (1994, pp. 3–16). The authors see the cause of the creation of the new knowledge in the changed structure of *knowledge production*. In their opinion this structure can be characterised above all by the following special features: there is a close connection between the production of knowledge and its application. The reason and starting point for the production of knowledge are typically formed by a practical problem. Knowledge production no longer takes place in the traditional institutes that were created for this purpose, but increasingly in new locations, e.g. in independent research institutes, small specialised companies, consulting firms and think tanks. The organisation of knowledge production is not hierarchical. Work is trans-disciplinary and not mono- or multi-disciplinary in the traditional sense.

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5 There have above all been three momentous occurrences in the history of knowledge: the verbalisation of knowledge in the mind, the writing down of oral knowledge and printing written knowledge. Each of these occurrences changed knowledge fundamentally as the result of using a new medium (Ong, 1987; Damerow & Lefevre, 1998).

New flows of information are created which can all be linked with and to one another. The information channels of traditional knowledge institutes are not used. The trend is that the knowledge that is generated does not remain bound to the institution but is socially distributed.

These changes to the way in which knowledge is produced are so fundamental that the authors propose that the traditional production of knowledge (Mode 1) must be differentiated in principle from the new production of knowledge (Mode 2). *"Our view is that while mode 2 may not be replacing Mode 1, Mode 2 is different from Mode 1 – in nearly every respect."* (1994, VII). In addition they come to the awareness that the other and new form of knowledge production also leads to a new knowledge (1994, VII).

Nina Degele (2000, p. 11) calls this new knowledge *"informiertes Wissen"* – "informed knowledge". It is based on interaction between an individual and a computer in which internal knowledge and external information are placed in relation to one another and integrated using an individually elaborated search, evaluation and selection strategy and in this way enter with regard to time and logistically into a symbiotic relationship. The production of knowledge with the help of a computer makes it necessary to bring knowledge into a "processing-friendly form". Nina Degele calls this procedure "informing". She deviates here from the usual use of this word and refers to its meaning as "bringing into a form". "Informed knowledge" is therefore knowledge that is worked out, processed, stored and subsequently activated in other contexts with the help of computers and computer networks.

The following information is important as it marks the special nature of informed knowledge:

1. Informed knowledge is based on information that is stored in global computer networks. This cannot be compared quantitatively or qualitatively with the traditional acquisition of information from books and articles in newspapers because the rapid access to this information alters the way knowledge is dealt with.
2. Informed knowledge makes use of an incredible abundance of information ("information overflow"). These items of information are ubiquitous, which means that in principle they can be accessed quickly and easily, in particular as the networked computers can be regarded as universal search engines. Knowledge that can feed from a practically inexhaustible volume of information is of its nature different from traditional knowledge because the process of acquiring knowledge is different. "Knowledge now means bringing theoretical assumptions, repeatable processes, practical rules and agreed foreseeabilities from every corner of the world into all possible relationships." (Faßler, 1994, p. 90).
3. Informed knowledge is in principle fractioned, in pieces[6], fabricated and often modularised as well. This means that it is taken from different contexts and correlations, "debedded" (Giddens, 1995, p. 33) and composed in a special way. In contrast, with traditional knowledge an appropriate context is usually present from

[6] We obtain an idea of the degree of fractionation and breakdown of knowledge by using Beatz Biblionetz: larger areas of knowledge are not described narratively but broken down into subjects, individuals, books, terms, questions, theories, lists and changes. Links lead to other areas. Go to: http://beat.doebe.li.bibliothek/b00021.html

the start through the circumstances of its creation, the situation and the personality of the respective authors or teachers.

4. The relationship between internal knowledge and knowledge stored as information is different to that of traditional knowledge, and not just with regard to the amounts but also to the type of interaction between the two.
5. With information that is acquired through interpretation it is often no longer possible to see in which disciplinary and place-time situation it was created because of its breakdown. This also has an effect on the nature of the new knowledge that has to be compressed. It is flattened.
6. Composing informed knowledge demands different competences to those of traditional knowledge production. What is required is a special degree of creativity, designing imagination, reasoning power, openness, tolerance, flexibility and above all the willingness to make use of virtual communication. But these communication processes tend to be broken down and are no longer, as before, cursory. This again demands special competence in being able to see many individual strands and heterogeneous events together (cf. Faßler, 1994, p. 90).
7. Informed knowledge supports the creation of a data-generating way of thinking which sets data-oriented problem-solving in place of theory-oriented problem solving. The capacity for generalising is greatly restricted.
8. Even contents change their traditional status. They are no longer the most important things on which everything depends, as with traditional knowledge. In contrast, the *way* in which knowledge is *dealt with* becomes more important. Nina Degele's (2000, p. 10) interpretation of these differences in the acquisition of knowledge is that greater importance should be placed on it than on contents, in particular as the shelf life of many contents is becoming shorter. What is increasingly important is "knowing how" rather than "knowing what." "In this way knowledge changes not only additively in the sense of an accumulation of things known. What is decisive is the qualitative change – the modified composition, in other words the configuration of the knowledge."
9. Acquisition of knowledge is not really based on original thought processes but on a type of "presentation" of the existing items of information. Significantly, we say of "knowledge workers" that they "produce" or "create" knowledge (cf. Schreyögg, 2001, p. 14).
10. Informed knowledge is therefore composed differently with regard to its contents in that it requires a second knowledge: the "application of knowledge to knowledge" (Drucker 1993, p. 63; Degele 2000, p. 38), whereby what is meant here is the conscious and methodically skilled organisation and management of knowledge. This "knowledge knowledge" makes informed knowledge "more dynamic, recurrent, moulding and mouldable" (Degele 2000, p. 293). This cannot be said at all of traditional knowledge.
11. Informed knowledge is always stored and therefore changed back into an abstract data structure. It is removed from the personal and temporal circumstances of its creation and use. It has thus left its "anthropological location". "This is a location which can define a stable identity, which permits a relation with the other and has a constant historical dimension" (Ribeiro, 1998, p. 2). The data structure no longer displays the criteria which were used to select it or the larger context in which they became important.

12. Informed knowledge is not arranged and embedded in developed "mature structures" and is therefore mainly only valid for a short-term ad hoc period. While traditional knowledge is fixed in books and libraries so that is available for longer periods, informed knowledge usually appears to be stored for "immediate use" only.
13. If knowledge is presented to acting individuals its appearance and its social status move into the background and the object itself moves into the foreground.
14. Informed knowledge can be presented in many forms because it no longer has to depend solely on the standard linear presentation. Complex contents can also be presented in the form of hypertexts and databases and with the help of multimedia.
15. Informed knowledge is cut off from the tradition of knowledge, lifted out of its historical development. In contrast, the effective presentation of the newly composed knowledge and its application become important.
16. Informed knowledge "ages faster, is renewed faster, is under pressure to keep up" (Degele, 2000, p. 43).
17. Production, presentation, representation and dissemination of knowledge are "systemically differentiated" (Wersig, 2000, p. 463) and have formed their own focal points accordingly.

Knowledge in the computer age is therefore in a state of fundamental transformation, whereby not only its contents but also its functions and structure are changing. There are new stocks of knowledge and knowledge activities. This transformation is taking place at a practically incomprehensible speed so that we can already imagine the great effect this new knowledge will have in future on traditional knowledge and thought. It is easy to predict that it will change them structurally. In the knowledge society we will be unable to manage without the co-existence of new constructed informed knowledge and historically grown, familiar forms of knowledge.

Features of the Radical Structural Change

We owe to Norbert Bolz (1993, p. 113), the philosopher and media theoretician, exact conceptions of how knowledge will look in the age of its digitalisation because he characterises thought processes in the virtual world which brings forth this knowledge.

> "Today, instead of the linear rationality of the Gutenberg galaxy, we have thinking in configurations. The adequatio theory of truth is being replaced by the constructivist theory of the 'fitting' of a theory; recurrence replaces causality, pattern recognition replaces classification. And where immaterial pixel configurations in computer simulation replace the appearance of a stable objectivity the question of a reference loses its meaning. Even our cared-for Nature, the most famous product of reflections of old European culture, can be recognised under new media conditions as a programmed environment. Under the conditions of the new media and of computer technology man has said goodbye to a world which was ordered through representations, and from a way of thinking which saw itself as a representation of the outside world. The technical media of the information society are the absolutely unavoidable a priori of our attitude to the world: programs have replaced the so-called natural conditions of the possibility of experiences."

No one else has worked out the breach with traditional thought in a more penetrating way. The knowledge which emerges as the result of this way of thinking leaves many standards behind which were previously valid: the relevant reality, truth, causality, order through classification and representation and finally the traditional relationship between appearance and being, simulation and reality. Under the influence of this radical change Bolz (1991, p. 110) arrives at the following conclusion: "Digitality has replaced metaphysics." In this way he characterises an epochal change.

Correspondences and Differences

Common Features

Certain *formal* correspondences between *information* and *knowledge* can be seen immediately: both appear as systematised, encoded and communicated data sets. No difference can be detected in their external forms. Furthermore, knowledge and information are always located at first in the head of an individual and obtain in this way their special nature. This is probably the reason why numerous experts, as we indicated in the introduction, hardly differentiate between the two. Helmut Spinner (1994, p. 27; Degele, 2000, p. 13) even speaks of "beloved but fruitless pathos of differentiating between 'knowledge' and 'information' ". Perhaps it is the formal correspondence which causes the frequent confusion of the terms. However, if we look closely the semantic content begins to become blurred and in part begins to melt from one into the other. Some examples can be given for this vagueness.

Rainer Kuhlen regards information as a "subset of knowledge". Hartmann and others define information as the "specific knowledge which an individual requires in a defined situation, for example, to solve a problem". A. J. Romiszowski (1981, p. 80) understands knowledge as being merely the information which a subject has stored. And Sabina Pia Jeger is even of the opinion that knowledge can be equated with the information which is available to a person (Jeger, 2000). There is no doubt that with these authors the meanings of these terms overlap and overlay each other. In this situation the recognition that there are important structural differences can have a clarifying effect.

Differences

The partial correspondences and marginal points of contact which have been shown here are not decisive. The structural differences are far more important.

1. *Reference to a subject*. With knowledge, and this has been proved above all by the disciplinary concepts, the most prominent feature is the reference to further cognitive activity of the subject. Only an individual or a group of individuals can evolve and be the bearer of knowledge. In contrast, information is, as it were, a floating set of facts, an object circulating in a network. If it is taken over by a historical subject it can be turned into knowledge. A. J. Romiszowski (1981, p. 80) reduces this problem to the simple formula: "Information: *information which exists.* Knowledge: *information stored in me".* In contrast to this simple explanation Don Tapscott (1997, p. 32) characterises the difference more precisely by referring to the cognitive activity which is required for changing information to knowledge: *"Information that has been interpreted and synthesized, reflecting certain implicit values, becomes knowledge".*

2. *Individual bearer.* If knowledge is bound to a subject, knowledge is then in the first place *individual* knowledge. It acquires its special characterisation in each case because the determining factors are different in each individual. This starts as early as the process of acquisition: the cognitive activity of each individual, the way in which he or she selects, analyses, checks, evaluates, adopts, integrates, synthesises and reflects on information naturally has an effect on the knowledge which is created. In each case the acquired knowledge comes into contact with a different prior knowledge and specific previous experiences and has to be placed in relation to them. What is also important is to link the acquired knowledge with already existing everyday knowledge and pre-scientific knowledge. "Each individual is confronted emotionally and cognitively with a fund of transmitted knowledge." This cognitive activity strives for agreement of the results, for entirety. Knowledge is always a component of an individual learning biography. Its transmission "requires in principle human actors, whereas the exchange of information can also take place automatically between computers" (Bruck & Geser, 2000, p. 33). To an extent this individualisation takes place on the interpretation of data for the purpose of acquiring information. But this is only a preliminary stage in the generation of knowledge. Even if groups hand down traditional knowledge it is always typical unique knowledge for the group.
3. *Reference to surroundings.* The individual who produces the knowledge lives in a defined location, at a defined time and in a defined cultural environment. Their knowledge is influenced by these factors and is linked to them. What is more important is that these individuals live in defined social situations; their knowledge has therefore a social, cultural and societal reference. For this reason it will have to satisfy ethical demands because the persons concerned are oriented consciously or unconsciously to the standards of their group or of society. Finally, we cannot ignore the institutions which usually plan knowledge processes, start them off, steer and control them. All these factors have an effect on the knowledge in creation. The product is therefore individual and unique.
4. *Constancy*. Traditional knowledge which people have acquired is relatively stable because it is embedded in personal knowledge structures and the long-term memory permits access to a relatively long period of time. In addition, it is relatively *static***,** because it is integrated in the learning biography, in other words remains at the person's location and is supported by institutions which outlast the times.

Information has a completely different structure. It usually lacks the features that are typical of knowledge. It is not the product of a cognitive process of a defined individual but has detached itself from its creator and the circumstances of its creation. Apart from decoding and interpreting, there is no non-recurring, unique, individual cognitive characterisation by an individual. For this reason the individual emotional, social, cultural and societal references are missing which have an effect on the genesis of knowledge. Unlike knowledge, information is not directed towards entirety but tends to be fragmentary. Some even talk of a "McDonaldisation" of information (Ritzer, 1996, p. 1). Ascertained, pre-interpreted and stored as data, these data remain the same for users in all cultures. They are stored on carriers, whereby these can, for example, be books, newspapers, periodicals, hard disks or servers. Because of the enormous compression and speed of electronic communication they can be disseminated "at the speed of light". Their ubiquity makes access to them possible practically anywhere in the world.

Overlappings

In view of the differences that have been shown here it is difficult to understand how some authors use these terms in such a lax way. Even with experts the semantic content of the one term often stretches into that of the other. Manfred Faßler (1994, p. 89) writes of the "world knowledge" which is stored in computer networks, of "electronic knowledge" or of "knowledge as information." "International data networks", he claims, "produce more knowledge than a single individual or a national elite can ever see" (p. 89). These designations show once again how information and knowledge are seen and considered in the computer age, which itself may be an additional reason for the substitution or confusion of the two terms. After what we have seen here we should really insist that the networks cannot store knowledge, let alone produce it and that human knowledge can never be electronic.

The situation is more complex than has been shown up to now. Firstly, in cognitive philosophy and AI (artificial intelligence) there is research which wants to show that knowledge can be the result of computerised information processing. In other words: even people's mental work, their process of recognition, is to be automated as well, at least wherever this appears possible. Secondly, it is certainly a standard practice to change knowledge back into information by storing it in a computer. This does in fact lend credence to the concept that we have access to stored knowledge and even, with regard to global networks, to a "world knowledge".

Thirdly, it cannot be denied that the stored information can provide great relief for human memories and in this way take over part functions in the production and "retention" of knowledge. Fourthly, it is believed that the computer can be integrated deliberately in the production of knowledge with the use of intelligent expert systems. In this way they become electronic agents which facilitate knowledge. Fifthly, the computer takes over in many ways the task of localisation and selection of information in the framework of *knowledge management* (Lechner & Tergan, 2001). Operative functions of human thought are relocated to the computer here as well, which reduces the cognitive strain on the human participants.

The previously assumed demarcations between information and knowledge are therefore crossed over at some positions. There are even partial overlappings.

Overview of important differences

Information	Knowledge
Tends to be economically-industrially marked	Tends to be institutionalised
Tends to have short-term use interests	Stable, long-lasting use interests
Not bound up with standards	Oriented to standards
Detached from individuals	Linked to the carrier's consciousness
Not fixed locally, global	Fixed locally
Independent of time	Fixed in time
Detached from society	Integrated in society
Detached culturally	Culturally adapted
More dynamic	More static
Independent of other types of knowledge	Bound to everyday and prior knowledge, etc.
Disseminated at the speed of light	Disseminated slowly

Exponential growth	Slow growth
External process	Internal processes
Extrahuman retention	Retention concentrated in people
Tendency to fractionating, distribution	Strives to achieve completeness, entirety
New complex types of information	Accustomed types of knowledge
Subject-specific demarcations overcome	Subject-specific demarcations strengthened
Media-specific demarcations overcome	Media-specific demarcations present
Communication extended locally and as to time	Communication restricted locally and as to time
Contact with "remote-presence" reality	Contact with present reality
Mediated reality	Contact to reality
Virtuality	Reality
Detached from the social situation	Socially anchored
No central anthropological meaning	Important anthropological dimension

Retroactive Effects on Traditional Knowledge

The present situation cannot be described to a sufficient extent if traditional knowledge and informed knowledge are placed next to one another, compared with one another and serious differences are brought out. In this context it is also extremely interesting how the situation shown has an effect on traditional knowledge. This deserves an examination of its own. Here we can only provide two indications.

Early Experiences in Digital Spaces

At first it seems obvious to assume that at present younger adults have different and unconventional cognitive skills and routines if they spent many years of their childhood in front of a computer and played highly interactive computer games with great fascination. They link items of information together in a different way; are able skilfully to associate situations with one another which are at great distances from one another; are used to the opacity of the world of the computer; are able to solve problems in a state of uncertainty; can think in a networked and multicausal manner; develop creativity as if it were a game; develop their own strategies, which they use to achieve goals they have set themselves and have trained subjectively significant actions. There are signs that because of these special experiences other networks have been created in their central nervous systems (Pöppel, 1995, p. 76).

If this were the case it would probably have had an effect on the way they deal with traditional knowledge, including scientific knowledge. What do they in fact have are new forms of evaluating, storing and reactivating knowledge. This cognitive characterisation appears to be so significant that adults who grew up with computers and the Internet are referred to as the "Net generation" (Tapscott, 1997).

When they are faced with the task of acquiring knowledge in the traditional way, these individuals, and it will probably be correct to assume this, will do this from a different angle, approach it with different attitudes and perhaps work under a different horizon of values.

Selective Experiences in Virtual Spaces

But we must also expect that even older adults who did not pass through the school of computer games will have experienced the effects of the computerisation of our life. Even if they produce traditional knowledge, they cannot ignore the presence of rapidly

accessible specialist information. To name just one example: the philosopher Jürgen Mittelstraß (1994) draws our attention to the fact that the mere abundance of information can have an effect on the *contents* and the *orientation* of the knowledge. For him, information differs from knowledge through its "inclination to infinite growth and unlimited variety" (1994, p. 140). New ranges of information, he claims, aroused new demands for additional information:

> "The thing about ranges of information is that the individual searching for information nearly always receives more than they are looking for, in fact, much, much more. This includes a great deal of information which he should have looked for and has now luckily acquired without having to search; but also a great deal which he does not need and which he his not prepared simply to ignore, now that he has it." (1994, p. 140).

Following this, he continues, "the substance of traditional philosophical work" begins to alter, because now research directions and interests in knowledge are influences and "curiosity and the pleasure in experimenting take a new direction". Even the way in which knowledge producers work changes:

> Where "everything is available on call, the liking for comparisons, contrasts, overviews grows. More and more collecting, numbering and presenting takes place, and less and less thinking." (1994, p. 143).

Accordingly, Mittelstraß sees philosophical work as being under threat from "a new superficiality" (1994, p. 143).

Possible Perspectives

These two outlined examples show by themselves how traditional knowledge might change as well. Members of the *Net generation* will proceed differently when producing and reproducing knowledge and arrive at different results. And even protagonists of traditional knowledge who do not have relevant experience gained as children and teenagers will be affected by the change. This will not only change the goals, directions and methods of knowledge production, but even the contents, perhaps even the traditional concepts of knowledge. According to this, but for other reasons as well, the traditional knowledge of the future will also be subject to a structural change.

Results

The understanding of traditional knowledge which was presented above is contoured and extended through the following excursus:

In many ways, knowledge is always imparted in society, which takes place individually, depending on the location of its carrier. Knowledge develops in an individual manner because not only the cognitive preconditions in individuals are different, but also because the life history of each individual has an effect on the knowledge. Knowledge is not a fixed quantity but changes its structure and nature through the media which dominated the storage and reproduction of knowledge in each epoch. The existing knowledge contents in a defined environmental contribute to the individualisation of knowledge. Knowledge is created in the minds of individuals through the particular development and correction of knowledge structures. Knowledge also feeds on insights

and experiences which are subjectively and objectively correct, which has to be substantiated and justified in each case.

On the other hand, however, it is also claimed that knowledge is a collection of facts and rules which exist objectively, and are therefore not dependent on or influenced by the subjectivity of defined individuals. This includes the concept that encoded information is stored in human neural systems: in other words, thinking is processing information.

Information Society or Knowledge Society?

Jürgen Mittelstraß (1999, p. 728) summarised the problem that we are discussing here as follows: "We are standing on the threshold to a new society, but where will the road take us? Towards a pure information society? Or are we on the way to a knowledge society?". Now that we have elaborated on the differences between information and knowledge, it seems obvious to consider these questions with their help.

Information Society

It is clear that the spectacular advances in information and communication media cause the dominance of the term "information society". They now determine society's economic, cultural and social life and in addition possess a "potential or a new organisation of material reproduction" (Wersig, 2000, p. 461). Their enormous power for altering structures has placed people under their spell and made "information society" into an extraordinarily attractive slogan. Politics, industry and academics all discuss their chances and challenges[7]. The resonance in the literature is enormous. For example, if the problem were to be decided using the number of academic titles on this subject in the university library at the FernUniversität in Germany, the equation of the priority of the two terms could easily be answered: there are 104 titles on the information society and just 9 on the knowledge society in 2002. The difference is even greater when we consider papers in academic journals: in October 2002 the paper search engine JADE showed 375 titles on the "information society" and only 68 on the "knowledge society".

There are also experts who place the emphasis from the start on information. Helmut F. Spinner (1994, p. 53 ff.) for example writes of a "knowledge order of the cognitive technological complex" in which "knowledge activities and stocks of knowledge" could be found. What he means here is the "creation, processing, networking, and dissemination of knowledge under the new technological conditions of electronic data processing. Nina Degele (2000, p. 14) criticises this shift of the cognitive emphasis of society to a data pool because she fears that the abundance of information would then "be accompanied by a lack of knowledge." Joseph Weizenbaum (1998) identifies this situation by giving his lecture in the Tele-Akademie of the German “Südwest Fernsehen” the title "We are looking for knowledge and are drowning in information".

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[7] For example the German Bundestag's Committee of Enquiry into "The future of the media in industry and society - Germany's road to the information society", the "Council for Research, Technology and Innovation" with its recommendation "Information society. Chances, Innovations, Challenges" (1995). In addition, I would also like to refer to the book "Information Society - Media - Democracy" (1996) edited by Edelgard Buhlmahn et al. (All of these titles have been translated into English).

Even a first glance at the summary overview of the criteria in which information and knowledge differ shows that they are in fact two very different things. They deviate from each other at 27 points. This of itself should stop us from claiming that the terms are interchangeable and from continuing to use them as such. But if these terms mean something completely different, it should be relatively easy to see more clearly what is actually meant with the terms "information society" and "knowledge society". Only this will enable us to answer the question as to which term provides a closer description of the present structural change in our society and should therefore be given priority.

In an information society the digital generation, storage, transmission and multiple use of information in many areas of work and everyday life have achieved great importance. In this society a cognitive-technical complex of innovative magnitude and composition is created and spreads with unheard of speed. It influences and alters most human activities. It leads to information and communication sector being "turned into data". It becomes an instrument of social control. It enables global interactive communication and the globalisation of economic, political and cultural processes. It causes the development of society to accelerate. As important concrete consequences of these processes new forms of work, of learning, of cultural activity, of leisure and of dealing with everyday problems come into being.

Because the term "information society" relates to the technical configurations and processes referred to here it arouses the impression in mass consciousness that it is practically value-neutral, because all technology, this is what many think, is originally value-neutral. Just as we are unable to oppose the industrialisation that technology brought about, this term suggests a certain progressive automatism, which no one can check. The concept of the impersonal is also inherent to the term. It associates concepts of a society in which communication takes place automatically within a giant networked technical system.

Knowledge Society

In the "knowledge society" things are different. Because knowledge has to be acquired through cognitive activity, with this term we imagine first of all the individuals or groups of individuals who have acquired the knowledge and have this knowledge available. They are what is important. The term "person" stands for the "I"-identity with whose help the individual puts forward his or her wishes and interests in coming to terms with their real and social surroundings. According to this, the person is "a values and actions system organised in the individual" (Hillmann, 1994, p. 662). Knowledge can therefore not be spread with technical media. "The spread of knowledge requires in principle human actors, whereas the exchange of information can take place automatically between computers" (Bruck & Geser, 2000, p. 33). The fundamental societal changes therefore do not take place automatically as a consequence of technology but on the basis of individual cognitive processes which end up in the decisions and actions of individual persons.

The technical-instrumental character of the information society also has to be looked at. The provision of all computers, all networks in this world and all rational processes (software) developed for their serviceability, basically even the complete immeasurable abundance of information that is stored with their help, would be to no avail if they were not used for the production and use of knowledge in social circumstances. This

argument by itself justifies the preference for the term "knowledge society". This will be seen in this way increasingly. The expression "knowledge society" has in fact now become an international key term because the UNO uses it to improve living conditions in developing countries with the help of information and communication media (Mansell & Wehn, 1998).

There are other arguments in favour of the knowledge society, and we will look at five of them here.

- The sociologist Nico Stehr (1994, p. 209) interprets knowledge as "direct productive power" and registers "in general the growing importance of knowledge as a resource and basis of social action. Consequently, he too defines knowledge as "the capacity for social action" (1994, p. 209) and pleads explicitly for the expression "information society" to be replaced by "knowledge society".
- The philosopher Jürgen Mittelstraß (1999, p. 728) interprets the present social change as follows: "All changes start in the mind". The impulses, the driving forces, for this did not at all start from the digitalisation of information brought about by technology. The huge apparatus of globally networked computers functions purely instrumentally here. Information is "only the way ..., in which knowledge is made transportable" (p. 734). For him, the transformation of the information society into a knowledge society is not just a terminological question but also, seen from the aspect of the theory of knowledge, a fundamental question as well (p. 733).
- Gernot Wersig (2000, p. 463), the information scientist, refers to Niklas Luhmann, who drew attention to the theory that society lives and exists above all in its self-descriptions. In his opinion, the self-description "information society" is "blurred" because "the concept of information was turned over by Shannon to access by technocrats, simplifiers, rip-off merchants. For this reason, increasing use was being made of the "alternative self-description 'knowledge society'" with which "a more clear and more far-reaching perspective" could be gained.
- The psychologists Siegfried Höfling and Heinz Mandl (1997, p. 18) argue as follows from a pedagogical point of view: "It is only the contents and their processing together with the appropriate context which make significant knowledge from information and enable the construction of coherent knowledge networks". For this reason it seems obvious to prefer the knowledge society to the information society as the goal of societal development.
- The educationist Sigrid Nolda (2001, p. 117) substantiates her adherence to the term "knowledge society" logically with the fact that "knowledge in general has become a constitutive mechanism of modern societies and the working content of an increasingly larger group of people, so that knowledge determines their identity so decisively in the way property and work once did".
- The programme coordinator of the Heinrich-Böll-Stiftung, Andreas Poltermann (2001) conceptualises the "knowledge society" sociologically as the "values discourse of a reflected enlightenment" which demands "justice and sustainability".

The consequence of these difference substantiations can only be that the expression "knowledge society" is more suitable for characterising the present fundamental change to the post-modern world. This term has been increasingly used in the last few years and has in fact gained a global presence as a result of relevant publications by the United

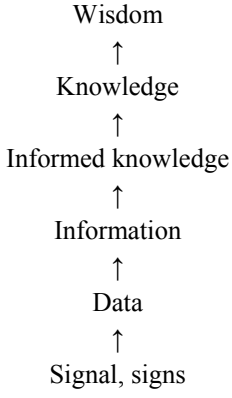
Nations Commission on Science and Technology for Development (cf. Mansell & Wehn, 1998).

Summary and Comments

Summary

If we take a look back at the above arguments we find the following situation:

1. Information and knowledge are in themselves multilayered and multifaceted terms. Because of the unprecedentedly great influence of information and communication technology on the production of knowledge and on the way people deal with knowledge, the complexity and versatility of the two terms are growing even further. Their aura of meaning is not only extended but also substantially changed through the formation of new meaning cores. A new understanding of the terms is contrasted with an older, conventional one.
2. Those who use the terms "information" and "knowledge" today should really be aware of the greater differentiatedness that has been created in this way. However, most people keep to the *traditional* meaning of these terms, probably out of habit, even if they work in computerised information systems.
3. The term "information" is used much more frequently than before. The situation is a new and radically so: Most "users" profit from the global distribution and unusual mass of this information, but take hardly any note of its technological derivation and its significance, which is rooted in information theory.
4. The term "knowledge" does in fact have several areas of meaning. However, the most important is the general differentiation between classical and informed knowledge. Because both forms demand different methods of work, strategies, quality requirements and ways of managing, they should be kept separate from each other consciously.
5. The aim should be to observe and evaluate the terms information and knowledge separately from one another. However, we still have to look at how they are both connected. This becomes clear if we illustrate the genesis of knowledge as an ideal-typical model of a process of transformation that runs through six stages. In the following diagram they run from bottom to top:



These stages can be described and demarcated easily as special development stages. This should prevent the confusion of information and knowledge.

6. With "informed knowledge" the contents of the knowledge become less important while the skilled handling of contents becomes more important. The knowledge that a person produces him- or herself becomes less significant; however, what is significant here is what a person does with and makes out of the existing knowledge. The knowledge producer becomes, as it were, the knowledge presenter.
7. As a consequence of this development the production of knowledge breaks down in a manner never before seen into the distribution, organisation and management of knowledge. Knowledge is applied to knowledge.
8. The classical forms of the production, transmission and application of knowledge will change through the development of informed knowledge.

Commentary

The diagram on p. 153 suggests an *ascending* trend which runs from the simple to the complex. This conforms to the fundamental trend in the genesis of knowledge.

Along with this can be found a *descending*, *falling* trend. Large stocks of knowledge are transformed back into items of information and encoded configurations, so that they can be stored and made available elsewhere. Not only "knowledge workers" but also academics and students find themselves in a situation that is unique in the field of cultural history, namely having to navigate their way in a sea of digitalised information. This brings us back to the motto of this paper, T. S. Eliot's complaint about the loss of wisdom in knowledge and of knowledge in information.

The poet touched on a fundamental problem of mankind in the modern world. As far back as 1934, long before the present computerisation of knowledge, he diagnosed in just a few words how *"endless invention, endless experiment"* generates the knowledge of the movement but not knowledge of the tranquillity. And he asked: *"Where is the Life we have lost in living?"* Here he diagnosed the fundamental change in our way of living in the age of industrialisation. By referring parallel to this to the disappearance of wisdom in knowledge and the disappearance of knowledge in information he criticised the transformation of our intellectual life, the increasing qualitative decline in our cognitive achievements, the impoverishment of our intellectual life. Eliot implies that there was a time in which people's actions were determined to a greater extent by knowledge and wisdom. What he was doing all those years ago was to bemoan with prescience the excessive abundance of information.

As a consequence of the digitalising of knowledge the process that Eliot complained about is at present intensifying and exponentiating to an extent that we have difficult in grasping. Norbert Bolz has listed the consequences for knowledge with relentless clarity. At the same time, most people hardly realise that they are taking place. The technological protagonists who have already recognised the process have accepted it without complaint, or even welcome it.

Cultural history aspects motivate many complaints about the structural change. They make us aware how fundamental are the consequences of rationalisation, mediation, automation, industrialisation, commercialisation on the area of knowledge in particular. Processes of depersonalisation, of "desubjectivisation" through the increasing objectivisation

of knowledge, even of its detachment from its anthropological location, of its "debedding" (Giddens, 1995, p. 32) from its social and cultural situation are continuing inexorably. In addition, this detachment from the grown situation and the dissolution of the geographical location and the fixed time facilitate the commercialisation of information and knowledge. The consequence of this fact is that a general dissolution of qualitative standards is taking place in the field of wisdom and knowledge as well, a special aspect of the general decline in values.

We have to accept the enormous structural transformation of information and knowledge in the hope that the losses will be compensated by gains in new opportunities for having available and handling hypertrophic volumes of information and new forms of knowledge.

Consequences for Continuing Education

What does this transformation of information and knowledge mean for those for have to plan and organise their continuing education not only for a lifetime but also increasingly individually?

The most important thing is probably the insight that information and knowledge are not the same, even though both play an important role in the individual learning process. However, the one should not be mistaken for the other. We should all recognise and internalise the different status in both theory and practice.

The following awareness is of particular importance: information that is filtered out of the data flood in computer networks does not as yet represent knowledge, but has first to be brought into a new context by learners. When this is done the knowledge is fitted into a current situation with regard to both location and time, as well as societally and culturally. Information that floats in a computer network acquires an anthropological location because learners make the new content their own in an individual manner. In the digital learning environment this represents the actual learning process, which can certainly have creative features as well.

Furthermore, those who are concerned with continuing education must learn to differentiate carefully between "classical knowledge" and "informed knowledge". It will be important to recognise the advantages and disadvantages of both forms of knowledge and to deal with them skilfully.

Newcomers to continuing education may on the one hand be fascinated by the new form of acquiring knowledge in the digital learning environment and on the other hand have their doubts, because the learning process is determined too much by games, improvisations, experiments and disengagement when learners are asked to juggle with segments of information and to value how they deal with knowledge higher than the contents. They will gradually grow into a new sphere of intellectual work and learn to surf and navigate, and to combine and link knowledge from different domains and sources. By acquiring a certain virtuosity in this they will develop forms of learning behaviour for which there are no examples in classical knowledge.

Finally, the structural similarity of the processes of the production of knowledge and of the acquisition of knowledge is of paramount importance. In the digital learning environment students in continuing education must above all recognise and use the great and not fully utilised opportunities for independent, self-regulated, autonomous

learning. The old pedagogical guiding principles of learning by exploration, learning by discovery, research-based learning, learning by problem-solving and resource-based learning will acquire new actuality and importance. And the new "learning by knowledge management" will increasingly come to the fore. The idea behind this is that students in continuing education will take on more and more the role of an independent researcher. In this way, new and demanding forms of continuing education can be developed.

10 Pedagogical Consequences of the Transformation of Information and Knowledge

A special aspect of the current cultural change is the transformation of the meaning of "information" and "knowledge" (cf. chap. 9). Both terms are also in wide use in the field of distance education, as a result of the computerisation of teaching and learning. Their range of meaning is extended here as well. Along with traditional information we find communication-technological information; along with traditional knowledge there is "informed" knowledge. In practical teaching and learning this change in meaning has the following consequence: teachers and students are confronted to the same extent by the unusual task of having to acquire new knowledge in the digital learning environment with the help of an inexhaustible abundance of stored information. However, this informed knowledge differs greatly from traditional classical knowledge. And there are consequences: we are faced with different forms of information and knowledge, "dealing with" knowledge is given a previously unknown meaning, new forms of learning behaviour arise and these include in particular knowledge management. Because lifetime learning is practically inconceivable for teachers and students without the computer-based acquisition of knowledge, this paper will discuss these consequences from the aspect of pedagogy and instructional design.

Introduction

Those who look at lifelong education seriously and who continuously develop new activities in this field know that a considerable part of this type of continuing education can no longer take place in the form of courses, seminars and conferences face-to-face. On-line learning will increasingly penetrate this sector, above all for those people who are already familiar from their work with computers and the unique opportunities they provide. However, on-line learning also confronts participants with unusual situations. They are provided comfortably and rapidly with an immeasurable wealth of technically stored information, and they have to be able to handle a new type of knowledge: "informed" knowledge (Degele, 2000).

This informed knowledge differs from classical knowledge in many important points: it is not presented directly or indirectly by people but filtered or "generated" by students from different items of information; it is broken down into fractions and pieces; it demands thinking in data and data configurations; it requires the application of an organising and regulating knowledge (meta-knowledge); and it can be represented in several forms, even complex ones. It is removed from the original context and cut off from the historical development. But above all: it is becoming more important for society because it is used as a productive power of the first order. This knowledge has become a sign of our post-industrial age.

The following is an examination of the way in which this type of transformed knowledge can affect learning in continuing education.

Pedagogical Interpretation

Historical Review: Defensive Measures and Acceptance

In German pedagogy, the category "knowledge" no longer played a serious part after Hebartism, which was oriented towards the Enlightenment, was overcome. From about the beginning of the 20th century reform pedagogues fought against "book knowledge" and dead "memorised junk". "Feeling" and "experience" were to determine lessons. For decades, the term "knowledge" was banned from discussions of pedagogical issues. Instead, liberal arts pedagogues spoke of "cultural riches" and pedagogues of "contents". Knowledge did not become a pedagogical category again until Paul Heimann (1976, p. 156). For him it exercised the functions of "enlightening, mastering and fulfilling existence".

Finally, under the influence of phenomenology, Gestalt psychology, linguistics and the first attempts to map human actions on the computer, the Swiss psychologist Hans Aebli (1983, p. 33) developed a psychological-pedagogical "theory of knowledge" with which he wanted to bring about expressly the "rebirth of knowledge as an educational goal".

The Present Structural Change

Today, pedagogy can no longer ignore the great effect on education processes of this previously unknown abundance of information and the rapid access to it. It must also accept that with "informed" knowledge a new and structurally different type of knowledge has now established itself. These developments will react on our traditional knowledge and also, and this is significant, on our thinking. They will change traditional, familiar forms of knowledge, knowledge production and of dealing with knowledge. And they will also change our concepts of knowledge and our attitudes to knowledge.

Although these changes became apparent clearly over a period of about ten years, which is very short as far as pedagogical innovations are concerned, in everyday life we have the impression that they took place slowly, without being noticed. To an extent we are growing into this new changing form of knowledge. However, from the aspect of cultural history this transformation was an abrupt caesura, a change of epoch.

Resistance

Experts who are influenced by cultural history regard all this with scepticism, apprehension and even with rejection:

- The pedagogue Hartmut von Hentig (1993) criticises: "The most worrying thing that computers do to us is, in my opinion, the concept of "knowledge" that we create for ourselves under their influence. The result is an arbitrarily accruable quantity". For this reason we can also equate "knowledge" with "information". On the whole he criticises the change as a "flight from thought into knowledge".
- The philosopher Jürgen Mittelstraß (1999, p. 173) mocks: "The information world now promises a paradisiacal empire of knowledge. Its pedagogical philosophy is that we should all change from being knowledge dwarves into information giants".

- The philosopher Holm Tetens (1999, p. 2) prophesies: "We will drown in a flood of data".
- And the media expert Neil Postman (1990) asks whether we are "informing ourselves to death". He bases this on the following diagnosis: "Our information immune system is inoperable. We don't know how to filter it out; we don't know how to reduce it, we don't know how to use it. We suffer from a kind of cultural AIDS."

Behind these attitudes and evaluations we can feel an almost desperate, because futile, attempt to resist. People want to defend the traditional forms of knowledge, classical knowledge, against a flood of data and a torrent of information. The feeling is that traditional knowledge is being forced to retreat in the knowledge society; it is losing its importance. And what makes everything even more precarious is that the opponents of the process have detected its "irreversibility" and are suffering from a culture shock which, according to Werner Faulstich (1997, p. 14), always happens in the history of culture whenever a new medium for imparting knowledge establishes itself.

The Emergence of Informed Knowledge

In view of the cultural criticism referred to above, and of many other critical opinions, which are mainly selective and criticise across the board, the research work carried out by the sociologist Nina Degele (2000) acquires particular importance. She has carried out wide-ranging, in-depth and impressive analyses of the effect of computerisation on our society not only with regard to information but also to knowledge. The direction and the unprecedented dynamism of the current actual change becomes manifest and clear, and puts the isolated cultural-critical objections of other authors into perspective. As shown above, the author describes the emergence of a new type of knowledge – namely "informed knowledge" – and diagnoses as a consequence nothing less than the "redevelopment of our knowledge" (2000, p. 9).

Pedagogical Tasks

There is no doubt that the significance of informed knowledge will continue to increase in the "knowledge society". Perhaps it will even come to dominate the way we handle knowledge. Because of this, it will also become pedagogically important as well. If a general goal of pedagogy is to prepare people for their future lives, both private and professional, for the purposes of "mastering existence", this must include clarification of informed knowledge, favouring appropriate attitudes, training exercises in how to cope with it and education in specific competences. However, this is a complex and therefore difficult task and the following benchmarks will have to be kept in mind to solve it.

Formation of Consciousness

- Consciousness of the epochal cultural-historical change from the industrial society to the knowledge society and from the modern to the post-modern must be created and developed so that the greater connection and the importance of the paradigm change in the field of knowledge can be seen.

- In particular the great, and still growing, societal significance of informed knowledge as an economic factor of production must be recognised.
- Dealing with knowledge in a real and a virtual world will have to be experienced consciously with reflection and trained.
- To a much greater extent than with traditional forms of acquiring knowledge learners must be imbued with responsibility for their own acquisition of knowledge and with the necessity of acting independently when doing this.

Changes of Attitude

It is important here to modify traditional attitudes, internalised conceptions and habitualised behaviour. The willingness to

- review the learner's own knowledge continuously and critically,
- develop own knowledge still further,
- share knowledge,
- take new paths,
- face up to the structurally changed situations in the world of knowledge

must be supported and strengthened. The routine interaction with the computer must not be allowed to drift into dependence on it. Knowledge workers must always "master" their computers as a cognitive tool, and not vice versa.

New Competences

The competences which are shown here are those which people in the knowledge society must have in a general pedagogical sense, but they also have a direct relationship to the electronic generation and acquisition of knowledge:

- In many areas of activity media competence is presupposed. However, it is essential for working with knowledge.
- Competence in dealing productively with plurality is important in the post-modern world and must be presupposed for generating new knowledge from heterogeneous sources with different contents and in a variety of forms.
- The competence to deal productively with change relates in general to rapid adjustment to changes in personal, occupational and social life. However, this competence plays a pre-eminent role in dealing with knowledge, and not only because of the "knowledge explosion" but also because of the rapid innovations of information and communication technology. Above all, an adjustment to instantaneous thought is demanded, habituation to learning *on demand* and *just in time*.
- Competence to active, conscious and responsible life planning is a general educational target. However, at the same time it enables and facilitates the acquisition of knowledge in the framework of lifelong learning.
- Life in the knowledge society necessitates the development and care of social relations in the real and in the virtual space. For this reason, social competence

may take many previously unknown forms. Some of these also serve the acquisition of knowledge.

- Particular value will be placed in future pedagogical scenarios on communication competence. This will be especially important in digital learning environments, because communication will be compressed, accelerated and globalised and because many new types of virtual communication will be offered that contribute to the generation and acquisition of knowledge.
- Competence for collaboration is frequently identified in the worlds of private life and work as the ability to work in a team. Independence from restrictions of location and, in part, of time, enables and facilitates collaboration with partners and groups in processes of knowledge acquisition that traverse borders. The production of knowledge may be the result of a collective process here, e.g. in *knowledge building communities.*
- Information competence will be the mark of all educated persons in the knowledge society. They will have to be generally able to make intelligent use of globally accessible electronic information facilities. This competence can and must also be used to generate and acquire new knowledge.
- Competence in knowledge management will be a general cultural technique with the help of which it will be possible to deal with problems in both our private and professional lives. In addition it is also absolutely essential as an integral element of the electronic generation and acquisition of knowledge.

This overview shows the great extent to which pedagogical processes overlap. The importance of these competences is confirmed when we realise which competences industry regards as desirable and necessary. In this field as well the "acquisition and management of information", "communication" and "self-learning" have been regarded as important criteria for some time (cf. e.g. Conference Board of Canada, 1991).

Orientation Towards New Models?

When pursuing the above goals we must not forget the fact that with the change and conversion of knowledge not only our concepts of knowledge but also of "education" will change. In the digital world the traditional concepts of knowledge, of the standard patterns of behaviour for acquiring knowledge and of the corresponding models for producers and bearers of knowledge will pale into insignificance. Manfred Faßler (1994, p. 96) describes the new situation as follows: "An intensity of communication opportunities based, supported and strengthened by computers has been reached that seriously asks the question whether prevalent concepts of knowledge and education enable conscious and reflected use of the multifaceted semiotic systems. Can common learning forms and contents, selection decisions for certain responses, etc., react to the open structures of regionally and globally distributed knowledge?". Norbert Bolz (1997, p. 464) answered this question negatively by simply stating: "The educational strategies of book-based culture have had their day.".

It is obvious that traditional and still common knowledge and education concepts will have to be differently structured, even totally reconceived and interpreted. There is an even more pressing reason for this in that the serious changes in the field of knowledge

are only part of a fundamental cultural change in which people themselves are changing, comparable in a way to the changes to people in the agricultural era to those of the industrial era. Pedagogy must react to this.

However, it is still uncertain as to what the new education concepts will look like. Unusual difficulties are coming to light and just one of these will be referred to here. Classical education was always based on a canon of knowledge. Now, however, the international data network has more heterogeneous information from all domains available than a single person will ever be able to exhaust and process. This is increasingly leading to the disappearance of a canon of knowledge. The "linear perspective homogenous world image" of old European humanism is dissolving into "facets of a mosaic" (Bolz, 1994, p. 9). In a similar way, yet other fundamental cultural definitions are being lost in informed knowledge.

In the knowledge society most people will have to deal daily with informed knowledge. To enable them to do this they will have to have a different mental attitude to people in the industrial age. This is why previous model concepts of knowledge, the acquisition of knowledge and handling knowledge will gradually lose their former importance and make way for new concepts. Klaus Haefner (1997, p. 90) puts the process of transformation into a nutshell by demanding a new model for our education system: "Right up to the 1970s the leading idea was a cognitively autonomous Homo sapiens sapiens who was directly committed to the enlightenment, but, in view of societal reality, the new model for the 21st century can only be the Homo sapiens informaticus." Philippe Queau (1999, p. 204), Director of the Department of Information and Informatics at UNESCO, is even more radical. "What is taking place at present", he claims, "is a radical change of humanity, which is turning into a new species. *Homo sapiens sapiens* has just created *Homo sapiens sapiens sapiens*."

Whatever a pedagogical model for the knowledge society in the post-modern age will look like, in the first place it will apply to the producer and bearer of informed knowledge. The latter is already displaying greatly changed behaviour. He is no longer the "pundit, the walking encyclopaedia, the possessor of knowledge, but the virtuoso: a juggler, player, who keeps the contextual components at a distance, but knows how to orchestrate them by radiating competence" (Degele, 2000, p. 301). These changes go so far that a new name has been found for the new type of person. We are hearing more and more about "knowledge workers" (Poltermann, 2001, p. 4).

Challenges

If we continue to try to imagine what concept of education might be adequate in the knowledge society, we will have to be prepared to discuss the following questions:

- Will new educational events and experiences develop parallel to the new forms of knowledge acquisition? What will they be like?
- What should the values be that are to determine the actions of producers and bearers of informed knowledge? Will there in fact be fixed values in the new media world that are characterised by "emergence and instantaneity" (Bolz, 1994, p. 9)?

- How will we have to imagine the basic sensitivity of those who are concerned with obtaining lifetime continuing education in the knowledge society?
- How will the process of knowledge acquisition be influenced and structured by the *two computer cultures* that are at present prevailing in a complex manner? They are based on modern and post-modern concepts of the interplay between man and machine in the case of the computer. We speak of different models of computer aesthetics. Their characteristic criteria could not be more opposite. The contrasts are:

Formalism	Complexity, flexibility
Clarity	Opaqueness, mystery
Programming	Learning capacity
Determined	Non-determined
Logical	Biological
Systematic processes	Process as game
Depth	Surface
Reality	Simulation
Seriousness	Game
Mechanistic	Organic

For Sherry Turkle (1998, p. 436), who works with the above criteria in her book *"Life on the Screen"*, a "culture of calculation" is contrasted here with a "culture of simulation". Five years ago she judged the status of the discussion as follows: "We have accepted the post-modern values of opaqueness, experimenting as a game and surfing over surfaces more and more strongly as serious forms of acquiring knowledge." This will naturally have consequences for the way in which knowledge is actually produced and how people deal with it.

Two Critical Points

Fundamental pedagogical considerations naturally not only have to substantiate theoretically and legitimise obvious benefits of acquiring informed knowledge but also to reflect on its dangers and developments in the wrong direction. A selected characteristic example will be given for both cases, in order to highlight in this way the special features of the acquisition of informed knowledge.

Benefit: There is no doubt that the "power of control" over a cosmos of information, the experience of a person's own successful activities, handling the codified knowledge of many experts, independently acquiring relevant knowledge, i.e. knowledge that can be converted into actions, changes those persons who make efforts to acquire new knowledge in the digital learning environment. They extend their intellectual possibilities and their virtual presence. But this does not fully characterise the pedagogical importance of acquiring knowledge in a digital learning environment. The relationship of people to computers is namely more important than their practical usefulness for acquiring knowledge. Work with this digital machine will also become "a means for

human self-definition" (Bolz, 1997, p. 626). This addresses a process of identity finding and changes which is important for a new form of forming personality.

For the human image of future pedagogy it is therefore important to see the great extent in which "I" constructions take place when working with computers and in the Internet. We "stylise and create our self" (Turkle, 1998, p. 290) in this virtual reality. This creates a new pedagogical problem: we do not know what the relationship is of this virtual self to the real self, i.e. to the traditional personality, in particular because practical experience makes clear that we are dealing with two greatly different ways of experiencing. Will people in the knowledge society be able to change easily from one sphere to another, as if it were amphibiously, when developing their personalities?

Disadvantage: How advanced is automation of mental functions? Does what has already been achieved have consequences for the acquisition of knowledge in the digital learning environment? Hartmut von Hentig (1993) has diagnosed with foresight how computers have made serious changes to this process. He argues that certain characteristics of the human mind penetrate the computer, react on students and accumulate there, while other characteristics "rest without being used, are neglected and in the end lost". This insight might in fact be extended to refer very generally to informed knowledge as such. How do pedagogues handle the acquisition of knowledge in which hermeneutic working methods, the power of memory, the force of remembering, reflection, productive doubts and systematic reasoning are and remain to a great extent masked out?

The Continuing Role of Classical Knowledge

In this transitional period the position of traditional, of classical knowledge will be of no less pedagogical significance. Not a few media theoreticians see us now quite decidedly at the end of the Gutenberg galaxy (e.g. McLuhan, 1962; Bolz, 1995) and already in the era of electronic communication. They toll the knell for the end of the culture of writing, the civilisation of the book and therefore of classical knowledge and see here "the turning away from the old, subjective, linearly thinking and historically conscious person" (Flusser, 1991, p. 158; quoted by Werner Faulstich, 1997, p. 32).

The reasons given by these authors are excitingly obvious and logical. However, if we do not describe the change theoretically and subtly but keep our eyes pragmatically on what is actually happening, we have to ask ourselves whether the knowledge society can do without the methods and findings of classical knowledge, whether the over three thousand years of »logophonocentric« development (Bolz, 1995, p. 186) of linear logical thought is in fact now coming to an end. Let us remind ourselves of the significance of continuous reflection on knowledge, of what epistemology and the science of knowledge have contributed, and above all of the hermeneutical and empirical processes of acquiring new knowledge. A reflected logical methodology for acquiring informed knowledge still has to be developed and may indeed not even be possible.

The increase in significance that informed knowledge is experiencing at present must for this reason not lead (yet) to the neglect or even disregard of classical knowledge. From a pedagogical aspect it remains an important content and is still an absolutely

essential means of acquiring the world, a proven medium for "enlightening" and "mastering" existence. Nina Degele (2000, p. 96) evaluates classical knowledge as "knowledge of the first order" that makes up most of our total knowledge. And Gibbons et al. (1995, VII) describe the new knowledge merely as "*Mode 2*" of knowledge and stress that it is developing *"alongside the traditional, familiar one"*.

In the interplay with the information stored in the Internet and when generating informed knowledge we must recognise that classical knowledge in fact possesses an essential degree of significance, because not only global knowledge but usually ordered and flexible expert knowledge is necessary as well that has to be easily accessible not in a computer but in memory when difficult and demanding problems are to be solved. The human memory assumes functions here that are not available to computers in spite of their memory capacities. Franz Emanuel Weinert (1997, p. 169) has indicated this impressively. He contradicts the frequently heard opinion that in the 21st century we do not need to have a general education and certainly no skilled knowledge available in our memories because of the short life of knowledge. In fact, he claims, "intelligent" contextually relevant knowledge is necessary in the first place to be able to use the help of the computer with promising objectives, part objectives and solution strategies. The role of already available knowledge, of intelligence and of personal motivation, the cooperation between working memory and long-term memory is integrated into the interplay of classical and informed knowledge, factors for which there are no correspondences in the computer.

The solution of a demanding task therefore starts in the mind and not in the computer, to paraphrase the phrase quoted from Jürgen Mittelstraß.

Pedagogical Chances

The internal and external conditions for the *production* of knowledge that the computer has changed also influence the *acquisition* of knowledge. The reason for this is that there is a certain affinity and parallelism between the two processes. They may even be isomorphic in important sections. For example, if we look at how informed knowledge is created the special relation between information and knowledge becomes clear that also has an effect in learning processes. This parallelism, which will be demonstrated in the following pages, opens up new and by no means charted opportunities for optimising and reforming the teaching and learning process.

Two Parallel Processes

Let us look back first of all at how *informed* knowledge can be created:

- At the start of the process is a problem that has to be described and analysed with the help of internal knowledge.
- By navigating and surfing in the Internet regionally and globally distributed information is filtered intelligently. With its help the existing relevant state of knowledge is brought to mind, the problem is illuminated from several sides, analysing it is simplified, and in certain circumstances externally existing solutions are surveyed.

- Researchers do not proceed in the sense of linear rationalism and logical consequences, but work with the tested information in a problem-related manner. "Searching and researching no longer follow line for line the wisdom of phonetic language but run over patterns." (Bolz, 1997, p. 664). Thought is carried out in configurations, work is done with pattern recognition, simulations, manipulations, delegations, assimilations, links, even with games of trial and error.
- Virtual communication and collaboration with other qualified persons take place.
- In its own way selected and interpreted information from the virtual space amalgamates with individual general knowledge and the individual technical knowledge with regard to the solution to the problem.
- At the end of this interactive process, in which several solutions may be worked through, stands new "informed" knowledge.
- Meta-knowledge (organisation knowledge, evaluation knowledge, *knowledge management*) is used to accompany and control the whole process critically.

The creation of informed knowledge is a singular process in each case, because specific real application opportunities in practice confirm the correctness of the results (relationship to actions).

The process of *acquiring knowledge* runs very similarly in a digital learning environment. The cognitive activity of the learner passes through the following phases:

- At the start, problems are recognised and described with the help of internal knowledge. Their solutions are defined as the learning goal.
- By navigating and surfing in the Internet regionally and globally distributed information which may help to clarify the problems and their solutions is filtered out and checked. By comparing, configuring, testing, visualising the interpreted information the user gains an overview and reduces the complexity with regard to the learning goal.
- Procedures, paths for solutions, learning problems and progress that has been made are discussed in the virtual space with teachers, advisors and other students (communication and collaboration).
- Advances in knowledge are made, and the learning goals are reached, on the basis of the interactive processes between internal knowledge and tested external information, if necessary by evaluating external solutions as well.
- The learning results are evaluated and tested for the practical application.
- Ideally, all learning steps in this self-controlled learning process are accompanied critically and controlled by the learners themselves (meta-cognition).

In learning processes of this kind, as in the generation of knowledge, free-floating information is adapted and integrated into a certain historical situation that is defined by time and space, socially, culturally and by society, and finds a new anthropological location on this transformation. Elements of explorative, discovering and researching learning and of the deciding learning orientation take effect, thus fulfilling demands from pedagogues for more self-responsibility from learners. Acquiring knowledge in this form can be seen as the ideal preparation for those who have to generate informed

knowledge as routine in the future knowledge society and deal with it in a previously unknown form. The structural proximity of this process of acquiring knowledge to the sketched process of producing informed knowledge makes this conclusion appear obvious. It can also be supported by a reference to knowledge psychology for which acquiring knowledge covers both "thinking" and "learning" (Staedtler, 1998, p. 635).

Specific Preconditions

Those who wish to acquire knowledge will have to work in the digital learning environment and generate informed knowledge there with the help of new strategies and methods of procedure. This is something fundamentally different and requires a specific learning behaviour. This behaviour may appear to novices to be not serious, unsystematic, random, even a game, but these are only superficial impressions of another world of learning that differs in its fundamental structures.

In order to bring to mind the fundamentally different nature of the acquisition of knowledge, we shall refer here to the formation of concentrations of emphasis in this process. Learners not only absorb defined contents cognitively, in order to reproduce them when required, they also have to adjust to a series of very specific behaviours. Because acquiring knowledge now means not only composing information that was searched for, found, interpreted and integrated, but also includes the following activities:

- Carefully planning, organising and controlling the process (management)
- Critical reflection on the process (meta-cognition)
- Effective representation and presentation of the created knowledge using digital verbalising and visualising techniques (knowledge design)
- Deliberately "sharing" the knowledge with others (participation)

Models for Acquiring Informed Knowledge

If we analyse the technological potentiality of the digital learning environment the special pedagogical possibilities spring to mind that this offers for the acquisition of informed knowledge. In a unique manner learners have greater areas of freedom and effective technological preconditions available, which are also extremely diverse and flexible. As examples, I want to introduce six models for this new form of acquiring knowledge: active learning, resource-based learning, self-controlled learning, exploring learning, learning as construction and learning as knowledge management.

Acquisition of Knowledge Through Activated Learning

For over a century reform-minded pedagogues have criticised the verbal imparting of knowledge because it favours a passive and receptive learning behaviour. If the goal of education is the self-determined person, the acquisition of knowledge also has to be independent and take place through the learner's own activities, in other words "with their own drive, under their own power, on self-selected paths, towards freely selected goals" (Gaudig, 1922, p. 1). Otto Scheibner (1962, p. 38) interpreted the acquisition of knowledge as a working process in which learners carry out all the steps themselves.

"Self-acting"(Selbständigkeit) and "free mental action" (freie geistige Schularbeit) were the key words at the time. Activity of this nature presupposes a corresponding intrinsic motivation, which is fed by the relevant interests and strengthened through experiencing success. In favourable cases the motivation for the active acquisition of knowledge can increase to such an extent that learners identify completely with their work and are sublimated into it.

In spite of these efforts by reform-minded pedagogues the expository imparting of knowledge and receptive learning continued to dominate and still dominate today. However, in the digital learning environment that starting point is different. In this case learners are forced into activity for the simple reason that the acquisition of knowledge does not take place without their activity. Here, decisions have to be taken, resolutions made and intentions pursued. Knowledge is acquired through action. Learners search for information, find and integrate it, download digitalised teaching texts, send e-mails, check bulletin boards, organise communication and collaboration with other participants and carry out computer-based evaluations. However, on this base for behaviour higher range activities are also developed during planning, controlling, evaluating and criticising the learners' own learning processes.

Both activating forms of acquiring knowledge conform to the demands of reform-minded pedagogues.

Acquisition of Knowledge Through Resource-Based Learning

Resource-based learning was developed in England in the 1970s. Materials that impart knowledge and encourage experimentation were regarded as resources at the time (Romiszowski, 1986, p. 345). In this way an attempt was made to individualise and activate learning and to make it independent of the continuous influence of teachers. Today's computer networks, which provide an unimaginable wealth of information, naturally cause pedagogues to fall back on this model, in particular in virtual universities. The inexhaustible fund of "resources" is the determining element for this way of acquiring knowledge. However, the materials are no longer stressed with this model, but rather the methods of opening them up and processing them. Accordingly, resource-based learning is defined today as "a set of integrated strategies" with which student-centred learning can be enabled and promoted in the context of mass education (cf. Ryan, 2000, p. 22). Of course, specific ranges for the Internet are still used as the basis for materials.

Acquisition of Knowledge Through Self-Regulated Learning

Protagonists of self-regulated learning want to protect the acquisition of knowledge as far as possible from the influence of teachers and other persons or instances. Students themselves should plan, implement, review and evaluate it as far as possible. Self-regulation is by no means related only to the cognitive activity but also to motivation and learning behaviour (cf. Zimmerman & Schunk, 1989, p. 4). The digital learning environment enables this type of self-regulation of processes of acquiring knowledge in a way that practically no other scenario of instructional design does. The ultimate goal is the autonomous learner.

Acquisition of Knowledge Through Learning by Exploring and Discovering

Methods of learning by discovering (discovery methods) were described in the USA by well-known learning psychologists (Bruner, 1966; Biggs, 1972; Gagné, 1965) in the 1960s and 1970s. Biggs differentiated between several types of learning by discovery, including discovery in open, unplanned learning situations (impromptu discovery), "free exploring learning ", "guided discovery" and "controlled discovery".

With on-line learning recourse to this model appears obvious for several reasons.

- The unimaginable scope of globally distributed information encourages students who are interested in a given subject to make their own discoveries. Technological provisions facilitate this very effectively: browsing, the links, the servers and online services. Here, too, can be found graduated forms of exploration and discovery. For example, browsing can take place in an open situation completely freely and without a definite aim, but can also be carried out with a view to the student's own targets.
- Hypertext enables an additional form of exploration with navigation. There are graduations here as well. The paths chosen can be selected freely, but can also be guided or even controlled, by either not setting any links or by fixing any number of appropriate links. This has developed into the "guided tour" in an unknown field of knowledge.
- Simulations enable exploration in the framework of complex representations of systems or processes. New knowledge can be generated by entering defined values.
- Real experiments can take place in virtual spaces.

Acquisition of Knowledge Through Construction

This model is preferred at present by a growing number of theoreticians and practitioners. According to them knowledge cannot be imparted (e.g. von Foerster & Pörksen, 1998). This understanding is naturally in contradiction to the traditionally dominating opinion according to which learning is based on the reception of represented knowledge. After all, "imparting knowledge" is still a key term of pedagogy today.

But von Foerster goes on to claim that knowledge "cannot be understood as a type of object, an item or a thing that … can be transferred from A to B in order to achieve a defined effect in an organism". On the contrary, the author is of the opinion that "knowledge is generated by a person himself and the essential thing is to create the circumstances in which these processes of generation and creation are possible." The digital learning environment provides the circumstances. In this environment the constructive view of the nature of knowledge gains direct pedagogical importance. Knowledge is created here in a process of construction which is based on the conversion of information into knowledge structures and their adaptation to the new situations.

According to Knuth and Cunningham (1993) as well as Duffy and Jonassen (1991), knowledge is by no means imparted by "instruction". They also describe the sequence of the process of constructing knowledge. According to their theory, the individual builds his own new knowledge structures, places them in networks, links them with new concepts, assimilates and integrates them. However, this process is influenced individually through existing knowledge and through anthropogenic circumstances as

well as through social, cultural and societal factors, in particular through interests, convictions, conceptions and ideologies. This process of constructing in particular brings once again to mind that certain steps in the production of informed knowledge can also be easily interpreted pedagogically.

It is difficult to overestimate the growing importance of this model. Gabi Reinmann-Rothmeier and Heinz Mandl (1998, p. 480) have already noted that "the constructive mental activity of learners represents a necessary precondition for all acquisition of knowledge".

Acquisition of Knowledge Through Communication and Collaboration

Knowledge does not develop its specific inherent effect until it is published, communicated. The constitutive interplay of knowledge and communication was seen by Friedrich Daniel Ernst Schleiermacher (1956, p. 224) as early as the beginning of the 19th century. What "some scientist or other worked out for himself in lonely work and enterprise" was for him merely "an empty appearance". In the 20th century Hartmut von Hentig (1971, p. 854) saw publication as "a constitutive and integral component of knowledge". With these ideas in mind, great importance is placed on oral dialogue, scientific discourse, and communicative action. This also concerns the acquisition of knowledge as well. It hardly needs to be mentioned in this context that in traditional teaching methods in large classes and in mass universities far too little account is taken of this aspect.

Things are different in the computerised knowledge society. Communication and collaboration can become important elements of imparting knowledge. The necessary hardware and software preconditions are given. They enable new forms that have no equivalents in pedagogy. A new field of pedagogical activity is developing here that will have a particular effect on the genesis of informed knowledge, one reason being that people are brought together who are separated from each other by time and space. Some of these new forms are discussed here in order to indicate the new opportunities.

Acquisition of Knowledge Through Knowledge Management

Knowledge management, although new to both theory and practice, has already entered public consciousness as a slogan. Its up-to-datedness is reflected in many monographs and collections of essays (e.g. Probst, Raub & Romhardt, 2000; Soukup, 2001; Schreyögg, 2001) and numerous conferences. The driving force behind this innovation is economics. Because knowledge is seen as first-rate productive force and value-added factor, companies must identify, acquire, develop, evaluate, split, distribute, use, manage, maintain and secure the knowledge that they possess or need. All these tasks are coordinated and administered, usually by specialists. Companies must solve these problems if they are to exist in global competition. The relevance of these activities also arises from the fact that research has taken up this new field of work, above all in general business administration, ergonomics, business informatics and industrial and organisational psychology. This development has led to the current impression that knowledge management is primarily a matter for companies, especially large industrial operations.

We have to thank the psychological-pedagogical research by Heinz Mandl and Gabi Reinmann-Rothmeier that "knowledge management" is in addition interpreted as a competence that concerns us *all*, because in future we will all have to find our way

around the flood of information provided by the Internet. Accordingly, knowledge is not just an economic good but also a "person-related good" (Reinmann-Rothmeier, 2002, p. 2). It is a competence "for life in the knowledge society" (Reinmann-Rothmeier & Mandl, 1997b, p. 97). Each of us must now develop strategies for dealing with information and knowledge in all their forms. This made clear the pedagogical dimension of the term. In fact, the authors relate knowledge management explicitly to the area of education (1997, p. 56). In particular, they regard it as an integral part of the acquisition of knowledge. In other words, they interpret knowledge management pedagogically.

It is exciting to imagine learning as a special process of knowledge management. Distance students and on-line learners have always been forced to organise their own learning processes, e.g. with regard to the beginning, duration, location and often the sequence of the modules they had to work through. To a limited extent they have always had to monitor and check their own learning. If they now in addition want to manage the actual process of acquiring knowledge they can orient themselves to the integrated Munich model of knowledge management (Reinmann-Rothmeier, 2002, p. 8).

This model focuses attention on four process areas: the *representation*, *use*, *communication* and *generation of knowledge*. Corresponding processes are planned in any case for the development of informed knowledge in digital learning environments. However, if these processes are controlled using this model, the pedagogical cornerstones are strengthened and the pedagogical contours are intensified. In addition, the model can coordinate the necessary activities for acquiring knowledge and legitimate them theoretically.

Knowledge management is particularly important in on-line learning. Gabi Reinmann-Rothmeier interprets it as a "melting pot" for knowledge management and continuing education (2002, p. 11). She points out how three basic functions of on-line learning can be used in continuing education: the *distribution* of information, the *interaction* between user and system and the *collaboration* between learners. And she also shows how basic functions of knowledge management (representation, communication, use, generation) can be linked in this way.

Principles for Acquiring Informed Knowledge

Some of the more important pedagogical concepts can be realised as well relatively easily and effectively in the digital learning environment. As examples of this I will refer to just three: learner orientation, problem orientation and actuality.

Learner Orientation

If we start from the constructivist learning model, in the acquisition of knowledge the actual work is done by the individuals. They move into the focal point of the happenings. In the digital learning environment this is expressed quite simply by the fact that learners work in relative isolation from others and that all activities of this acquisition of knowledge have to, and should, start from themselves, which makes them, so to speak, to the leading actors.

In this way, their individual preconditions (motivation, interests, needs, intelligence, prior knowledge, attitudes, social background) can take effect and impact without restriction. Whereas in expository teaching in front of groups the heterogeneous preconditions of learners can only be taken into account in rudiments and in a generalised manner, if, in fact, they are not ignored completely, an extreme and therefore optimum learner orientation can be achieved in the digital learning environment. The orientation to teachers that may be observed in many places is correspondingly extremely restricted. The task of teachers consists of enabling learners to orientate towards their own requirements and possibilities and to design the learning environment accordingly. This is a new and very efficient form of learner orientation.

Problem Orientation

The independence, automatism and activity of learners can prove itself in particular in the acquisition of knowledge in a digital learning environment when they detect, describe, define and, with the help of cognitive tools as well, solve problems during the analysis of the contents that have to be worked through. They can become involved to a greater extent in the process than is in general usual and possible with the mere reception of orally presented texts. The orientation towards problems forces them to become involved with the material to a deeper extent and from the point of view of even more aspects and to think up and try out possibilities for solutions. In this way, the process of acquisition obtains a cognitive and pedagogical structure: ideally it consists of a chain of greater and smaller problems, the appropriate attempts at solutions and the results achieved.

Relation to Reality

In traditional teaching knowledge is mainly imparted by speech or the printed word. However, this mono-medial coding makes imparting relatively abstract and remote from reality. In contrast, in the digital learning environment there are new opportunities for relating the acquisition of knowledge to a much greater extent to reality. These include:

- *Multimedia and multimodality.* Several forms of presentation address more than one of the senses. Reality is therefore perceived more clearly.
- *Authenticity.* Because learners have access globally to information through the Internet, the virtual world does not present itself as in a textbook, but directly.
- *Simulation.* Real processes and situation can be illustrated in such a complex manner that "subjectively significant action under real conditions" is made possible.
- *Virtual reality.* Learners can "immerse" themselves in this three-dimensional computer-generated data world and gather their own experiences that then have an effect on their acquisition of knowledge. "Information landscapes" and "knowledge spaces" may be developed in the future (Alsdorf & Bannwart, 1997, p. 442).
- *Situated learning.* In self-regulated learning in a digital learning environment the acquisition of knowledge will become a complex process. Knowledge will "always be acquired here in a very definite cognitive, affective, social and cultural context" (Reinmann-Rothmeier & Mandl, 1998, p. 490). Problems will be selected that are real and not just constructed for the purposes of exercises. The learner is then in a

position to work on the problem from several perspectives, whereby virtual communication and collaboration make their contributions as well. We approach closer to reality here simply through this understanding and procedure.

- *Communication and collaboration* with mentors, other students, experts, and fellow employees are all acts of action-related learning that can have strong relations to reality.

Summary: Information Is Converted to Knowledge

The active, self-regulated acquisition of knowledge, based on materials and the process of constructing, can develop particularly easily and effectively in a digital learning environment. Materials here are isolated and standard items of information.

The new and certainly unusual task of learners now is to deal with these items of information with the help of cognitive operations as, for example, abstracting, formalising, structuring, evaluating, processing, combining, transforming, associating, producing collages, modelling, networking and by generating relations. All of this should be done in such a way that the solution of the initial problem is approached creatively and the learning goal can be reached.

This way of dealing with standardised information tends to be more similar to the presentation of potential knowledge elements by than the creation of classical knowledge, such as comes from "doubting, questioning, deliberative thinking" (von Hentig, 1993), from inducing and deducing, forming terms, judging and from drawing logical consequences.

However, what is decisive for the computerised process of acquiring knowledge is not the indicated dealing with suitable standardised items of information but their conversion into new knowledge. This is done by bringing the information that is filtered out into a new *context* which differs from learner to learner. The following factors may influence this complex process:

- Motivation and interest
- Relevant prior knowledge
- Biographical situation
- Goals of knowledge and learning
- Structuring of the identified information (facts, concepts, procedures, principles)
- Construction instead of simply taking over findings
- Possibilities of transfer and application (reference to activity)
- Integration in existing knowledge structures
- Embedding in the here and now (locating and placing in a time context)
- Embedding in the societal, cultural and social contexts
- Validity test
- Possibility of the effective presentation of the new knowledge.

Knowledge in a pedagogical sense is by no means a stock of abstract knowledge that can be passed on (″distributed″ or ″delivered") or imparted, but is the result of an extremely individual process in which floating items of information, which are the same everyone all over the world, find a new and unique anthropological location.

Consequences

The described change of conditions in the acquisition of knowledge of learning is sensational. In the same way as in industry and business that knowledge-based production and knowledge-based management have led to the "creative destruction" (Castells, 2001, p. 106) of traditional working conditions, we may assume that there will be a radical dissolution of traditional forms followed by their necessary re-construction in the "knowledge-based acquisition of knowledge" as well.

The change that this brings about is characterised by an excess of standardised stored information and by work with the new concept of informed knowledge. This covers and changes learning locations, learning environments, contents, learning strategies and even our thinking and consciousness.

The following changes above all must be registered or expected:

- Traditional familiar forms of imparting and acquiring knowledge will by and by become obsolete. Old feelings of security will be dissolved.
- New pedagogical structures will come into being as a result of the integration of text, image and sound, the dissolution of traditional time- and space-based situations for learning, the global accessibility of information and the creation of virtual communication and cooperation networks. This will have the following effects:
  - The efficiency radius of teaching and learning will be extended enormously.
  - Processes of acquiring knowledge can develop a previously unknown dynamism.
  - In comparison with traditional forms of acquiring knowledge the processes of acquiring knowledge electronically are typically discontinuous, not only with regard to the processes but also to the results.
  - The changes with regard to thinking and consciousness are radical. If we agree with Norbert Bolz (1994, p. 9), "intellect" is now only the "embodiment of all possible data combinations". For him, the familiar "linearly perspective world image is broken up into the facets of a mosaic" (1994, p. 10) and "the classical theory of truth" is replaced "by the constructivist criterion" of "fitting" (1994, p. 10).

The changes to the acquisition of knowledge that were indicated above are so fundamental and extensive that that question whether there will still be pedagogical continuity arises. Only a few have already recognised and processed the fact that a changed conception of information and knowledge can be so successful.

Everyone is affected by this change. Even those who cling culturally to the traditional conditions of teaching and learning and want to see them retained will in the end not be able to escape the changes shown here. Everyone will be forced to find a new relationship

to information and knowledge and gradually to develop their own corresponding individual learning behaviour. This should take place deliberately rather than unconsciously.

Because this does not just affect learning in schools and institutes of higher education but also affects everyone's lifelong learning, continuing education will probably be the largest and most important field in which the described change will take place. In the knowledge society, continuing education will become a fixed, if not even an integral, component of each individually experienced private and vocational life. Never before has continuous education been promoted so vehemently, has it been so pressing. And it can probably only take place to the extent aimed for in the changed conditions of a computerised knowledge society.

If we keep the pedagogical tasks in mind that result from the change and also call to mind the corresponding pedagogical chances, it becomes clear just how complex, fundamental and successful the adjustment to the changed situations has to be. With the focus on information and knowledge only a tiny aspect of the general cultural change has been examined. If we look at it, as in this essay, as *pars pro toto* we are overwhelmed by those happenings that pull us unawares into their undertow.

11 The Pedagogical Flexibility of the Virtual University

In this section the development, organisation and typical pedagogical structures of virtual universities are described in order to demonstrate their unusual pedagogical flexibility. In this way it is possible to demonstrate how flexibility is increased by virtuality. Another objective is to point to the overriding importance of the concept of the autonomous self-regulated learner in a virtual university.

Introduction

Flexible Learning

Experienced educators might be surprised at the great emphasis that is currently placed on this particular feature of learning. They know that each form of instruction and of imparting knowledge requires extraordinary flexibility. For instance, the form may be student-oriented, lecturer-oriented or content-oriented. It may be adapted to the requirements of different disciplines, and must mirror the current trends in research and cultural developments. The pedagogical structure consists of many components which influence each other each time in another way. Flexibility is an inherent quality in any form of pedagogical endeavour.

However, we must also see that in the present situation of our culture this term assumes a special meaning. It is a reaction to the rapid change which now enmeshes every aspect of society. The focus is on the fact that universities have to adapt their teaching to the new requirements of life in a post-industrial, post-modern knowledge society. This new situation calls for forms of teaching which are highly flexible. Consequently, flexible learning is at a premium. There is even a sense of urgency in the debate. Higher education must become more flexible if universities want to survive. The concept has acquired a deep, existential significance.

What do we mean when we speak of "flexible" learning today? Theoretically speaking, there are several dimensions to flexibility. Institutions, administrative structures, curricula, as well as strategies and methods of learning, may be rigid and fixed or flexible and easily adaptable. Furthermore, the very goals of education are no longer obvious, but have to be reconsidered and quite often changed. Just now we are in a transformation process even with regard to our values. The educational paradigm shift is a powerful driving force towards more flexibility.

In everyday higher education, however, flexibility has assumed four special meanings which have become instrumental in university reform. First of all, there is a focus on increased accessibility. Universities should be flexible enough to attract and to enrol more and new groups of students. Secondly, there is a focus on giving students more choice and control over their learning processes. They should be allowed to learn when they want to, what they want and how they want. Thirdly, an outstanding feature is helping the students to take responsibility for their learning. And fourthly, reformers are interested in meeting students' needs by providing more support than has been the case in our conventional universities. Hudson, Muslin-Prothero and Oates (1997) made a

study of 31 reform projects in higher education and identified these four elements of flexible learning.

The urge to make our universities more flexible has increased so considerably that we may even speak of a campaign towards more flexibility at many universities. In Australia, we can see most, if not all, universities engaging with the applications of new technologies to teaching and learning because it is becoming increasingly difficult for them to maintain conventional patterns of teaching and learning. Global competition and rising costs are the driving forces. The University of Southern Australia commenced a process of a planned approach to implementing a changed learning environment as long ago as 1994. These environments provide many more options for students, offer programmes and services which are highly flexible and have a significant technological dimension (Kenworthy, 2000, p. 5). Murdoch University has developed a master plan for a "flexible teaching and learning policy" in which the authors have described what flexibility will mean for this university: Students should be allowed "to have a choice of teaching modes, assessment modes, accesses to teachers, peers and learning resources which suit the style and circumstances of the learner" (Atkinson, 1997). Other aims of this policy are changes in teaching attitudes, in the role of teachers, in the university structure, and in enrolment and assessment options. With this strategy a judicious and planned use of information technology is required as it will become instrumental in achieving the flexibility envisaged. A similar plan has been developed by Macquarie University in Sidney. These universities are trying to meet individual needs by providing choices in time and place of study, learning styles, access, pace, progression and learning pathways (Gosper, 1997–2000, p. 1).

How can such an extraordinary degree of flexibility be achieved? Many universities believe by introducing new forms of distributed learning and, in the long run, by establishing »virtual universities«.

Learning in a Virtual Environment

Similar to the term "flexibility" the word "virtual" is much in vogue nowadays. Because of its attractiveness and appeal it is used very often, if not in fact overused. People speak of "virtual" classrooms, seminars, departments, colleges, and, of course, of »virtual universities«. The literature now abounds in articles about virtual universities. However, if we take a closer look at these universities we find that this designation is quite often used more or less boastfully. A "real" virtual university can be considered as a purposefully structured accumulation and combination of a large number of net-based learning approaches. It must provide for an entire virtual academic infrastructure which enables all students to benefit from all functions an ordinary campus based university can offer, including administrative and support systems as well.

In order to understand the meaning of virtual learning it must be noted that the learning process itself is never virtual, but always quite real. However, it can be initiated, stimulated and developed by optical and acoustical signals in virtual spaces – in virtual learning spaces in fact (Peters, 1999; cf. chap. 6). These virtual learning spaces differ in many ways from real learning spaces. Most important of all: they are infinite. The boundlessness, uncertainty, inconceivability and "emptiness" of the space seen on respective "behind" the monitor's screen probably makes the greatest impression on the observer. This signalises a space *beyond* previous learning locations, and to a certain

degree *beyond* the learning experiences which can be gained at previous real learning locations.

The feature which is most important and characteristic for our learning processes is that geographical distance no longer exists. As Nicolas Negroponte (1997) used to say: "Distance is dead!" However, not only constraints of distance, but also those of time and even reality are relaxed by information technology. Considering the remarkable new possibilities of such new virtual learning space we must ask ourselves whether

- learning in virtual spaces can or should be the same as learning in real learning spaces, as many protagonists of net-based learning believe,
- we are faced with a challenge to develop new pedagogical models for pursuing university studies,
- we should start placing much more emphasis on developing and empowering autonomous learners.

A. Preparing the Way to More Flexibility

A critical analysis of those universities which offer net-based courses soon shows that a real virtual university cannot yet be found anywhere in the world. This means that, for the time being, all we can do is describe the ways in which the net has been used for imparting knowledge and skills in institutions of higher learning. In order to do this an unusual approach is taken. Four levels of activity are described: (1) pragmatic approaches by students, (2) pragmatic approaches by faculty members, (3) measures taken by institutions of higher education, and (4) theoretical interpretations of these processes. Only the integration and further development of these four levels of activity will finally lead to real "virtual universities".

Pragmatic Approaches by Students

An analysis of how students use their computers and the net for their own learning without any guidance or organisational provision by their faculty members or institutions is, pedagogically speaking, interesting and revealing. Two journalists (Fliege & Härtel, 2000, p. 54) interviewed individual students and identified the following activities:

- carrying out bibliographical research,
- reading notice-boards,
- reading extracts from books,
- reading professional periodicals,
- reading newspapers,
- contacting the administration by e-mail,
- exploring the respective labour market,
- developing catalogues of books owned and used,
- developing a network in evolution biology for young researchers,
- developing the "service" *"Find and Bring"* which identifies relevant information and literature for the benefit of *other* students (commercially).

These elements of net-based learning behaviour are entirely voluntary and casual ones. This is the reason why they are, pedagogically speaking, significant from the aspect of a future virtual university as well. These students demonstrate initiative and engage in activities themselves, set their own goals and try to achieve them. They develop activities and improve and evaluate them. Again and again they have to make their own decisions on how to proceed. In one case the net is also used to communicate with the university administration. In another case even co-operation with other students is sought and implemented. And in yet another case, the student demonstrates the application of the acquired knowledge and skill in practical life by starting a small commercial enterprise. According to theories of teaching and learning the transformation of knowledge into relevant action is considered a very important goal, which is to a great extent neglected by our university teaching, which is mainly based on cognitive processes only. We might think that students are often already sufficiently motivated and are also able to use the net for their own learning. This, however, is a learning behaviour which will assume great, if not overriding, importance in the virtual university.

There may be some truth in the frequently heard statement that students are the main driving force in the process of digitising higher education.

Pragmatic Approaches by Individual Faculty Members

In many universities there are some faculty members who are fascinated by the new possibilities of net-based teaching and learning. They start experimenting with it in order to gather experience. Because of the special nature of their disciplines, the available technical possibilities, the, usually limited, funds and the quality of expert support the formats of their experiments differ a great deal. Therefore, there is a great variety of such approaches.

Quite often these teachers use the net for performing an individual instructional function as an addition to their conventional face-to-face instruction. The simplest example is the distribution of lecture notes or other handouts. Other faculty members make provision for access to texts which are rare and not available in the library, to special data-bases, to additional or new research findings in the field covered by the lecture, to information about changes to the timetable or other organisational matters. Yet another addition is established when students are invited to exchange their views in chat-rooms or discussion-forums.

These activities are mere adjuncts to conventional university teaching. They enrich the processes of learning, but may also be missing altogether. They do not really change the basic structure of customary expository teaching, nor do they change the structure of the university.

What do we know about these *first steps* into the world of digitised learning? A joint survey by the Bertelsmann Nixdorf Foundation (1997) on the subject of "Virtual Teaching and Learning at German Universities" in 151 projects provided initial information about how often these individual experiments were conducted (Schulmeister, n. y., p. 3). The survey provided a list of 12 typical net-based activities. The main finding of the survey is that these activities differ considerably in their frequency:

Scripts of lectures	39
Multimedia CD	35
Administrative and organisational matters	11
Use of Internet	10
Simulations	9
Tele-teaching	8
Development of tools	6
Non-specific use	5
Use of Internet combined with interactions	5
Learning with tools	4
Research projects	4
Presentations	2

It would appear that in the first place faculty members used the net for distributing papers (handouts) which normally are given to students before or during face-to-face lectures. This has already been mentioned. In the second place the net is used for delivering lectures which are also presented at standard, face-to-face meetings. Thanks to their independence from fixed times and places, faculty members find it convenient to use the net to provide small amounts of information or lecture notes quickly and easily. Some of them find satisfaction in leaving the lecture hall and lecturing to students in virtual space. Structurally, however, it is the same. They adhere to conventional pedagogical structures, although the external learning and teaching behaviour is considerably altered. Basically we can still see expository one-dimensional teaching. Multimedia CDs are used for the same purpose. In the third place the net is used to acquire information, in the fourth place to simulate learning by construction in vocational courses. Surprisingly little use is made of presentations.

It is important to see that these first steps do not include any teaching using carefully developed interactive multimedia modules or courses or any elements of self-regulated learning. The obvious reason for this is that it requires considerable funds and expertise and a completely different approach to the understanding of learning.

Rolf Schulmeister (n. y., p. 2) was interested in the pedagogical substance of those first approaches and analysed the results of an HIS (Higher Education Information System) survey carried out as early as 1996 and found that at that time there were already 100 institutions of higher education in Germany using the net for teaching and learning purposes. He identified the following six pedagogical factors:

1. Searching for information,
2. learning by constructing,
3. exercices, repetitions,
4. visualising,
5. cognitive learning programmes,
6. communication and co-operation.

Items 5 and 6 show that Schulmeister identified more complex and demanding approaches aimed at new forms of virtual teaching and learning. However, his conclusion was that learning software which exploits the interactive possibilities of the new medium was extremely rare. With regard to the virtual university that is aimed for we should like to stress that most of the pedagogical factors, and not merely one or two of them, should be represented.

At this point the aim is to reach a consensus that a virtual university can never simply consist of a group of digitised teaching and learning functions, or of a single project, or two or three isolated courses, or a virtual seminar of four or five weeks' duration. Likewise, we cannot even call a university a "virtual university" simply because every faculty member and every student is provided with a laptop, or because a number of universities form a consortium in order to develop a small number of special courses. Rather, a real virtual university should be defined as an "infrastructure for providing students with a learning experience and related support services to complete a degree program (...) totally online and for providing faculty members with resources for teaching and doing research effectively online" (Aoki & Pogroszewski, 1998). In addition, we might hope that a virtual university also consisted of an adequate number of departments.

Measures Taken by Institutions of Higher Education

The possibility of delivering teaching programmes at a high speed to external students everywhere in the country or in the world is a tempting one. Even for many experts this seems to be the main objective of using the Internet. In the USA many protagonists believe that "delivery" is the main and quite often only function of a "virtual university". In this country there are university presidents urging their faculty members to have their lectures digitised and presented on the Internet as well in order to increase the number of students and the income of the university. The idea of "delivery" may even have inspired Michael Saylor, the owner of the software company MicroStrategy, to invest US$ 100 million in founding an online university which is to offer courses of the Ivy-League universities at no cost to everyone in the world who is eager to learn (cf. Remke, 2000, p. 3). It is obvious that protagonists of online education believe that delivering learning material to many students means teaching. But presenting content is certainly not teaching. John Daniel (1998c, p. 11) has characterised this approach by saying: "Much of the commercial hype and hope about distance learning is based on a very unidirectional conception of instruction, where teaching is merely a presentation and learning is merely absorption". He calls it "an impoverished notion of distance education" and predicts that it will fail.

Web-based education is distance education and must also embrace teaching and learning activities other than just delivering, namely virtual tutoring, virtual group work, virtual seminars, virtual practice in simulated companies, laboratories and excursions. A virtual university must be able to provide for these support services. And even more: it must develop new pedagogical approaches which exploit the unique potential of online teaching.

Trans-Institutional Co-Operation

According to estimates of a group of German experts at the Bertelsmann-Foundation, the development costs of a single multimedia course to be delivered on the net run to between US$ 1.5 – 5 million (Sproß, 2000, p. 3). Because of this high level of expense, universities have begun to join forces in order to be able to finance their multimedia and interactive net-based teaching projects.

In USA, for example, the most spectacular project is the *Western Governors University* which unites the resources of 21 universities of 16 states in the Western parts of the USA (Schulmeister, 1999, p. 166). In Germany, smaller co-operation projects were referred to by Ludwig Issing (1998). The universities of Kassel, Göttingen, Leipzig and Saarland are co-operating by offering a common net-based course in economic informatics. The "Virtual University of Applied Science" (in Lübeck) was established by a consortium of a number of regional universities of applied sciences, universities, industrial companies, and employers' and employees' associations. These institutions are co-operating in the development of two modular, multimedia and strictly practice-oriented basic degree courses in economic informatics and media informatics, as well as in catering for new target groups. The main function of this virtual university of applied science is to act as an agency to organise continuing education with new partners and to co-operate with institutions outside the consortium. Plans to establish a "Virtual University Bavaria" are being realised at present. All universities and universities of applied science are invited to participate. A central institute will co-ordinate these co-operations. Enrolment and examinations will also be administered virtually. However, only up to 60 percent of a degree course can be studied virtually. And no student will be obliged to study virtually. The Bavarian approach to this project is one of caution.

We can see once again that these co-operative approaches as well will not lead to virtual universities if they are measured against the above criteria.

Theoretical Interpretations

The progress of net-based learning is not only based on spectacular technological advances and on the surprising enthusiasm of a relatively small group of academic protagonists for pedagogical net-based experiments, but also on the prevalence of new or renewed theoretical insights into the nature of learning. One is the new importance placed on self-learning, another one the current predilection for constructivism. A third insight is the concept of a "virtual society" of which the virtual university will be just one component. These theoretical approaches are important for the discussion about the new teaching and learning behaviours required in net-based learning in a virtual university.

A Pedagogical Goal: Autonomous, Self-Directed Learning

The emergence of a large number of different forms of net-based learning and the use of the digitised learning environment has caused educators to revive and to apply pedagogical models which they always have thought to be relevant for innovating and reforming teaching and learning. Individualisation, activation, communication, games, projects, student-centred approaches and autonomous learning are some of the old pedagogical keywords which assume new relevance in virtual learning spaces.

The most important one among them is autonomous and self-regulated learning. For about a hundred years this has been a pedagogical goal for the education of school children and even more so of adults. Hence, trying to realise it is nothing new. However, we are now challenged by the fact that the digitised learning environment provides for many new, unforeseen, unexpected and extremely effective possibilities for being successful in this pedagogical endeavour. In fact, the digitised learning environment is full of promise in this respect. For the first time in the history of learning, autonomous learning can be developed, applied and practised relatively easily. The old pedagogical idea of the independent, self-acting, self-confident, self-assured and self-competent student who learns by studying on his or her own can be realised. And in the long run, practising this model of learning will become even a sheer *necessity* in the face of the lifelong learning that is required in our post-industrial information and knowledge society.

Precisely, what is self-regulated learning? Malcolm Knowles (1975, p. 18), a world famous representative of the adult education movement, described self-directed learning in this way: Self-directed learning is "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human or material resources for learning, choosing and implementing learning strategies, and evaluating learning outcomes".

This definition is still valid. Knowles speaks of self-directed learning as the opposite of teacher-directed learning, which is, as we all know, the traditional form of learning. In self-directed learning the students have taken over most of the functions of the faculty member. Knowles´ (1975, p. 14) "immediate reasons" for this transformation are convincing: People "who take the initiative in learning ... learn more things, and learn better, than do people who sit at the feet of teachers passively waiting to be taught". And: "Self-directed learning is more in tune with our natural processes and psychological development." Many "of the new developments in education – the new curriculums, open classrooms, non-graded schools, learning resource centres, independent study, non-traditional study programs, external degree programs ... and the like (have already) put heavy responsibility on the learners to take the initiative in their own learning." This quotation shows again that the concept of the autonomous learner is not a new one. It was developed long before the first digitised learning environment was established. As a quintessence of his ideas Knowles said that it is "no longer realistic to define the purpose of education as transmitting what is known. – … Thus, the main purpose of education must now be to develop skills of inquiry".

Exactly this will be the main objective of the virtual university.

A Psychological Contribution: The Constructivist Model of Learning

The revival of the model of the autonomous learner is supported and intensified by a change of paradigms in the field of learning theory. This change is of great consequence. The traditional view is based on epistemological realism. This means that experiences imprint the structure of the real world into the minds of the individual. Cognition is thus a passive process of copying the structure of the objective world. Accordingly, teaching means presenting objective facts to the students. Learning is absorbing these facts.

Currently, a large number of psychologists and educationists are convinced that learning can never be understood in this way. We do not copy the objective real world in our minds, but rather construct our own reality. "Innate categories and concepts (...) are imposed by individuals upon the world" (Paris & Byrnes, 1989, p. 170). Consequently, learning is basically an individual process, greatly influenced by former experience. This constructivist approach is based on findings of Paul Watzlawick (1981): "Man does not passively copy the real environment – neither by perceptions nor by actions, but creates it by active processes of constructing" and of Jean Piaget (Städtler, 1998, p. 589): "The cognitive development does not consist of a passive increase of experiences, but of an active development of cognitive structures".

What are the consequences of this paradigm change?

- Learning is a highly individual process. The traditional model of expository teaching and receptive learning seems to be the wrong approach. The individual student is to take the initiative in defining, redefining, changing and supplementing his or her cognitive structures.
- Perceiving, thinking and acting are not linear sequences, but circular, recurrent processes.
- The task of the teacher is no longer to impart knowledge and skills, but to create learning environments that are conducive to self-regulated learning.
- The new task of faculty members is to enable and to empower students to learn in their own way.
- This kind of learning cannot develop easily in college classes and lecture halls. Virtual universities, however, are very conducive to practising it.

A Sociological View: The Virtual Society

The ongoing processes of digitising our world have caused a far-reaching transformation which has dramatically changed the processes of production, distribution and communication and has divided our traditional world into two parallel worlds: a real one and a virtual one. According to Achim Bühl (1997) these two worlds differ greatly in that the virtual world is de-coupled from place, time, and conventional social relations. In spite of this, or even because of this, it assumes great importance as it functions as a centre of gravitation which permanently influences the real world. Therefore, Bühl calls our society a »virtual society«.

If we accept this view, it becomes obvious that the virtual university will function as a component of this virtual society. Hence, we have to operate in two learning worlds, in real and in virtual learning spaces. And the virtual learning world may also become a centre of gravitation influencing what happens in the real learning world. This sheds some light on the possible impact of the virtual university on all higher education.

Summary: Flexibility Gained

The way in which individual *students* have used the net for their own learning purposes shows strikingly how their learning behaviour can be developed and improved simply because the net allows much more flexibility than traditional forms of learning, provides limitless space and invites students to become active, to try out new and unusual approaches, to venture into self-learning.

The pedagogical elements and factors identified in the first approaches of *faculty members* to net-based learning increase the flexibility of their conventional teaching. Each one can become instrumental in intensifying the learning/teaching process. Each one can become a valuable addition to conventional teaching and learning. There are clear enrichment possibilities. And each one has the potential to cause some changes to the pedagogical structure, in particular with regard to the way in which learning processes are organised and social configurations are established. But even if a university uses all these factors successfully altogether at once, the result will still not be a »virtual university«. There is certainly more to it than this.

Given their traditional firm insistence on institutional autonomy, the co-operation of several *universities* for the purpose of developing and offering net-based courses can already be considered to be a remarkable achievement with regard to the goal of increased flexibility. Furthermore, the co-operation with universities of applied sciences and employers' and employees' associations is an example of extraordinary flexibility. Institutions of higher education, governments and the EC Commission as well also show a great amount of flexibility by taking the initiative in developing these new forms of net-based teaching and learning and promoting the emergence of virtual universities. Because they wish to employ the latest high level technology they are forced to co-operate. They develop networks not only locally and regionally, but also nationally and internationally. The scope of activities in learning and teaching and the horizon of higher education widens. Faculties can cater for an international student body, and students can design courses of their own at universities far away from their home. Through networking new services become possible. We might mention here the CUBER-project (Curriculum Builder in the Federated Virtual University of the Europe of Regions) which is financed by the European Community (IST – 1999 – 10737) and conducted by Professor Bernd Krämer (2000) of the FernUniversität in Germany. The first tasks envisioned are: supporting learners searching for higher education courses matching their specific needs, making courses comparable through standardised meta-data descriptions, and allowing the combination of courses from heterogeneous resources to coherent packages. Finally, this project aims at building the foundations for a »Federated Virtual University of the Europe of Regions«.

The consequences of the change from teacher-directed to student-directed learning cannot be overestimated. Here, I want to address only the positive and pedagogical ones. Learning becomes highly individualised and student-oriented. Students have the chance to communicate and co-operate more often and more easily with teachers, tutors and fellow students than on campus, to take pedagogical decisions, and, most important, to assume responsibility for their own learning, which includes that they also have to reflect on and evaluate their learning. All these particular pedagogical goals can only be realised in highly flexible institutions.

The constructivist model of learning provides for another source of increased flexibility. If learning is a highly individualised process, uniform presentations of knowledge, fixed curricula and carefully described competencies cease to be rigid frames fettering the activities of teachers and students alike. There is now freedom enough for developing many new forms of activated learning, such as learning by exploration and discovery.

In addition, the theory of the two parallel worlds of learning enlarges the flexibility of learners and teachers as there are innumerable possibilities for combining learning in real spaces and in virtual spaces.

B. Emerging Institutional Patterns

Another driving force in the process of developing net-based learning and virtual universities are the universities themselves. Many of them have seen that this cannot be achieved by individual faculty members working independently of each other, but must be brought about centrally by the governing bodies. It is obvious that these universities can only be transformed into virtual universities by developing and pursuing a uniform strategy of innovation. Quite often they intend to use computers and the net on a large scale. Four such universities can be distinguished: (1) ThinkPad universities, (2) Internet universities, (3) virtual universities, and (4) virtual distance teaching universities. Each of them displays distinctive characteristics and is interesting with regard to the goal of increasing the flexibility of teaching and learning.

ThinkPad Universities

As early as in 1996 IBM began a »Global Campus Initiative« in the United States in order to be able to supply as many universities as possible with IBM-laptop notebooks. The idea was that universities interested in this technical innovation should require every faculty member and student to own and operate the same mobile computer. In order to promote this campaign a special Computer Enhanced Learning Initiative (CELI) was founded. Many institutions of higher learning adopted this particular system. In 1999 there was a Yahoo ranking of "the most wired colleges" in which 500 institutions were already taking part. There is also a Yahoo guide to America's 100 most wired campuses. (http://www3.zdnet.com/yil/content/college/intro.html).

We might be tempted to call these institutions virtual universities because each faculty member and each student has access to the net. But a closer look shows that we are dealing here with *web enhanced campus-based learning* only. This can be demonstrated by two examples:

- *Wake Forest University in Winston-Salem (NC)*

This is a private university catering for 6 000 students of business administration, law and medicine. Tuition fees are USD 21 420 per year. The university has accumulated endowments totalling USD 823 million. The teacher-student ratio is 1:11. Since 1996 all teaching staff and all students have been required to own ThinkPad notebooks.

- *Seton Hall University, South Orange, NJ*

This is the oldest and largest Catholic university in the USA and caters for 8 500 students. Here, too, everybody is supplied with the same mobile computer which is exchanged for a new one every second year. This university is considered to be the showpiece of IBM. In the Yahoo ranking of the 500 "most wired colleges" it achieved the 16th place.

Although the use of the latest computer technology is promoted by a campaign called "Catholicism and Technology", many faculty members remain hesitant. Only one third of them use the laptops in teaching processes as well. Another third of them refuse to use

them. And the remainder are prepared to attend courses to acquire computer competency, but have to be "bribed" and "motivated" by the university with USD 2 000 per year to do so.

Internet Universities

These are commercial enterprises which systematically inform potential students about the availability of online degree courses offered by universities throughout the USA and facilitate their enrolment at these universities. In other words, they are not engaged in research, do not teach and do not confer degrees. They limit themselves to performing the function of *educational brokers*.

- *The Internet-University in Cambridge, MA.*

This university was founded in 1996 and uses the net to establish links between potential students, most of whom are working adults, and those degree courses which would suit their needs, educational background and vocational experiences. The main functions of this institution can be explained by mentioning that it operates three search engines: (1) "Find a course", (2) "Search by school", and (3) "Search by degrees". Its educational relevance derives from its success in attracting students. In 1996 there were 27 co-operating universities offering 705 courses. Just three years later there were 124 co-operating universities offering 3 878 courses (Ritter, 1999, p. 103). Obviously, there is an enormously growing demand for online degree courses in this country. In fact, the number of students can be estimated at about 50 000 (Ritter, 1999, p. 103). This institution *functions* as a "virtual super-university" or "virtual meta-university" which combines and concentrates on the teaching power of a large number of universities.

- *Western Governors Virtual University*

This institution is called "the nation's first exclusively virtual university", but in reality it is only an electronic clearing house for promoting interstate exchanges of net-based courses. It was established in 1997 by a consortium of 18 western US states and 13 larger industrial corporations. In the first place its task is to serve as platform for counselling students and brokering courses from other universities. At present, 375 certificate and 55 degree courses are provided. In addition, this institution is also a real private, non-profit university with the privilege of providing courses and conferring its own degrees. However, only 100 students have enrolled so far.

Virtual Universities

Morten Flate Paulsen (2000, p. 61) made an "International Analysis of Web-based Education" commissioned by the European Community as part of the European Leonardo da Vinci Programme. Paulsen analysed 130 institutions providing online courses. Although there were seven universities among them that use the terms »virtual university« or »online university« as part of their name, none of them was really a virtual university. In these cases, virtual university is a bombastic term which indicates only that a professor, or a teaching unit, has started to go digital. In most of these cases the net is used only for performing or mediating a limited number of pedagogical functions. Obviously, the use of the term »virtual university« is misleading here.

When a conventional university begins to transform into a net-based university it certainly benefits from an academic infrastructure which has stood the test of time. This means that there is an organic integration of scientific research, academic teaching and a

specific academic administration. These are missing in those "virtual universities" which are mere clearing houses. On the other hand, the traditional academic infrastructure is also an impediment to the development of a real net-based learning system. Traditional universities will be confronted with severe structural changes which are due to the simple fact that face-to-face teaching and learning in real spaces on a campus and distributed learning in virtual spaces are two entirely different things. It is evident that both forms of learning and teaching develop learning and teaching behaviours and administrative practices which differ considerably. The transformation referred to is a very difficult and complex process. Unfortunately, this is not seen by many practitioners and even by experts in the field. They still believe that the foremost task before them is to replicate on the net traditional forms of academic teaching and learning and administrative procedures.

- *Macquarie University in Sydney*

This university caters for 6 000 students in a broad range of subjects. It is one of those Australian universities which have developed master plans in order to adapt their institution to the tasks of the post-industrial information and knowledge society. Part of their innovated structure is the integration of web-based learning.

According to Morton Flate Paulsen (2000, p. 59) this process of innovation proceeds on three levels:

Level 1	Administrative information about the course, some course content, links to other resources, e-mail contacts to staff for more information.
Level 2	*Compulsory* use of the web by all students, generally with a wider variety of content, learning resources and interaction, later often virtual tutorials and discussion forums (synchronous or a-synchronous).
Level 3	The course is essentially managed via the web, with a substantial proportion of content, learning resources, and interaction provided this way.

So far the virtual part of the university offers *60 courses* on the web which are studied by *4 000 students*. A characteristic feature of this virtual university is that they are still experimenting with three versions of net-based learning: (1) "www plus paper", (2) "all on the web", (3) "paper plus web". The web is not only used to deliver written content but also for interactivity, sound and video. Audio is in fact emphasised. Virtual tutoring takes the form of "human, machine and group tutoring". The ultimate goal is "a mature and stable provision of university degrees via the WWW" (Paulsen, 2000, p. 63).

Virtual Distance Teaching Universities

When a conventional university and a distance teaching university transform into a virtual university the result can never be the same. As the name indicates, distance teaching universities have already established a tradition of distributed learning and of supporting individual students continuously by means of regular assignments, counselling, tutoring, and examinations. They have also developed strategies to cope with (extremely) large numbers of students (mass higher education). When a university of this type goes virtual, it is relatively easy to profit from these traditions, to integrate them and to develop ambitious pedagogical net-based systems.

- *The Virtual University of the FernUniversität in Hagen, Germany*

This academic institution profits from six favourable circumstances. First: unlike Internet universities it is based on the fully developed academic infrastructure of a real university, including research in six departments and 17 institutes. Second: it benefits from considerable expert experience in teaching at a distance, in distributed learning. Third: the FernUniversität has gained 25 years' experience in teaching with technical media in a professional way. Fourth: it can tap into the resources of two fully developed respective departments, one of electrical engineering and the other one of computer science. Fifth: several departments started to teach with computer-based programmes 20 years before even the idea of a virtual university was conceived. And sixth: two faculty members, Gunter Schlageter (2000) and Firoz Kaderali (1998), internationally well-known protagonists of the virtual university, are in charge of developing this ambitious project. It should be added that a strong sense of direction towards the virtual university can be recognised everywhere in this university.

This Virtual University of the FernUniversität does not only offer net-based interactive multimedia programmes, as many of the other virtual universities do, but transcends this task by performing *all* functions of a regular university "virtually". In order to achieve this goal a uniform comprehensive and homogeneous platform has been developed and tested over a period of several years. It provides students with the following services:

- Communication for pedagogical purposes
- Communication for social reasons
- Access and use of the conventional and of the virtual library
- Access and communication with the administration
- Virtual counselling
- Virtual tutoring
- Virtual co-collaboration
- Access to current internal university information
- Cafe, chat-room

In this way the digitised learning environment performs five significant functions: it presents courses, provides for a space for carrying out experiments, offers access to the library and virtual library, and becomes a centre of information, communication and collaboration.

The platform is used by *all* departments of the FernUniversität. At present, two complete net-based degree courses can be taken: a Master of Science in information and Communication Engineering (bilingual, German/English) and a Bachelor of Science in Computer Science. A third net-based course in mathematics is being prepared. Other departments are engaged in developing smaller modular interactive teaching-learning units. So far about 6 000 students have enrolled for the web-based courses, and probably 2 000 other students use the net for other modules of net-based learning; altogether 14 000 students communicate regularly with the university via e-mail. This means that roughly one in four of these adult students, most of whom are in employment, has entered the realm of net-based communication.

- *Online campus of the University of Phoenix*

The University of Phoenix is a for-profit university established for the benefit of working adults in the USA and abroad. It caters for 62 000 students. One section of this institution is the Online Campus with 6 000 students. Course materials are produced at the headquarters in Phoenix by a small core of permanent staff. The majority of staff members are hired on a part-time basis only for each individual course. Quite often they are practice-oriented instructors from industrial companies. They teach and provide for support functions. Basically, students are engaged in flexible self study. There is a great deal of feedback for them and group work is provided for. A rigid system of control and permanent assessment is administered. One BA degree and three MA degrees can be conferred. The graduation rate is 65 percent.

- *Other virtual distance teaching universities*

Other well-known virtual distance teaching universities are the Open University in the United Kingdom, the University of Maryland University College, the Catalan Open University, and the Open University of Hong Kong.

Where is all This Leading us?

At this point we become acutely aware that, *technologically* speaking, it is already possible to digitise practically all the relevant teaching, support and administrative functions of a conventional university. However, *pedagogically* speaking, the question arises whether this is really to be desired. Can we bear the responsibility for fundamental changes of higher education which will be the inevitable consequence of such a complete degree of digitisation? Will we not lose some constitutive elements of the learning process which we still deem to be significant? In other words, is the quest for a fully developed virtual university, the "most wired" college, a sound, reasonable and sensible one?

Will we not miss some of the qualities of real learning spaces, the feelings of belonging and security, the interaction with persons of flesh and blood, the face-to-face dialogue, the experience of working together with fellow students in the same room, the strong sense of community, the intense feeling of being an active and accepted partner in a scientific discourse, the meeting with original and authentic scholars (Peters, 2000a, p. 181)?

The question whether studying for a degree should take place entirely at home in digitised learning environments is still open for debate. Perhaps the virtual university of the future should be based significantly on online courses, but also employ other forms of learning which might compensate for its obvious deficiencies.

Summary: Flexibility Gained

Generally speaking, these four institutional and organisational patterns have something in common as they contribute to the flexibility of the university as an institution in the same ways. They are able to extend their reach and have the potential to offer more flexible learning opportunities to more students. But each of them also shows *specific* dimensions of flexibility.

The "ThinkPad universities" are still far from being virtual universities, because the computers were introduced for the benefit of the campus-based students only in order to

enrich their learning in conventional classes, and because specific pedagogical goals for net-based learning were not set and respective strategies were not developed. However, the example of Wake Forest University shows that even such a minimal innovation as the availability of notebooks for everyone can result in more flexibility of the teaching-learning process. Certain improvements have been achieved without being centrally planned: more interactivity, more activity, more project work, more co-operation, more communication, more intensive support. The pedagogical innovations include online access to external databases, digitised courses on demand, student-teacher discussion on the net, doing assignments, performing mathematical operations and presentation of information. A survey has shown that faculty and students reacted positively to the changes resulting from the use of the laptops.

Seton Hall University even reports that the use of notebooks and the net also added to the flexibility of the university as an institution in the sense that it has made this university more attractive to students. In the USA small universities have to compete for students with larger ones. In this particular case, increased flexibility helped the university to survive in the educational market.

"Internet universities" usually restrict their virtual services to counselling prospective students and to arranging for their enrolment where they live at universities wherever they are located. In spite of this, it has to be admitted that even they contribute to the flexibility of their students, of co-operating universities and of the overall system of higher education. The students profit from the unprecedented diversity of available courses which allows them to select and to construct tailor-made curricula. The modular structure of the courses provides for additional flexibility. Students may even change from one course to another one. Co-operating universities widen their scope of educational endeavours considerably. They can reach out. A small local and otherwise unknown college can cater for students throughout the USA and overseas. The most important innovation, however, relates to a more general educational goal. The Internet universities greatly enhance the flexibility of the entire system of higher education because they extend access and increase the number of working adults profiting from continuing education considerably.

"Virtual universities" are usually universities within universities, but more or less integrated ones. Because they are outgrowths of traditional universities they have to deal and come to terms with fixed academic structures and conventions which are normally resistant to change and restrict flexibility. They have to assert themselves when trying to innovate and modernise not only the learning-teaching system, but also the mission and the sense of direction of the institution in order to adapt it to the requirements of a rapidly changing society.

The example of Macquarie University, which stands for a number of other Australian universities, shows that by relying on communication technology it was possible to intensify the links between learner and learner and between learner and teacher, and to make more flexible learning opportunities available to students of the same university, but also to students in other parts of this huge continent, as well as in countries in South-East Asia. The discussion about the virtual university and the respective experiments led to a thorough modernising of the entire pedagogical structure of this university. Reading the planning papers communicates a sense of urgency which cannot be felt anywhere else. Here, the planned integration of net-based learning has impacted the philosophy

and pedagogy of higher learning. The whole university, and not only the net-based part of it, breaks away from traditional paths and now aspires to rely less on face-to-face teaching and more on high quality learning, greater opportunities to communicate outside traditional teaching times, and on the development of multi-skilled teams. All these measures help to reach a peak of success in making the university more flexible.

"Virtual distance teaching universities" reach the highest degree of flexibility because they do not have to develop their learning-teaching system against the background of delaying tactics by conventional academic teaching structures. In a way they are already used to "virtual" learning spaces and to bridging distances by using technical media. There are inherent similarities and corresponding requirements in the pedagogy of distance education and the developing pedagogy of electronic distributed learning.

At the online campus of Phoenix University we can identify the following dimensions of increased flexibility: multimedia and interactive learning opportunities can be offered to more working adults, a significant contribution to continuing education can be made, the reach of the university is extended, an international student body is served, the model of self-study is practised a great deal and students are activated considerably. Obviously, this is not a university in the sense that co-ordinated research and teaching in departments of their own go together. The teachers who are employed do not have a fixed relationship with the university. On the other hand, they act as vocational practitioners and contribute their respective skills and abilities to the learning. Because linking academic teaching to the working world is a significant goal of university teaching, this particular approach demonstrates another dimension of the desired flexibility.

The flexibility of the FernUniversität is improved by its Virtual University in many ways. There is a tremendous impact on university reform and pedagogical innovation. Faculty members are to adapt their teaching to the needs of online students and are enabled to do this by solutions to the problems raised by the increased use of multimedia, by increased activity, interactivity and communication and by the development of suitable forms of virtual seminars and virtual tutoring. Furthermore, the university can co-operate more easily with companies and museums in order to cater for more students in the working world. Tutors are quite often professionals in various parts of industry and commerce and adapt learning processes to their requirements.

C. Pedagogical Models

For most of us, the fully developed virtual university which will meet the criteria presented above remains a futuristic idea. Of course, we already have the hardware and much of the software needed for constructing it, and have put the platform in place which allows students to have access to its services. Furthermore, we can study numerous approaches to it all over the world. But we do not yet know the appropriate general ways of learning and teaching in such a fully developed virtual university. However, having observed some of the more relevant experiments in net-based learning we can make assumptions about which models of learning and teaching will emerge in virtual universities and speculate about them.

The Replication Model

For many practitioners, and also for some theorists of distributed learning, it is obvious that the extraordinary flexibility of the virtual university should be used for imitating conventional forms of academic teaching and learning as far as possible. This is understandable, because it would mean that faculty members can practically go on teaching in the way they are used to. According to many of them only the medium has been changed. The tacit idea behind this notion is that the teaching and learning presented on the net will be very similar, and hence of the same quality, as traditional university education which has stood the test of time. Such an approach would mean that we arrive at a model which might consist of the following components:

Conventional forms of teaching and learning	**Net-based forms of teaching and learning**
Lectures	Online lectures, synchronously, a-synchronously, on demand, CD-ROM
Seminars	Virtual seminars: participants present their papers and discuss them under the guidance of a faculty member. Synchronously, a-synchronously, text-based, video-based
Colloquia	Virtual seminars, text-based or video-based, synchronously, a-synchronously
Practical training	Training in simulated (virtual reality) environments
Reading	Reading texts on the screen of the monitor, or downloaded, or texts transmitted by CD-ROM

Here, a question of fundamental importance arises once again: Is it advisable, acceptable and tolerable to transplant conventional models of teaching and learning from *real* spaces into virtual spaces? Or is replicating them the wrong way of operating in virtual learning spaces? Should we set up our learning/teaching models in a completely different way and move in new directions?

The more we learn about and analyse the unique new possibilities of distributed learning the more we become convinced that the replication model is not to be recommended, because we will not make much progress in this way towards a virtual university. Important and badly needed innovations of the learning process cannot be implemented. The extraordinary pedagogical possibilities of the digitised learning environment cannot be exploited. The extraordinary flexibility of net-based learning cannot be developed and used in order to improve the quality of the learning system and of the university as an institution.

Digression: The Quest for Flexibility and Autonomy

If we reject the replication model we will have to design new approaches whereby surprising current developments will be absorbed and recognisable future trends will give orientation. What might these approaches look like?

Before suggesting other possible pedagogical models for use in a virtual university we must reflect on the overriding importance of three obvious qualities of virtual learning spaces: they are not time-bound, place-bound or reality-bound. We all know this because

this statement is continuously repeated in articles on net-based learning, but which of us has considered the pedagogical consequences of these facts?

In order to grasp fully the real meaning of the disappearance of constraints of time, place and reality we should first remember this: Up to now, all teaching and learning has been bound by time, place and reality. These criteria refer to the external conditions of all learning processes, including academic teaching and learning, since time immemorial. As learning is now released from these three bonds we experience a serious breach of our learning tradition and learning culture. We understand that learning structures which emerge in virtual learning spaces differ greatly, if not sharply, from learning structures which have developed in the oral face-to-face culture of real learning spaces. The boundlessness, uncertainty, inconceivability and "emptiness" of the space behind the monitor's screen changes the entire situation. It differs radically from the learning situation in real learning spaces such as classrooms or lecture halls. What does this mean for learning and teaching, where are the concepts which could guide us into these limitless, completely unstructured, new, virtual, learning spaces (Peters, 1999, p. 2)?

With regard to our topic it must be stressed that the absence of the categories of time, place and reality, especially of the disappearance of conventional social relations as part of this reality, is the first and foremost reason for the significant increase in the flexibility of learners, teachers, tutors, and of the university as an institution. In addition, it is a precondition for the emancipation of the students and for a considerable increase in their autonomy. Flexibility and autonomy are the most important categories of net-based learning and virtual universities. If we realise this fundamental shift of categories, we will be ready to see and admit that learning and teaching in a virtual university must necessarily differ greatly from the situation in which the teacher stands in front of a class and writes words on the blackboard. Flexibility and autonomy have become significant features which signify far-reaching structural changes. They will challenge us to consider the subsequent models under the aspect of whether they are following well-trodden paths or opening up new dimensions.

The Composite Model

When conventional university teachers "enter" virtual learning spaces they learn very soon that things can happen here which they have never before thought of, and which are even alien to their ways of thinking, and which cannot easily be integrated into their concept of learning and teaching. They have mainly internalised the model of expository teaching and reception learning, and are now confronted with very strange things indeed. They find that there are learners who enjoy browsing and surfing in the Internet, who navigate in hypertexts, who like to talk to fellow students in chat-rooms or virtual cafes; they also learn by permanently interacting with certain multimedia teaching software, communicate by means of e-mail, mailing list or newsgroup, and discuss scientific problems a-synchronously in virtual seminars or synchronously in video conferences. They find learners who co-operate via GroupWare, joint editing, and application sharing, listen to a lecture delivered by an eminent scholar at another university (remote lecture room); search, find, and download interesting and necessary learning programmes which are available on demand, just in time and just in place, discuss the interpretation of a text with a tutor, whose image can be seen on one part of

the divided screen of the monitor with the help of Talk; use an Internet Relay Chat Channel to participate in a discussion of a scientific problem with a great number of persons who are unknown to them but who are also interested in the subject. And there are others who join in games with a great number of players (Multi User Dimension, MUD), or even immerse themselves in a simulated virtual reality to perform special learning tasks (Döring, 1997, p. 310; Beck, 1998, p. 218).

All of these specific elements have little or nothing to do with our traditional forms of learning at a university nor with the traditional pedagogy of higher learning. Most of these activities are adopted from computer science and information and communication technology. It is our task to interpret and use them pedagogically.

A first approach to net-based learning in a virtual university might be to design teaching modules in which some or all of these new and still strange learning behaviours are purposefully combined. The advantage of this approach is that it is derived from net-based learning behaviours that are already being practised. However, a disadvantage is obvious. This model is an eclectic one which has not yet achieved a definite sense of pedagogical direction.

By practising this model we will become aware that in virtual learning spaces the external conditions of the learning processes are also entirely different. Instead of sitting together with many other students in a lecture hall in a university listening to a lecture the student sits alone in a digitised learning environment and has to develop self-learning activities. The model of autonomous and self-regulated learning will have to be applied here and faculty members should interpret it in a constructivist way as well.

The "Ten-Virtual-Learning Spaces" Model

This approach is based on an analysis of the technological functions of the digitised learning environment and the net. Ten of them are highly interesting for pedagogical designers, namely the virtual spaces for instruction, information, communication, collaboration, exploration, documentation, multimedia, word processing, presentation and simulation as well as the spaces in virtual reality.

We are dealing here with distinct spaces which are in essentials separate from one another. Each of them can be interpreted pedagogically. In each of them original elements of learning behaviour can be developed and fostered. The new model could be constructed by combining and integrating the functions of some, or even of all, of these virtual learning spaces. They can be used when multimedia interactive modules are developed, but much more so in order to establish a learning environment in which autonomous learning is possible and supported (cf. Peters, 2000a; cf. chap. 7).

The Virtual Distance Education Model

This model can be established by combining a number of approaches to distributed learning which have long been practised widely. Here, designers might wish to create a net-based form of distance education. A possible standard form of university study might be:

- Completing interactive multimedia modules of pre-prepared learning programmes
- Reading set books and academic articles in the discipline to be studied
- Active participation in virtual seminars
- Virtual tutoring
- Virtual communication with fellow students, tutors, and faculty members
- Regular self-assessment by communicating with the central computer
- Human and automatic assessment of assignments
- Periodical consultation with faculty members – virtual and face-to-face
- A project of self-regulated learning
- Oral examination in a virtual video conference

The "Learning by Research" Model

The digitised learning environment in a virtual university has potential for developing, practising and stabilising the concept of the autonomous learner. This concept means that the focus is no longer on the teacher, but on the learner. The pedagogy of higher education is no longer concerned with how the methods of teaching can be improved but rather with how learners can be motivated and empowered to teach themselves in a better way. This means that learning environments must be developed which induce them to self-learning. The digitised learning environment does this in a spectacular way. Possible components of this model could be:

- Personal meetings with a faculty member for counselling and motivating and for negotiating a general sense of direction (once or twice per semester, continued virtually)
- Personal meetings with a tutor to negotiate a preliminary study plan (continued virtually)
- Acquisition of the recommend literature (in digitised and real form) and searches for relevant information
- Continued communication with fellow students, tutors, faculty members via e-mail
- Establishment of a knowledge-building community (with students in the same university or in other universities)
- Studying interactive multimedia modules from the same university or from other universities
- Participation in virtual seminars
- Carrying out small research projects individually and in collaboration

This model applies the well-known concepts of learning by activation (learning by doing), individualisation, self-direction, exploration, and of "learning by discovery" (Bruner, 1961). The ultimate model to be aspired to is that of the independent scholar doing research. Academic study is to be considered a reflection of this; it should consist of a series of successive approaches to reach this model.

Digression: Hesitation and Doubt

Are there preferences with regard to the pedagogical models presented here? Which of them should be applied in virtual universities? Can all learning and teaching be performed by using these models? Can web-based learning be practised exclusively? If so, can it replace campus-based education fully? If the "learning by research" model should turn out to be the most desirable and optimal one, will faculty members be able and ready to apply it? Will it be financially feasible, because developing interactive multimedia courses will be incomparably expensive? Where are the experts to help faculty members to develop these courses and the respective hypertexts/hypermedia?

In view of these questions it might be advisable to design another pedagogical model. This should include learning elements from distance teaching universities and from virtual universities, but also from conventional universities. One important requirement which should be preserved is the regular and habitual reading of scientific literature. Another one is the face-to-face academic discourse, and yet another is informal social intercourse face-to-face with teachers, tutors and fellow students. These three elements are missing in the pedagogical models that we have considered so far in a fully developed virtual university.

A Hybrid Model: The "Virtual University of the Future"

When trying to imagine the pedagogical structure of the university of the future we have to see that for some time to come it will be impossible to design, develop and produce interactive multimedia modules for all the courses required at a virtual university. We must keep in mind that the development costs of a multimedia presentation will quite often be prohibitive. Some experts say that the development costs for a single teaching hour will run as high as US$ 50 000 (Scheer, 2000). Neither the necessary funds nor the required experts are available to do this in a professional way. Therefore, it would seem to be appropriate for us to remain low-key for a while and to adapt our universities to the requirements of the knowledge society by developing a new pedagogical system which is based in essentials on the following three basic forms of academic learning: (1) guided and independent self-study, (2) net-based studies, and (3) scientific discourse and social intercourse in face-to-face situations (cf. Peters, 2000b; cf. chap. 10).

Summary: Flexibility Gained

It goes without saying that the "replication model" provides for limited flexibility only as it is still determined by traditional patterns. However, the digitised learning environment that is used can facilitate both teaching and learning to quite an extent by adding to the traditional learning processes: Handouts, texts to be read and relevant information can be distributed earlier and more effectively and e-mailing can increase communication easily between all persons participating.

All elements of the "composite model" referred to demonstrate that in a digitised learning environment students are both inspired and required to become active in many ways without the guidance or control of a teacher. Here we find a learning behaviour which most of us are not yet used to. How should faculty members react? They should use these elements creatively for pedagogical purposes and strengthen this new behaviour. Its openness and diversity adds new dimensions to the flexibility of teaching and learning.

The flexibility of the "ten-virtual-learning spaces model" cannot be surpassed as it is highly individualised and allows each student to design his or her own curriculum. There is a wholesome absence of fixed methodical patterns. Innumerable combinations of learning behaviours specific to each of the ten virtual learning spaces are possible. Therefore, learning strategies and learning paths can be easily adapted to the goals to be reached, the nature of the contents to be dealt with, and the skills to be mastered. Most important, however, is that this model provides for the scope and for the freedom to develop an activating learning behaviour that is necessary for developing self-regulation and autonomy.

Distance education has always been an extraordinary flexible form of learning and teaching. In the "virtual distance education model" this flexibility can be enhanced by merging it with net-based learning. One important factor is the increased speed of communication, which reduces the turn-around-time of assignments to be assessed, improves the co-operation of all members of the learning projects and the university, and strengthens the ties to students, especially to those living far away in all parts of the world.

The "learning by research model" is by far the most flexible one because it is radically individualised. Students perform most of the functions of teachers themselves and have the freedom to adapt their learning to their individual needs and circumstances. Hence, their learning is highly personalised, student-centred, student-directed and is activated by searching, exploring, doing projects, by many forms of communicating and collaborating, by seeking tutorial help and professional advice and by critical assessments of their own achievements. In this way each student chooses his or her own learning path. The flexibility of this form of learning relates not only to curricular matters, but also to the strategies and methods of self-learning and to the ways in which this can be organised and evaluated.

The "Virtual University of the Future" provides even for more flexibility of learning and teaching because it combines the great flexibility of three basic forms of imparting academic knowledge and skills. This extraordinary flexibility derives from the fact that faculty members may design their courses by freely combining elements of these three ways of learning according to the nature of the educational goals and learning objectives, of the students and their circumstances, and of their previous teaching experiments. Students with families and working obligations can then adapt their learning programmes easily to their restricted opportunities. By relating distance education approaches to net-based learning and face-to-face experiences of scientific discourses, the advantages of one form of learning can compensate for possible deficiencies of the other two forms of learning. This type of teaching is also flexible with regard to the weight which is to be placed on each of the three components.

Time will show which of these components will become particularly popular and be preferred by students and faculty members. Also costs will be a decisive factor. Because all students will be linked to the university by net-based communication and considerable parts of the learning and teaching will be done virtually, this type of a university might be still called a "virtual" one. But it may also be possible that one of the three forms will gain more importance than the others.

Conclusion

At present, the possibility of establishing virtual universities is an issue of great concern. There is a larger group of technological enthusiast and a smaller group of realists. Mark Eisenstadt and Tom Vincent (1998, p. 1) refer to their ways of arguing as »evangelical« and »pragmatic«. Both groups engage in experiments in many forms of net-based learning which might pave the way towards real, i.e. fully developed, virtual universities. Some universities have already gained experiences in the new field based on an obligatory strategy. The development is accelerating. However, the majority of faculty members remain sceptical (cf. Newman & Johnson, 1999).

An analysis of what has been achieved so far shows that four different types of net-based universities have emerged: ThinkPad universities, Internet universities, virtual universities, and virtual open universities. Most of them still use the digital learning environment to deliver conventional, or only slightly elaborated, learning material. There is still a strong tendency to transplant conventional forms of teaching into the virtual learning space. This means that time-honoured expository teaching and reception learning are even intensified. This, however, is the wrong way. The extraordinary teaching power of the digitised learning environment and distributed learning cannot be exploited, and it does not take advantage of the new opportunities of being able to operate outside the constraints of time and place.

The central idea of establishing virtual universities must be to innovate learning and teaching at the university in order to adapt them to the requirements of the post-industrial, post-modern knowledge society. Therefore, the design of forms of learning which are specific to digitised learning environments assumes paramount importance. Six pedagogical models should be considered here:

- the replication model – widely practised but not recommended,
- the composite model,
- the ten virtual learning spaces model,
- the distance education model,
- the learning-by-research model, and
- the model of a virtual University of the Future.

The last five models may become instrumental in innovating and modernising learning in higher education.

The most important requirement of this innovation is to make both learning and teaching and the university itself as an institution more flexible. All types of virtual universities that are presented here increase this flexibility, although with different degrees of success. The most efficient way of increasing the flexibility of learning is to admit, encourage and support autonomous and self-directed learning. This approach is based on pedagogical, psychological and sociological concepts. And the digitised learning environment provides for the best opportunities for meeting this important requirement. Autonomous learning should be given preference and acquire at least the same importance as expository teaching and reception learning. In addition, the calculated use of the two approaches to learning improves the pedagogical flexibility.

Should university education be acquired entirely in virtual spaces? Should all universities be transformed into virtual universities? These questions will continue to remain unsolved for some time. Many experts believe that the development will never go that far. A pragmatic way of finding a viable solution may be the establishment of a Virtual University of the Future which combines the most successful elements of distance education, the most promising elements of net-based learning with the joy and immense benefit of academic discourse with highly competent scholars face-to-face on campus.

This university would be extremely flexible because it would cumulate and integrate the specific kinds of flexibility of three important, but structurally quite distinct forms of university study. As it reaches out to more students it increases its accessibility, gives students more choice and control over their learning processes and requires that they take responsibility for their own learning, and it also provides for more forms of intensified and enhanced support than were ever available at traditional universities. Above all it would reduce costs because of the distance teaching component. In so far a Virtual University of the Future of this nature would innovate and reform higher education considerably and make it fit for the changed educational requirements of the post-industrial knowledge society.

12 The Transformation of the University Into an Institution of Independent Learning

> *"... each university should become an open university offering possibilities for distance learning and learning at various points of time." Report of the International Commission for Education in the Twenty-First Century to UNESCO (Delors Commission).*

In view of the crisis facing university teaching, of technical and societal changes and of the demands made by the knowledge society for new qualifications and competencies, we must consider whether the university will be able to retain its traditional methods of learning and teaching. Is not a fundamental structural change necessary to meet the challenges of the present and the future? Should not the teaching structure of university courses place more emphasis on online-learning and self-learning? A teaching structure of a university of the future is sketched below which is based not only on indispensable forms of traditional university teaching but also on distance teaching and learning in networked digital environments.

In most countries, universities are faced by unprecedented challenges: rapid technological and societal changes, changes to educational paradigms, volatile increases in the significance of distance education and open learning, the beginnings of digitisation of learning and teaching, chronic financial difficulties, the quest for quality and steadily increasing industrialisation, commercialisation and globalisation. In German universities, teaching is still being neglected as against research. Lectures, classes, seminars and periods of practical training are usually overcrowded. There is a general lack of support services for students. The jungle of courses, degrees and examination requirements means that students, above all in their first few semesters, are faced with almost insurmountable problems. The consequences are excessive periods before students actually sit their degree examinations, frequent changes of courses and high dropout levels (Ehrhard, 1997). These are all factors that quite naturally have a considerable negative effect on studying. Jürgen Mittelstraß has diagnosed that the 'non-up-dated university' finds itself 'in a serious structural crisis' for other important reasons as well, for example its 'inability to reform itself' (Mittelstraß, 1994, p. 7). And Peter Glotz warns in his critique that it is now '5 minutes to 12' in the university. He gave his polemic the harsh title 'Rotten to the core?' (Glotz, 1996, p.1).

The situation described here is aggravated even further because, university graduates in the emerging knowledge society will have to have qualifications and competencies that are different, or differently weighted, from those in the industrial society with which we are familiar (cf. Heid, 1995; Klauder, 1992; Conference Board of Canada, 1991). 'Today's production methods, communication technologies, perceptions of problems and problem solving strategies can be overdue and obsolete tomorrow' (Bardmann & Franzpötter, 1990, p. 424). In the future, there will be great emphasis on the ability to learn and to continue to learn independently and autonomously, to communicate to others deliberately and on a differentiated basis, to collaborate with others in a group, to show social sensitivities, to accept social responsibility, to be ready and willing to be flexible, and to have experience of flexibility. According to Gertrud Höhler, in the future the search will be for creative, self-confident, convivial, committed, communicative and socially competent employees (Höhler, 1990).

In view of the difficulties referred to here, the deficiencies indicated, and of the digitalisation processes that are already altering learning and teaching, it would appear to be expedient to start considerations of whether, in their present form, with their classical self-image and their traditional methods of teaching and learning, universities are in any way in a position to impart these. If this question is answered negatively, we are faced with the task of imagining how much university must change to cope with new tasks and challenges. What is particularly interesting here is how learning and teaching at university in the first decades at the 21rst century will have to be conceived and organised. Our attention is therefore mainly directed to the required pedagogical processes.

Will this type of change have to be a radical change? University teachers who, in spite of all obvious difficulties, continue to insist that the university is 'basically healthy', will answer 'No' here, and will tend to speak in favour of a gradual adaptation of traditional forms of studying to new situations. Futurologists who have analysed the problems with which we will be faced in the knowledge society are of a different opinion. They believe that the university will have to take on a completely different shape. For example, Peter Ferdinand Drucker even prophesied in view of the digital revolution that "30 years from now big university campuses will be relics" (Drucker & Holden, 1997, p. 1745). And Gerhard Casper, the former President of Stanford University, goes even further and asks with some presentiment whether in fact we will have in future a 'world without universities' (Casper, 1996, p. 1). The present situation of the university is therefore serious. There is no doubt that it is an acute 'modernisation crisis'. In fact, the only treatment available is a bold wave of modernisation such as never before in the history of the academic teaching and learning.

In order to make clear the structural change that has become necessary it will be shown how learning and teaching at the university could develop if it were to recognise the challenges of the present and the future, accepted them and reacted to them in a committed manner. A primary concern here is to define and to describe the functions of digital information and communications technology (cf. Bacsish, 1998), because they quite obviously not only suggest a structural change, but in part further it, or even force its implementation. Furthermore, this type of sketch can supply criteria with which experiences from abroad in this field can be analysed and evaluated under the aspect of what they can contribute to planning the future university teaching. In addition, we should examine whether they inspire and encourage us to take new paths.

New Changes

The educational and policy aims and requirements for universities suggest the following changes for university teaching:

- Continuing education must not continue to be peripheral, carried on by the incidental interests and activities of some members of the middle hierarchy (Woll, 1988). It must be made into an essential task of the university that is taken up in the first place by all university teachers.
- Because academic education and further education stretch over complete adult life, universities must admit and look after adults of all ages.
- Universities must be 'open universities' in several respects.

- Because of the extension of university activities, the number of students will increase considerably. It may not be possible to look after them with the traditional systems and approaches of teaching on campus. For this reason, a different – and cheaper – teaching and learning system is necessary which will enable many more people to obtain undergraduate and postgraduate education.
- In order to achieve the highest degree of flexibility and to be able to cope more easily with the different life situations of students, most of whom will be older and in employment, learning must be separated from prescribed locations and times.
- One of the aims of universities should be preparing students for the information society. They must be able to work in virtual companies, organisations, working groups and project teams in the emerging 'virtual economy' (Baron & Hanisch, 1997). This presupposes a considerable degree of 'media competence' (Lange & Hillebrand, 1996).
- The curriculum must no longer be made uniform and fixed for long periods by means of degree course regulations, but be variable and adaptable to current needs, for example, in professional life. It must be related not only to individual learning requirements, but also take account of the challenges and demands of practitioners and anticipate future trends.
- It must be possible to impart to students not only cognitive but also methodical and social action skills (Arnold, 1995). 'Autonomy and integration' (Gottwald & Sprinkart, 1998, p. 5) must be the preferred aims of academic education.
- In general, there must be a 'conversion from a teaching to a learning culture' (Arnold, 1995, p. 300).

To sum up, learning and teaching at university must be orientated to a much greater extent than before to the principles of continuing education and lifelong learning (Dohmen, 1996), have an egalitarian character and be open as well as student-, practice- and future-oriented. It will have to proceed with flexible teaching and learning programmes which impart not only cognitive, but also communicative and collaborative, competence. Along with classical expository teaching and receptive learning, autonomous and self-controlled learning should be cultivated (Candy, 1988; Dohmen, 1997; Friedrich & Mandl, 1997; Lehner, 1991; Paul, 1990; Weingartz, 1991). This should be oriented towards the research process. In addition to this, students must also be prepared to prove themselves in the 'virtual world'.

A New Structure for University Education

It is obvious that the above changes cannot be met readily within the framework of traditional degree courses and classical forms of teaching, such as lectures, seminars, classes and teaching in laboratory courses. Hence, new approaches will have to be sought based on the following three basic forms of academic learning:

1. Guided self-study and self-study.

Forms of learning that developed from correspondence education and distance education over the past one hundred and fifty years. These provide the following specific learning activities:

- working independently through self-instructing study programmes,
- working independently through learning packages with different media (e.g. tapes and videos),
- reading recommended and additional specialist literature independently,
- discussions (face-to-face or through communications media) with tutors and counsellors that students initiate themselves, the course of which is also determined by the students,
- optional participation in tutorials in small groups in study centres,
- self-initiated and organised discussions with fellow students locally (self-help groups),
- solving training and examination problems relatively frequently for the purposes of controlling the student's own progress,
- corresponding with the persons responsible for correcting written assignments,
- voluntary or obligatory participation in seminars.

2. Studying in a digital learning environment.

The following learning activities are currently in use:

- using networks for the purposes of scientific information, communications and collaboration,
- targeted individual searching and selecting, evaluating and contextually applying information: transforming information into knowledge,
- making individual efforts to obtain advice, help and additional motivation through professional tutors, course counsellors, moderators and experts on a subject,
- establishing individual social contacts on several levels,
- joint learning in small and larger working groups, whereby problems that students themselves have thought up are solved, for example in project work, or new areas of knowledge are opened up for all those taking part, such as knowledge building communities (Scardamalia & Bereiter, 1992),
- individual interactive work with CD-ROMs, a medium that offers a great number of new educational opportunities (Hoyer, 1998),
- individual participation in virtual courses of lectures, virtual seminars, virtual teaching in a college class, virtual examinations,
- studying 'at virtual universities".

3. Taking part in teaching events at traditional universities.

Not traditional lectures, but above all the opportunities for direct communications, in particular taking part in live scientific discourses and in 'social intercourse' (Casper, 1996, p. 26). The following experiences from this field might be absorbed and developed further:

- Advisory talks with a teacher (at set times),
- counselling by tutors and study guidance, either single or in groups,

- discussions in colloquia, seminars, classes and practical courses with the aim of active participation in the scientific process,
- free academic discourse,
- preparation for and participation in oral examinations,
- informal talks with other students and with other members of the university.

Two possibilities for combining the learning activities of these three basic forms of academic learning spring to mind here, an additive and an integrative method. In the additive version the university enables students to develop those learning activities that are possible on the basis of their private circumstances and employment obligations. The priority here is to reach those persons as well as those who have been prevented from studying because of the traditional organisation of university education (egalitarian function). But what is of special interest is the integrative version, because here students can put together their own personal 'menu' of learning activities from these three areas (pedagogical function) depending on their own interests, preferences and practical requirements. When doing this students construct particularly effective combinations in which, among other things, the deficiencies of one form of studying can be compensated by the strengths of other forms. The interplay of learning activities from distance teaching, studying in a digital learning environment and traditional face-to-face teaching, which is planned from a pedagogical viewpoint, could generate such optimum study conditions that cannot be found in any one of the participating forms of study by itself. We would then refer to a mixed-mode university.

On the whole, the university of the future will have to be the result of a fundamental process of transformation in which it changes into a university which mainly enables self-studying in all its forms oriented towards the research process, supports this and in the end makes it into the foundation of its curricula and teaching. A strict orientation towards research must in fact be presupposed for all three forms of learning. '*Learner empowerment*' (Baron & Hanisch, 1997, p. 1) is the decisive overriding and comprehensive educational category.

The educational structure that results from the combination and integration of the three basic forms of academic learning constitutes a fundamental change in university study. We should not recoil from this, in particular as two of the planned basic forms have already proved their value.

Focus Points: Self-Learning, Online Learning and 'Social Intercourse'

If we attempt to imagine a university that is able to do justice to the new demands referred to above, and in which studying takes place in the framework of the three basic forms of academic learning outlined here, we can be quite certain that we would not imagine a traditional university. In the information and communications society it is possible to take part anywhere in teaching programmes, even when travelling. And professors and lecturers can teach, advise, discuss and examine from any location. Even more: 'The global network of students will follow on the global network of scientists' (Casper, 1996, p. 21). This means that the localisation of university teaching is practically obsolete. 'Distance is dead!' announced Nicholas Negroponte, Director of the Media Lab

at the Massachusetts Institute of Technology and a distinguished thinker on the digital future (Negroponte, 1997).

In fact, space and time have become negligible parameters for data transmission. They cross over borders even now. It is inevitable that the university of the future must realise this, accept it and use it for its own purposes. It must draw consequences from the overwhelming progress made by information and communications technologies that are changing not only our ways of learning, but of working as well, and in fact are even changing our lives. If it does this, the traditional model of university teaching will lose its previous binding character. And university teaching that is independent of prescribed space, time and personnel will be on the march. Those who have always interpreted all learning and teaching as an exchange of information will understand the changes that have taken place and will tend to accept them. The final reservations will be broken down when people see that adult higher education and the required system of lifelong learning cannot be realised in any other way.

Self-Learning

The ubiquity of learning that is achieved thanks to distance teaching and studying in a digital environment is the decisive innovation with which we have to get to grips with regard to the development and consolidation of self-study. Distance teaching detaches and isolates the students because the focal point of learning is displaced from the university to the home, the workplace or a learning centre. Simply from pure necessity, and not even because of the educational ideal of autonomous learning, they are required to determine the location, time, sequence and arrangements for learning themselves, and even to test the success of their own learning. Distance students are even forced to take over a number of important functions which, in traditional systems, the universities or their teachers carry out. They learn under their own aegis, and thus have more responsibility, achieve a greater level of self-determination and in this way achieve a certain degree of learning autonomy.

Online Learning

The extent of independence that is conceded can become even greater with self-learning in the ubiquitous digital learning environment. Where the autonomy of students studying self-instructing courses in distance education is related above all to the external, organisational, sequence of studying, it can be supplemented here through curricular autonomy. It is true that the digital learning environment is also used to take students by the hand and guide them in small steps through heavily structured programmes, and to subject them to a rigorously heteronomous learning system, but at the same time it offers autonomous learning new and greater chances which were previously not thought possible. Here students can in fact set their own targets and select the content, apply their own methods of learning, establish criteria for evaluating and in fact use them to evaluate what they have achieved. This new form of studying therefore enables an incomparably high degree of autonomy and self-guidance which is manifested in many forms. For example, the Empire State College of the state of New York has carried out pioneering work in this field through the development of ‘contract learning’ (cf. Peters, 2001, p. 224).

We are dealing here with a change of educational paradigms, namely from a dominant theory of expository teaching and reception learning to a dominant system of learning by working out. New dimensions of self-learning are being developed for students through the integration of the distance teaching tradition with the extraordinarily diverse educational opportunities of the digital learning environment that are being opened.

"Social Intercourse"

The third basic form of study in the university of the future will finally and necessarily provide traditional university teaching as well. This will not be presentational, but interactive and communicative forms of teaching, because, from the aspect of educational philosophy, the latter forms involve personal encounters. Free academic discourses in seminars, classes or laboratories will be aimed for and developed further here.

Where persons come together to learn or discuss, where they are 'eyeball to eyeball' (Wedemeyer, 1971, p. 135) with their discussion partners, a specific atmosphere is created in each case characterised by their individuality which can only be reproduced in part, and indeed in a reduced form, by mediated means. A dialogue in the same room has more elements than in an abstracting teleconference, even where this is not merely the a-synchronous exchange of messages, but is in fact a video conference. Those taking part experience an original and authentic dialogue. They absorb non-verbal signals and unconscious behavioural reactions. With all their senses they become part of a multi-dimensional encounter that can be analysed with psychological and sociological criteria. For example, 'Geselligkeit' (social intercourse), which Johann Wolfgang von Goethe in 1791 understood to be 'active intercourse with educated persons' (Goethe, 1994, p. 406).

Casper (1996) asks whether the university will survive in the age of communications technology, and comes to the conclusion that this will only happen if it is 'irreplaceable'. He concludes that such irreplaceability is probably 'only the link between research and teaching in laboratories and seminars' under the precondition that universities create 'those working conditions for professors and students' (which) 'presuppose and really enable social intercourse' (Casper, 1996, p. 25).

Is it old-fashioned to presume that this direct participation in university discourse that has an 'educational' effect in the true meaning of the term? The contribution that it can provide, for example, to the development and differentiation of the student's own scientific thought processes through conscious or unconscious imitation, through following the teacher's train of thoughts or arguments or through spontaneous contradiction, is incomparable. And what it can achieve during the acquisition of (spoken) academic language, and above all in the process of academic socialisation and the development of habits of mind, is of great educational value. Anthony Bates says, 'There are many things that are valuable in education, as in life, which technology cannot do, and we need to recognise that' (Bates, 1997, p 95). And Wolfgang Klafki, the distinguished German educationalist, when asked by a journalist about the chances for learning in a virtual university replied succinctly, 'It is clear that a university will fail if it disregards direct communications between persons. We should not even try this out.' (Seyfferth, 1998, p. 75).

These arguments should be used to respond to those technology enthusiasts who believe that, on the one hand, face-to-face teaching, as practised in traditional universities, can be replaced and, on the other, the lack of direct communication in distance teaching can

be effectively and cheaply compensated for by means of e-mails and teleconferencing. Without wishing to diminish the educational opportunities which the digital learning environment can have in combination for 'learning together apart' (Kaye, 1992, p. 1) and for 'teaching face-to-face at a distance' (Keegan, 1995, p. 108), the self-deception that is found here must be pointed out. A technically imparted discourse is reduced and altered in important points in a virtual seminar (Fabro & Garrison, 1998; Hesse & Giovis, 1997; Kiesler, 1992). The protagonists of electronic communications assume that, with the help of technical communications media, learning in distance education and learning in a digital learning environment will emulate the learning forms that are obtained in traditional teaching (cf. the criticism by Beaudoin, 1998, p. 98). According to them, its standing in the scientific community will increase (Garrison, 1993, p. 20). What a fatal error for university education!

Forms of traditional academic teaching, in particular if they are based on address and rejoinder and personal dealings, will be indispensable in the university of the future. In these forms, the autonomy of tele-students that is acquired in independent learning in distance teaching and in the digital learning environment can prove itself, be consolidated and develop further. We are dealing here with a constitutive component of learning in the university of the future.

Organisational Preconditions

In order to provide these three basic forms of academic learning with opportunities for development, combination and integration, the university of the future must be reorganised, restructured and rebuilt. The following matters will need to be addressed in this regard.

Instead of having lots of lecture halls and organising mass teaching events on the campus, the university of the future will have a communications system which enables links to networks (Internet, Web), television and radio. It will have to maintain laboratories for developing audio, video and multi-media teaching and study programmes (including hypertext and hypermedia) at the state of the art. The university library will be converted to a great extent to on-line operations, once the catalogues have been digitalised and, for example, electronic journals, world literature and documents about current scientific developments have been made available. To achieve all this, a technical platform will have to be developed consisting of servers, author environments and tools for university administration and library access (Unger, 1997).

At the same time, the structure of the university's workforce will have to be altered by means of a previously unheard-of number of educational designers, graphic artists, media experts, Internet experts, project managers, the respective technicians and experts for quality control (Behrens, 2001). However, the structure of appropriate development institutions can only be justified financially with high numbers of students, such as those which, up to now, have generally been achieved by some distance teaching universities. Equipping traditional universities of average size with technology that is required for distance studying and for studying in digital learning environments only increases their costs in these times of chronic financial difficulty, instead of reducing them. The only reduction in costs with increasing student numbers at present is taking place in the distance teaching 'mega universities' (cf. Daniel, 1998).

The integration of the elements of the three main forms of learning and teaching provides the university, whose traditional ways of working have solidified and quite often become ritualised, with a flexibility and variability that it has never before experienced. In this way it is enabled to deal with the special private situation and occupational requirements of older students as well, and to take sufficient account of them. For this reason it will no longer prescribe fixed and binding locations and times for learning and personnel for teaching. Studying may be started, interrupted and restarted at any time, and may be carried out either full-time or part-time, whereby students may also switch between the two forms. Where this is necessary and possible, the curricula can also be oriented more closely to students' private and vocational experience, because studying will be extremely individualised and student-centred, and mainly based on self-learning. Students may decide on one of the three basic forms of studying that have been referred to here, but at the same time evolve learning activities from the other two basic forms, and combine them with one another in parallel and consecutively. It will even be possible to take up courses offered by several universities simultaneously, e.g. those of a 'real' university and those of a 'virtual' university.

As a counterweight to the great emphasis on self-learning and online learning, the university needs a professional student support system that is technically competent and very well organised. This system will no longer be on the periphery, but will be of central importance. Great emphasis will be placed on personal counselling from tutors, which will advance to become an important component of academic teaching.

Sceptics may ask whether this type of university of the future can in fact reduce the problems and deficiencies of present-day university education that were referred to at the outset. Of course, no one can see into the future, in particular because it may also be determined by factors that are unknown today. We can, however, see the following already:

- Because the learning location is moved to students' homes, workplaces or local learning centres, there will be no more overcrowded lecture halls and seminars in the future.
- Other unacceptable aspects of mass universities today (long journeys to university, badly scheduled lectures, classes, etc.) will no longer apply, because self-learning and group learning is decentralised and individualised in real rooms, and in some cases takes place everywhere in virtual rooms.
- As a result of the upgrading of guidance and counselling as legitimate components of university teaching, students will be additionally motivated and better oriented with regard to their personal needs.
- Because lifelong continuing education will be established, and students can no longer 'stockpile' what they have learnt, it will be possible simply to reduce the duration of basic degree courses, and this will reduce loads.
- Links to occupational and private practical situations are provided, or easy to establish, through the experience of, mostly older, students and of many tutors.
- Teaching will not be neglected at the costs of research, but will tend to be stressed because multimedia courses will be carefully planned and professionally developed. Also the educational skills of teachers at university will no longer consist of

presenting content, but of enabling, facilitating and supporting research-related learning, preferably by 'discovering'.

- Autonomous learning in self-study develops and strengthens students' abilities to make autonomous and independent decisions for their own lives, and also to accept responsibility for these.
- The problem of studying for overlong periods disappears if, on the one hand, the basic degree course is reduced and, on the other hand, continuing academic education (lifelong and recurrent) is spread over a lifetime.
- Changing courses frequently will no longer be frowned on if studying has to be flexible and variable and is constantly adapted to meet new societal, technical, and employment market requirements.
- The increased interactivity in virtual and real rooms gives studying a structure in which students will be able to gain skills in acquiring knowledge and become used to working in teams. Those methodological and social skills that are already in demand in the workplace (communication, collaboration, understanding) can be developed and trained during and in the framework of higher education.
- The special skills required in the knowledge society can be acquired more easily when studying takes place continuously in a largely digitised and networked information and communication system and not in the forms of classical academic teaching, which are, in fact, pre-industrial forms.
- The circle of students can be increased enormously, and this meets the demand of employers for university graduates. In many countries, for example, it is practically impossible to obtain a career without a bachelor's degree.

For many people, the new educational structure of academic studies justifies a new fundamental humanitarian aspect. The reason for this is that it enables those capable of academic studies to start, continue and conclude their studies at any time where this is desirable for private or professional reasons. This can be done relatively independently of the residential location, the student's age, social background, social position or vocational and private obligations, or of disadvantages the student has experienced in the past.

The transformation of the traditional university into an institution of self-study and distance teaching has, therefore, wide-ranging structural consequences. If the university wishes to prepare itself for the tasks facing it in the future, it is not sufficient for it to regard the new technologies merely as additional media units and to misunderstand them as an extension and extrapolation of the previous familiar teaching operation. It must not use these technologies in the same way as it used the audio-visual media in the past. What the university of the future needs are fundamental new educational concepts. Self-learning, tele-learning and 'active intercourse with educated people' (Goethe, 1994, p. 405) are the most important of these. They form the basis of a culture of self-study that, by the way, should be aimed for generally.

Conclusions

The scenario shown here for learning in a university of the future points to an institution that looks completely different to a traditional university. It will be the result of delimiting education and destructuring processes, such as those Jochen Kade has described for adult

(Kade, 1989) and Rolf Arnold for the dual mode university (Arnold, 1996). Also traditional universities are subject to processes of extension that are becoming even more intensive. Their traditional structures are becoming brittle. Gradually, a 'deprivation of power' (Kade, 1989, p. 801) is taking place in this once monopolistic institution of research and teaching.

This is certainly not a unique feature but a general process which is at present changing our society as a whole. Anthony Giddens argues that we are dealing here mainly with the separation of time and space, the creation of disembedding mechanisms and the reflexive acquisition of knowledge (cf. Giddens, 1995, p. 72). He speaks of a space-time "increase in distances" that is typical for today. Through the "detachment from the constraints of local habits and practices ... various possibilities for change" are opened up (Giddens, 1995, p. 32). At the same time, social systems are "disembedded". Social relationships are lifted out of local interaction contexts and restructured so that they overlap with the help of unlimited space-time margins. These findings, which are related to society as a whole, apply in a particularly concise manner to the university of the future that has been sketched here. This would then have to be interpreted as the result and as a component of the processes of change within society in the sense of its modernisation.

In fact, the close connection between space and time in traditional teaching becomes obsolete here. There are now 'increases in distance' of any size between teachers and students. The acts of learning and teaching are removed ('disembedded') from the traditional context and dislocated. The decoupling in terms of time is expressed in the a-synchronicity of most acts of teaching and learning and of academic discourse. Teaching and learning functions are "disaggregated and unbundled" (Farrell, 2001, p. 146). In concrete terms: we are witnessing the change from traditional on-campus teaching to that of a university without walls; from a university which remains closed to many, to an open university; from an exclusive system of teaching and learning to an inclusive system. Here we can only mention the great importance which the reflexive acquisition of knowledge has for self-learning, self-studying and even more for the formation of the identity of students who are autonomous, self-regulating and who work individually.

As a consequence of the delimiting and destructuring processes, the university of the future will have to extend its objectives, admit and counsel new groups, use new methods and media, evolve new functions for its teachers and organise studies as a whole in a completely new manner with regard to time and space. Research will naturally continue to be the starting point, objective and means of teaching. However, even research is not exempt from the typical processes of delimiting and destructuring, but is subject to them even now to a great extent. An important feature of the crisis facing universities is in fact the "emigration of research to other areas" (Mittelstraß, 1994, p. 7).

Will the teaching and learning of the future adopt professional planning with well-thought out strategies? Or will rather more casual activities of individual, reform-friendly university teachers encourage others and lead to this type of university almost by accident? These might be those teachers who are full of enthusiasm for technical progress and are experimenting at present with CD-ROM and teleconferencing, or teachers who, convinced of the necessity of lifelong learning, are committed to the concept of continuing education, and teachers who are inspired by new concepts of

university education and experiment with forms of open learning and test single mode or dual mode distance teaching. These could be three starting points for the development of a university of the future which would have to be brought together, combined and integrated with traditional teaching and learning patterns. Even though this development appears obvious, and in fact corresponds to previous efforts at reform, it is not really desirable, because internal and intra-institutional collaboration necessitate a strategic approach. In this context it is naturally helpful if educational policy planners attempt to work out the financial, legal, structural and institutional consequences of a possible university of the future.

The situation becomes more complicated if the obstacles and difficulties are included in the calculation. Will the majority of university teachers leave their cherished forms of teaching without complaint? Will they accept the deterioration of the traditional model of the scholar which might result in a transformation of the very nature of scientific knowledge and lead to closing our minds instead of opening them (Campion, 1996, p. 147)? Will educational policy necessities, such as opening universities, turning to new groups of students and supporting the concept of autonomous learning, not be bogged down by traditional structures? Do university teachers in fact possess the skills that are required in a university of the future? Will they be prepared to see the most important part of their activities in counselling self-learning students, and not in lectures? Will they be prepared to develop their research results in the form of hypertexts and complicated multimedia presentations in collaboration with experts? Will they be prepared to answer questions from their students via e-mail?

In this type of situation universities will have to reflect and proceed strategically. According to Anthony Bates it will be necessary for them to develop clear perceptions of the following: what learning and teaching in universities will look like in the information age; which new learning models are favoured or rejected; how this completely different system of teaching and learning can be financed; how those university teachers who are still sceptical and hesitant can be convinced to co-operate; what kind of technical platform must be in place; how university teachers will be prepared systematically for their new tasks, and given continuing training subsequently; how important professional project management is; whether and how the organisational structure of the university will have to be adapted to the new requirements; and, finally, whether the university of the future can perhaps only be created on the foundation of collaboration of many, or even all, universities in a country in the form of a consortium (Bates, 1997a, pp. 7–19).

If these strategies can be successfully applied, the university of the future will be realised. What it will look like cannot be prophesied today. Professor Helmut Hoyer, who as an engineer and expert for control engineering is averse to all educational speculation, has characterised this new university as follows: “It will be more like a distance-teaching university than a traditional university” (Hoyer, 1997).

13 Visions of Autonomous Learning

Teachers and learners have to deal with a serious paradox. Research stresses the importance of the constructivist interpretation of learning; personal computers and the net provide for new and previously even inconceivable learning environments which easily lend themselves to the implementation of independent learning – and yet most online learning follows the pattern of expository teaching and receptive learning. This chapter addresses the fact that the idea of independent learning has a long tradition in pedagogical thought, that contemporary experts predict its realisation in the future and that models of independent online learning are already available. A cultural history interpretation of autonomous learning is made.

1. Introduction

1.1. Negative Opinions: Stiff Resistance

Whenever I tried to convince audiences of the importance of learner autonomy I was sure to be confronted with reservedness, scepticism, and even disbelief. Quite often I discussed this concept with students of the Online Master Course on Distance Education of the Universities of Maryland and Oldenburg. My opponents, usually adults and mid-career students, brought forward arguments like these:

- Students are not ready for autonomous learning, or, *not all* students are ready for this kind of learning.
- This concept cannot be applied in traditional universities and schools, which usually insist on keeping up the traditional system of expository teaching and receptive learning.
- Our schools and universities are not organised and equipped for the purpose of autonomous learning.
- A general curriculum for all students can no longer be prescribed.
- Most important: you cannot test the scholarly achievements of an individual student, class or school or even nation.
- The concept of the autonomous learner is a romantic idea or an idée fixe of notorious reformers.
- The concept is "too radical and too strident to have much impact on the mainstream of academic practice" (Fleming & Rutherford, 1984).

I suspect, or may I say that I am even quite sure, that some or possibly even many of the readers are hesitant about the concept of the autonomous learner as well and may be inclined to support some or even all these arguments.

1.2. Positive Opinions: Hopes and Expectations

On the other hand there are many educationists who consider networked computers and digitised learning environments as a desirable innovation and a significant contribution, which might enable us to reform learning and teaching. According to their visions the emergence of autonomous learning will be a significant development in future years.

1.3. Clash of Opinions

The opponents of autonomous learning are in the majority and the proponents in the minority. However, the proponents also include some who agree fully with the humanistic idea of the emancipation of the learner as well as of autonomous learning, but not in everyday practice. In the face of this conflict it is important that the issue is discussed in depth. I should like to do this by trying to achieve the following objectives.

1.4. Objectives of This Paper

I intend to show that

- autonomous learning is not a utopian pedagogical model, not an idealistic vision of isolated innovative educationists, not a figment of the imagination, but rather a standard pedagogical approach, which is based on tradition, practice, and theory and is justified by empirical research.
- Autonomous learning has today acquired prime importance because of the wonderful new and unique pedagogical possibilities of online learning, especially with regard to future developments. Obviously we must all become aware of them and perceive their outstanding significance.
- The vision of autonomous learning can be validated by referring to models which are currently being developed and tested.

The general objective is to investigate the support of online learners. My basic thesis with regard to this objective is that the best support we can provide for online learners is to enable them to become autonomous learners.

2. Exploring the Meaning of »Autonomous Learning«

2.1. Synonyms

Let us consider the term "autonomous learning", not as an exercise of defining, but rather in order to identify *different angles* from which this phenomenon of the self-learner can be seen. In this way important aspects become visible which help us to see many dimensions of the term.

In educational practice several different terms are used in order to refer to the special situation in which students study and learn by themselves:

independent study	self-education
independent learning	self-directed inquiry
learner-controlled instruction	individual learning
self-study	non-traditional learning
self-controlled learning	open learning
self-determined learning	self-planned learning
self-regulated learning	self-teaching
self-initiated learning	

The great number of synonyms shows that many educationists are aware of and are trying to promote independent learning in many areas of our educational system and in

many countries. While these different terms are useful, because each of them indicates special dimensions of the situation, I prefer go beyond them by calling the phenomenon autonomous learning**.**

2.2. The Term »Autonomous«

The notion of autonomy encompasses many meanings, apart from the synonyms shown here. We arrive at a deeper understanding if we are familiar with them. This term comes originally from the area of *constitutional law*, where it means self-government, and it is also used in a *philosophical* and *educational* sense. This disproves the hastily formed opinion that autonomous learning is merely a *technical-organisational* peculiarity of instructional design, in the same way as terms such as group, partner or individual instruction are imagined. The narrowness of the meaning of the term 'self-controlled learning', which is being used increasingly, may have led to this.

However, there is much more to it. The term *autonomy* is broad and has depth, because it is anchored in our philosophical and educational traditions in many ways and has also considerable psychological and sociological bearings.

2.3. Disciplinary Aspects

It is possible to identify characteristic perspectives of the term if we look at the way in which it is used by these disciplines.

Educational: Learners are no longer the *objects* of educational guidance, instruction, influences, effects, and obligations, but the *subjects* of their own education.

Pedagogical: Put more exactly, and with the help of pedagogical categories, learners are always autonomous when they themselves take over and exercise the functions of teachers. This means in other words that

> "the students diagnose their own needs for learning, for formulating their own learning objectives, identifying a variety of learning resources and planning strategies for taking the initiative in using those resources, assessing their own learning, and having their own assessment validated." (Knowles, 1988, p. 5)

This statement is still valid. It describes a demanding task. Some people may even be intimidated by it and others may think that autonomous learning is quite simply too great a challenge. The whole thing appears to be even more difficult if we have a look at the definitions of learning psychologists such as Carl Rogers and Barry Zimmerman:

Psychological: Learners are autonomous when they are "*meta-cognitively, motivationally and behaviourally* active participants in their own learning processes" (Zimmerman, 1989, p. 4).

> "Autonomous learners not only have to develop and transform cognitive structures but also to change surface structures into depth structures, and to reflect simultaneously on this process" (Lenzen, 1976, p. 15).
>
> "Learners must be able to stand back and keep their distance from their own actions, and to accompany them with critical contemplation" (Frey, 1995, p. 29).

Sociological: A free and open society requires the autonomy of as many individuals as possible in order to enable them to make critical and rational judgements about the causes and consequences of their own actions in a responsible way.

If we do not consider instructional design as an end-means relation in a technical sense, but believe in identity establishment and personality building, we have to include these disciplinary aspects in our pedagogical considerations.

Conclusion: The concept of autonomous learning is not a clearly defined one. It includes many significant meanings which enhance its relevance. Its links to general educational goals are characteristic and demonstrate the inherent relationship of instruction and education.

3. Renewed and Increasing Interest

3.1. Contributing Factors

If we try to explain why the interest in autonomous learning has currently increased and why this format of learning is widely accepted by now, at least theoretically, we can identify the following contributing factors.

- The current influence of three theoretical trends: classical theory of education, the modern theory of vocational/professional qualification, and the theory of learning, esp. of cognition and constructivism (cf. Huber, 2000**)**
- The tradition of autonomous learning fostered by innovative teachers and adult educators during the 20th century.
- The campaign towards "lifelong learning".
- The strong movement towards "humanistic", "non-traditional" and "open" education in the seventies and eighties.
- The legacy of distance education.
- The arrival of a younger student generation which has already grown up "on the net" and is already experienced in online learning and non-linear thinking.
- The current increase in scholarly activity, which is aimed at exploring relevant issues of autonomous learning and which leads to a huge amount of publications and information on the net.

The most important driving factor is, of course, the current process in which our traditional educational world is being replaced by a »telecosm« (Perelman, 1992) – "a new communication-based environment that makes all knowledge accessible to anyone, anywhere, anytime" (Raschke, 2003, p. 17). Here we are witnessing the advent of »hyperlearning« "which represents the fusion of both teaching and learning" (Raschke, 2003, p. 17).

Never before were the conditions for the emergence of new autonomous learners so convenient and favourable. It is fair to note that the renewed and increasing interest in autonomous learning could not have aroused without the powerful impact of digitisation.

3.2. A Multitude of Scholarly Publications

Researchers on this subject become aware that interest in autonomous learning has now reached a peak. It is referred to and debated in our digitised world more than ever before. Google reports that there are more than 17,000 references to the term "autonomous learner" on the net. Our own university library keeps 65 books on autonomous learning, most of them published recently.

The Third EDEN Research Workshop 2004 on "*Supporting the Learner in Distance Education and E-Learning*" was a convincing demonstration of the increased interest in autonomous learning as quite a number of papers dealt with it or with aspects of it.

4. Early and Contemporary Visionaries

Visionaries have strong, original ideas about how things might be different in the future, especially how things might be improved. This definition describes the intention of a number of futurists accurately.

4.1. Two Philosophers:

In 1783 Immanuel Kant wanted to liberate people from "*mental immaturity brought on by their own fault"* by causing them to *"make use of their understanding without outside help.*" (Kant, 1783, p. 1). The influence of this definition cannot be overrated. According to Immanuel Kant's ethics, man is autonomous if *his will and the criteria for judging his actions* are determined by his individual reason.

In 1873 Herbert Spencer wrote: In "education the process of self-development should be encouraged to the fullest extent. Children should be led to make their own investigations, and draw their own inferences. They should be *told* as little as possible and induced to *discover* as much as possible. Humanity has progressed solely by self-instruction…" (quoted in Dale, 1967, p. 41).

4.2. Three Futurologists:

In 1967, Herbert Kahn and Anthony J. Wiener caused a sensation with their *book "The year two thousand: a framework for speculation on the next 33 years*". They described how learning material could be accessed in the home, at work and in school with the help of computer networks. They foresaw individualised and distributed learning. We can see that great hopes for innovations in teaching and learning were linked from the start to the use of computers and computer networks.

In 1970, Alvin Toffler published his book "*The Future Shock*", He diagnosed the bankruptcy of the contemporary educational system (1970, p. 319) and criticised above all the widespread lecture system, in which he recognised the hierarchical structure of industry. He wanted to replace this by seminars and simulations games in "artificially created situations on a computer basis" (1970, p. 322). Toffler clearly foresaw the restructuring of learning which was required by computers and networks: "The new education system must teach people to classify and reclassify information, to determine its veracity, if necessary to change categories, to move from the concrete to the abstract, and vice versa – and to teach themselves something." (1970, p. 327). Here Toffler was already referring to techniques of self-teaching which have become necessary in digital learning environments today and which are propagated for autonomous learning.

4.3. Contemporary Expert Opinions

The present urge to know something about the future of online learning is understandable. As the speed of change is increasing dramatically we need ideas about where all these innovations in information and communication might lead. This is the reason why ministries and research institutes organised polls in order to learn more about the ideas of great numbers of experts.

In 1998 the German Federal Ministry for Education and Science published the Delphi-II Study (BMBF, 1998). The researchers predicted that the following changes would take place in the period to about 2020:

- From 2005 the distance education system will be used generally for further training of the population.
- From 2007 education will increasingly lead to bundles of individual qualifications and not to final degrees or diplomas.
- From 2010 virtual world universities will be widespread.

These three prophecies can be interpreted in conjunction. It is obvious that the experts who were polled regard the future of online learning in connection with the increasing importance of distance education. Both forms, whether integrated or not, will become all the more important as the "individual bundles of qualifications" cannot be mediated by means of traditional teaching, but have to be acquired above all through self study. For this purpose a general culture of autonomous, self-directed learning will be developed which will change learning in schools, universities and in the workplace. The broad consensus in this question is amazing. Only a small percentage of the experts believe that these developments will "never take place". With regard to the general use of distance teaching systems the contrary opinion was held by just 1.2 percent.

The study presents also more detailed prophecies which will become relevant for the autonomous learner. Let us begin with those dealing with what might be technically possible in the future

- An astonishing 99.4 percent of the experts who were polled agreed that between the years 2008 and 2015 electronically stored information would be retrievable in all the common languages of the world.
- Only over 1.6 percent did not believe that between 2011 and 2022 computers would be able to put texts together automatically and make automatic extracts from books and documents.
- Only 17.8 percent did not think that between 2010 and 2019 databases would have learned to arrange their "knowledge" without any misunderstandings.

Perhaps it is now also time to consider how far the learning of the autonomous learner will be facilitated and changed when computers without a monitor and a keyboard are on the market, which has been predicted for 2010 or so (cf. Maurer, 2004).

In 2000, Klaus Beck, Peter Glotz and Gregor Vogelsang polled 109 international experts in order to learn about their opinions about the development of online learning. According to this Delphi study, the following might happen:

- By 2010 there will be a specialised educational network.
- By 2010 self-directed learning phases will have gained considerably in importance.
- Between 2010 and 2015 the role of teachers will have changed radically in the direction concerned with educating, moderating, coaching.

When we consider the extent of the reservations even today with regard to autonomous self-directed learning, these prophecies about the growth in importance of self-directed learning are remarkable. Many students and teachers are naturally attached to traditional pedagogical thought, in which expository teaching and receptive learning dominate. And in developing countries in particular group links prevent the individualisation of learning. In spite of these circumstances, self-directed learning has acquired a firm place in the conceptions of the experts who took part in the survey. Obviously they have seen and understood that the pedagogical structure of online learning must of necessity differ from that of traditional learning.

The findings on the change in the role of teachers also bear witness to the growing realisation of the necessity for this change. This consequence, which has been described again and again and was already regarded as necessary in the discussions on programmed instruction, is now forecast by a remarkable number of experts (83.5 percent). The prophesied change in the professional image of teachers is in so far material as it will lead to considerable difficulties of both an institutional nature, and as far as career and promotion regulations are concerned. Will these prophecies come true?

5. Origins in Educational Theory and Practice

5.1. Traditional Starting Points

Autonomous learning is not at all alien to our general pedagogical traditions. Elements of autonomous learning are integral parts of any learning. No learning can take place without a minimum of active participation and of self-motivation of the learners. They must make at least some decisions about their own learning. There are also traditional models with reduced teacher regulation and domination.

We should also recall that the autonomous person is a goal of education which fosters the establishment of the learner's identity, self-realisation and self-reliance. The personality perspective is important: it is concerned with intrinsic motivation and personal growth.

Furthermore, there is a tradition going back about a hundred years in which innovative and reform-minded educationists promoted and emphasised student independence and responsibility.

Finally, autonomous learning is based on a tradition of about a hundred and fifty years, if we include distance education, which already requires a substantial amount of self-regulation. The legacy of distance education must not be forgotten or denied when online-learning is being developed.

5.2. Educational Visionaries

Even many experts do not know that there were very active proponents of autonomous learning in the past who promoted this particular format of learning. Autonomous learning has been a relevant objective of educational theorists and practitioners for

about a hundred years. I cannot go into all the details here and I will limit myself to mentioning just some of them:

- John Dewey and his concept of "self-activity" (1916, p. 353). He maintained that "Children like grown persons, require a judicious amount of being let alone." – "Only by a pupil's own observations, reflections, framing and testing of suggestions can what he already knows be amplified and rectified." (1952, p. 553).
- Carlton W. Washburne and his "Winetka Plan" which put the learner beyond the continual reach of the teacher (cf. Scheibe 1969, p. 309)
- Maria Montessori and her "pedagogical material" which enabled children to learn individually without the assistance of a teacher (cf. Montessori, 1913).
- Malcolm S. Knowles and his influential concept of "self-directed learning".
- Charles A. Wedemeyer and his *concept of independent learning* (cf. Wedemeyer, 1981)
- Hugo Gaudig, a German school reformer, who advocated "free mental activity" of students (cf. Gaudig, 1922).
- Otto Scheibner, another school reformer, who interpreted learning as an individual working process and provided a general plan of independent learning consisting of five formal steps (cf. Scheibner, 1930).

Some of these reformers tried to change the learning behaviour not of adults, but of school children. This is an important aspect.

Helmut Felix Friedrich, the educational psychologist, characterised the general situation in this way:

> "Whereas the debates (sc. on self-controlled learning) 10 to 15 years ago were to a great extent inter-disciplinary discussions in which educational scientists and psychologists announced: you may use self-controlled learning, today they say: you must use self-controlled learning." (1996, p. 42).

Characterising the situation today I would add that we should re-double and concentrate our efforts on establishing and developing autonomous learning.

The extent to which the vision of autonomous learning affected even the official American national education policy can be seen from the following guideline issued by John W. Gardner, a former Secretary of Health, Education and Welfare:

> *"The ultimate goal of the educational system is to shift to the individual the burden of pursuing his own education."* (Zimmerman & Schunk, 1989, p. V).

6. Visions of Pedagogical Innovation

6.1. First and Second-generation Online Learning

We have all experienced "first generation" online learning. We learnt that the most important impediment to the development of autonomous learning is the widespread habit of replicating traditional formats of expository teaching, such as lectures and taking notes.

Rolf Schulmeister (2001, p. 225) analysed a great number of learning projects at virtual universities in many countries. His findings are as follows:

- very often traditional ways of imparting knowledge are transferred to the new technological medium without reflecting this process;
- virtual learning is used for the transportation of subject matter content, and not as a medium of self-organised active learning conceived on the basis of a cognitive foundation;
- pedagogical software, which uses the possibilities of the medium in the right way, is rare.

Som Naidu (2003, p. 355) also observed that in the beginning "faculty rushed to embrace it by doing little more than post course syllabus and PowerPoint slides of their lectures on the course website". This means that they used the independence of time and location for logistical reasons only. They tried to apply methods of oral face-to-face teaching developed in *real* learning spaces in the *virtual* learning spaces of digitised learning environments. They adhered to the traditional pattern of expository teaching and receptive learning. When I say that this is "putting old wine into new bottles" I wish to express my opinion that the replication of traditional learning and teaching methods will not lead very far. On the contrary! It prevents us from discovering, developing and applying the marvellous powerful approaches made possible by networked computers. Quite a number of them are without parallel in traditional education.

Pedagogically speaking, the replication of traditional formats of learning is a flagrant misuse of the digitised learning environment. It strengthens the ability and the skills of students to learn by being taught. According to our vision we should be promoting the development of the activity of the learners and strengthening their skills of self-directed inquiry and self-directed learning. This is quite the opposite behaviour.

Currently theorists and practitioners are in the process of developing a *"second generation"* (Reimann & Zumbach, 2001, p. 35) of online learning. Participants of the Third EDEN Research Workshop 2004 in Oldenburg (Germany) played a material part in this endeavour. More and more faculty see and understand that learning and teaching in virtual learning environments require specific and adequate methods of learning and teaching. This is a pedagogical challenge and will lead to a pedagogical paradigm shift. One major goal of these endeavours is to create and promote independent, self-regulated learning, that is, autonomous learning. In order to achieve this we need a vision of how learning in virtual spaces will have to differ from learning in real spaces. The problem is that nobody can tell us, as the changes before us may be drastic and therefore unpredictable. Nevertheless, I am going to try to draw a rough and tentative sketch of a vision of this kind based on current experiences and pedagogical thought.

6.2. Prerequisites of Success

If we intend to promote autonomous learning at colleges and universities we need students who have already developed some of this competence as children in their families and at school. Here education must be geared to our demanding goal. More important than strategies of autonomous learning is the general attitude towards this form of learning, the forming of the habit of learning autonomously, the process of internalising this new way of learning. My vision tells me that in ten or twenty years parents and school-teachers will be much more concerned with fostering independent thinking in their children and students, that they will encourage their natural curiosity and their urge to

explore their environment independently. I envisage a time in which children will be no longer kept dependent, but be dealt with in ways Carl Rogers, the humanistic psychologist and educator, has taught us. When children are educated in this way, when they are motivated to "learn how to learn" by themselves they will be prepared for autonomous and self-regulated learning at colleges and universities, and also throughout their lives.

Another precondition is, of course, a wide-spread general acceptance of the constructivist assumption that learning is the construction and continued change of cognitive structures in the individual and not the result of the transportation of »knowledge« from one person to other persons. Yet another precondition is that educationists and teachers have already started to conceive and develop notions of what autonomous, self-regulated learning might look like in the future.

6.3. A Tentative Futurist Scenario

I imagine and hope that the renewed interest in autonomous learning will increase further and will lead to a positive societal perception as well as to general acceptance and promotion of this format of learning by the scientific community. If this happens, in ten to twenty years the conditions of autonomous learning will be as follows:

Colleges and universities are transformed into institutions of independent learning (cf. Peters, 2000, p. 10) in which learning will probably be based on three approaches: mainly on online learning, but also on distance education, and, very important, "social intercourse" and free academic discourse, which might take place in seminars and other face-to-face encounters. Faculty believe that alongside with the digitisation of learning environments, which disembodies learning, it is necessary to emphasise the »embodiment in learning« (Ess, 2003, p. 117) as well. Each faculty and each teacher is competent in self-learning and in enabling students to learn independently in virtual spaces. They are able to construct adequate virtual learning environments (scaffolding).

The "ten virtual learning spaces" are filled with many new pedagogical approaches. Students have developed and trained an entirely new learning behaviour. Faculty have recognised and internalised the educational value of supporting learners. Many new models and strategies of independent learning can be applied and facilitate autonomous learning. Here are just some of them. Developing portfolios and learning journals (as envisaged by Christine Walti, 2004) are standard forms of purposeful engagement of students, which help them to consider their progress in learning and "their growth and development over time" (cf. Barrett, 2001, p. 5). Students are able to apply meta-cognitive knowledge and meta-cognitive strategies (as envisaged by Mirjam Hauck, 2004). Adequate methods for assessing the scholarly achievements of autonomous learners are developed. This means students have acquired techniques of formative peer and self-assessment (as envisaged by Brian Hudson, 2004). »Scaffolding« is by then recognised and employed as a "key concept in the quest for a more inquisitive, individualistic learner-centred model" as envisaged by Elena Barcena and Timothy Read in 2004.

Virtual seminars are acknowledged basic formats of learning and teaching. Moderating them (cf. Salmon, 2001) is a highly developed sophisticated pedagogical skill. The use of several specific forms of communicating and collaborating has become second nature of the students. An unusually great number of trained moderators are available. Techniques for developing "individual bundles of qualification" can be applied. New methods and

systems of support (McLoughlin, 2002) for students as well as for faculty (Zawacki, 2004) are available and can be implemented. Colleges and universities understand that support is also a task of the academic institution. »Situated learning« has become the most precious achievement, as learning content can be easily embedded into contexts.

The whole educational setting is permeated by a new culture of independent learning (Arnold & Schüssler, 1998) Theorising and research no longer emphasise strategies of *teaching* but strategies of *learning*; no longer emphasise expository teaching and receptive learning, but individualised, self-regulated learning.

It is needless to say that today we are still far from this imagined situation.

6.4. Pedagogical Innovations

I imagine and hope that there will also be a third generation and subsequent generations of online learning, and that they will bring about definite pedagogical innovations as part of the transformation process. I foresee that autonomous learning will become the *standard* format of learning, whereas forms of expository teaching and receptive learning will be used for carrying out special tasks. Of course, autonomous learning is already in itself a major innovation, but the *way* in which it should and could be implemented can add to this innovation considerably. It is a shame if we do not use and exploit the wealth of opportunities for innovation when changing from real to virtual learning spaces. Joint efforts of pioneers in many countries will lead to the emergence of specific models and strategies of autonomous learning in virtual learning spaces. They will have to be developed, tested, adopted, implemented and habituated. This is an extremely difficult task, as these models and strategies are not based on *natural* behaviour in our *Lebenswelt*. They are highly abstract and must be applied in virtual spaces. This is a hard road to travel as we have to break new ground.

6.5. Guiding Concepts and Principles

While it is *not* possible to transplant *methods* of oral teaching into online learning it seems to be necessary to stick to a great number *guiding concepts* and pedagogical principles of traditional instructional design. Some of them are:

- Learning by exploration
- Learning by discovery
- Activity learning
- Learning by doing
- Resource-based learning
- Individualised learning
- Learning by increased communication
- Learning by increased collaboration
- Learning by knowledge management
- Situated learning
- Learning communities
- Tutor-guided learning
- Meta-cognition

These concepts have been used to enhance the quality of traditional learning. They are still valid and will remain so in the future. An analysis of them will even show that they have a close affinity to independent learning. Digitised learning environments provide for convincing opportunities for their application. So far most of the new chances and possibilities for innovating education have not yet been seen, let alone discovered, communicated and applied.

7. Specific Pedagogical Models

In order to demonstrate that autonomous learning in digitised environments can and must be implemented in ways that differ considerably from learning in real spaces, I should like to mention seven models:

- Working with ten virtual learning spaces
- The self-regulated learning process
- Learning by knowledge management
- Knowledge building communities
- Distributed knowledge based learning
- Distributed learning by design
- Learning in virtual seminars.

I chose them in order to show configurations of pedagogical activities which are possible in online learning only, and which are of special interest for implementing pedagogical innovation.

7.1. Working With »Ten Virtual Learning Spaces«

Traditional methods of learning and teaching do not reflect the actual potential of teaching and learning that is enabled by electronic systems, and in fact hardly touch on them. For this reason, I propose a different approach, one which is based essentially on the opportunities provided by information and communication technologies. What are the *technological* functions of the digitised learning environment that deserve the special attention of instructional designers? I can see and distinguish ten of them. It is important to recognise their affinity to certain pedagogical functions as can be shown in this table:

Technical functions	**Pedagogical functions**
Presentation of information	Presentation of instructional content
Storing	Documentation, compiling files, portfolios
Retrieval	"Remembering"
Communication	Discussion with students, tutors etc.
Collaboration	Cooperation with classmates etc.
Browsing	Searching for relevant information
Multimedia	Presenting and representing
Hypertext and hypermedia	Independent learning
Simulation	Working with dynamic models of reality
Virtual reality	Three-dimensional spaces and landscapes

It is important to see that these functions are not structurally linked to one another as in real learning spaces, which are structured by curricula and "courses". Each function is available separately, on request. This leads to the idea of speaking of ten separate virtual learning spaces in which special pedagogical activities can be planned and implemented. Learners can combine two, three or even all of them. In this way an unprecedented freedom of choice, combination, sequencing and arrangement is gained.

The great differences between real and virtual learning spaces show that electronically imparted teaching and learning can be designed in such a way that the methods used are structurally completely different to traditional methods. The technological innovations which have been referred to do in fact enable activities which are greatly desirable in the sense of pedagogical innovation. They help us to create new opportunities for self-initiated and self-directed learning. They provide us with chances for the further development and consolidation of self-governed and self-controlled learning, as well as for reality-oriented, communicative and collaborative learning. The thing to be done here is to develop new methods, procedures, rituals and conventions, and to use them to occupy and structure the infinite virtual space at various positions so that a new educational field of operations with its own legitimacy can be created.

The close relationship of the innovative educational activities to their respective technological basis makes it seem obvious to provide different designations for the virtual learning spaces which they constitute. This is also appropriate because, as we have seen, we are in fact dealing with spaces which are essentially *separate* from one another, namely virtual

- instruction spaces,
- documentation spaces,
- information spaces,
- communication spaces,
- collaboration spaces,
- exploration spaces,
- multimedia spaces,
- hypertext spaces,
- simulation spaces, and
- spaces in virtual reality

The ten new learning spaces characterised here confront us with unexpected possibilities of educational innovation and reform. It is remarkable that specific combinations of these virtual learning spaces may lead to entirely new pedagogical structures. I emphasise in particular the fact that individual autonomous learners can use these virtual learning spaces, because they can learn by exploration, through communicating and collaborating, through representing and simulating and also by designing their own learning.

7.2. Acquiring Knowledge in a Self-regulated Way

This model is well established in real learning spaces. We are interested in finding out how it could be arranged in virtual learning spaces. Here cognitive activity of the individual learner passes through the following phases:

- At the start, problems are recognised and described with the help of internal knowledge. Their solutions are defined as the learning goal.
- Regionally and globally distributed information acquired through navigating and surfing in the Internet may help to clarify the problems. Solutions are filtered out and checked. By comparing, configuring, testing, visualising the interpreted information the user gains an overview and reduces the complexity with regard to the learning goal.
- Procedures, paths for solutions, learning problems and progress are discussed in the virtual space with teachers, advisors and other students (communication and collaboration).
- Advances in knowledge are made, and the learning goals are reached, on the basis of the interactive processes between internal knowledge and tested external information, if necessary by evaluating external solutions as well.
- The learning results are evaluated and tested for the practical application.
- All learning steps in this self-controlled learning process are accompanied critically and controlled by the learners themselves (meta-cognition).

In learning processes of this kind, free-floating information is adapted and integrated into a historical situation and is defined by time and space as well as by social, cultural and technological conditions. And it finds a new anthropological location on this transformation. Elements of explorative, discovering and researching learning and of the deciding learning orientation take effect, thus fulfilling demands from pedagogues for more self-responsibility from learners. Acquiring knowledge in this form can be seen as the ideal preparation for those who have to generate informed knowledge as routine in the knowledge society of the future and deal with it in a previously unknown form.

7.3. Learning Through Knowledge Management

Knowledge management, although new to both theory and practice, has already entered public consciousness as a slogan. Its up-to-datedness is reflected in many monographs and collections of essays (e.g. Probst, Raub & Romhardt, 2000; Soukup, 2001; Schreyögg, 2001). The driving force behind this innovation is economics. This development has led to the current impression that knowledge management is primarily a matter for companies, especially large industrial operations.

We must pay tribute here to the psychological-pedagogical research by Heinz Mandl and Gabi Reinmann-Rothmeier. According to them "knowledge management" is also interpreted as a competence that concerns us *all*, because in future we will all have to find our way around the flood of information provided by the Internet. Accordingly, knowledge is not just an economic good but also a "person-related good" (Reinmann-Rothmeier, 2002, p. 2). It is a competence "for life in the knowledge society" (Reinmann-Rothmeier & Mandl, 1997, p. 97). Each of us must now develop strategies for dealing with information and knowledge in all their forms. This made the pedagogical dimension of the term clear. In fact, the authors relate knowledge management explicitly to the area of education (1997, p. 56). In particular**,** they regard it as an integral part of the acquisition of knowledge. In other words, they interpret knowledge management pedagogically.

It is exciting to imagine learning as a special process of knowledge management. Distance students and on-line learners have always been forced to organise their own learning

processes, e.g. with regard to the beginning, duration, location and often the sequence of the modules they have to work through. To a limited extent they have always had to monitor and check their own learning. If they now in addition want to manage the actual process of acquiring knowledge they can orient themselves to the integrated Munich model of knowledge management (Reinmann-Rothmeier, 2002, p. 8).

This model comprises these tasks, activities and competences:

- Distributing information
- Selecting and evaluating information
- Embedding information in a context
- Attributing meaning
- Transforming information into knowledge
- Developing new knowledge
- Relating contents of knowledge
- Creating nets of knowledge
- Distributing knowledge
- Exchanging and supplementing knowledge
- Applying and converting knowledge
- Evaluating knowledge-based actions and deducing new knowledge from them.

(Source: Reinmann-Rothmeyer & Mandl, 1997, p. 21).

This model focuses attention on four process areas: The representation, use, communication and generation of *knowledge*. Corresponding processes are planned in any case for the development of »informed knowledge« in digital learning environments. However, if these processes are controlled using this model, the pedagogical cornerstones are strengthened and the pedagogical contours are intensified. In addition, the model can coordinate the necessary activities for acquiring knowledge and legitimate them theoretically.

Knowledge management is particularly important in on-line learning. Gabi Reinmann-Rothmeier interprets on-line learning as a "melting pot" for knowledge management and continuing education (2002, p. 11). She points out how three basic functions of on-line learning can be used in continuing education: the distribution of information, the interaction between user and system and the collaboration between learners. She also shows how basic functions of knowledge management (representation, communication, use, generation) can be linked in this way.

7.4. Knowledge Building Communities

To some it may be paradoxical that I am now going to deal with certain forms of distributed group learning in a presentation of autonomous learning. But group learning in virtual learning spaces can be planned, initiated, controlled and evaluated by the autonomous participants themselves. The benefits of such communication and collaboration in virtual groups are obvious: The learners

- have access to a broader information base,
- are stimulated by other group members,

- have opportunities, and are compelled, to express their ideas, thoughts and knowledge verbally, partly even orally,
- are obliged to communicate clearly and comprehensibly,
- learn from other group members,
- enjoy the feeling of solving problems together,
- are additionally motivated.

A particularly attractive form of self-directed and self-responsible learning can be achieved if a knowledge building community (Scardamalia & Bereiter, 1992) can be established successfully in which several learners communicate via a central computer. Originally these knowledge-building communities were developed in thriving scientific disciplines, such as cellular microbiology. Here the researchers work jointly on the same subject and inform each other regularly about what they have experienced, discovered and worked out. At the same time they may criticise or praise information and texts they have received from other members of the community. In this way a virtual project group is created which produces new knowledge through joint discussions and individual contributions. This model was also applied in schools. Its pedagogical advantages are obvious: not only are we faced here with an ambitious form of »autonomous learning«, but also with »partnership learning« and »group learning«, which strengthen the components of »communicative learning«. Furthermore, new knowledge structures are developed here jointly, which can be interpreted roughly in accordance with the radical constructivist learning model (cf. Siebert, 1996, p. 16).

A form of autonomous learning is being developed here which leaves expository teaching and receptive learning far behind, replacing them with independent achievements. The new learning behaviour manifests itself in the search for, and assessment and application of, suitable information and in careful (written!) communication and co-operation. The proximity to learning by doing research and to academic work in general is remarkable.

7.5. Distributed Problem-based Learning

Problem solving is an acknowledged traditional goal of instructional design. It is a process of recognising an obstacle or difficulty and of devising and testing possible solutions. The pedagogical value of it is obvious when the learners generate new ideas, unique ways to solve the problem, contribute new ideas and identify new problems. This method is attractive as its high thinking levels can result in new learning. The traditional group learning method distinguishes eight stages: problem definition, analysis, generation of alternatives, selection and synthesis of optimal solutions, controlled implementation, evaluation and revision.

What happens to this process when it is performed by autonomous learners in “networked computer-supported collaborative learning environments (CSILE)”? Som Naidu (2003, p. 356), by referring to Evensen & Hmelo (2000), analysed this situation meticulously. He identified 15 stages. The main advantage of this scenario is that each learner combines rigorous self-study with collaborate learning. Each learner is informed by the ideas, thoughts and approaches of each member of the virtual group. Naidu distinguishes five pedagogical phases of this process:

- Presentation of the problem
- Learners post their first perceptions of the problem
- Learners explore the problem and the first perceptions
- Learners revise their first perceptions of the problem
- Learners prepare and post a critical reflection record.

The learners develop hypotheses and possible solutions and search for evidence to support their hypotheses. In this way it is possible for them to compare and modify solutions.

7.6. Distributed Learning by Design

Recently »design« has attracted considerable attention by instructional designers. The reason for this is a transformation of this pedagogical approach. Formerly special abilities and skills in designing were developed with students of architecture, fashion designers, engineers, and developers of software. But now experts find that the »learning by design approach« can also be applied in other disciplines as it can intensify learning of a more general nature as well. It is pedagogically attractive because it activates the students, encourages reflection, communication and collaboration and can become a considerable source of motivation when this particular type of learning-by doing is successful. Furthermore, the task to be solved is usually an authentic one. It requires the formulation of questions and the assessment of possible solutions. The designed artefact must be repeatedly compared with the original. Different levels of abstraction must be distinguished.

Design approaches of this kind have been described by Peter Reimann and Jörg Zumbach (2001, pp. 145–152), with reference to Lahti, Seitamaa-Hakkarainen and Hakkarainen (2001), Hmelo, Holton and Kolodner (2000), Schank (1994) and by Schank, Fano, Bell and Jona (1994). Jörg Zumbach and Peter Reimann (1999) tested the method of learning by design by developing a project of "information design" and compared this method with a Hypertext programme and with a tutorial program in which the same contents were imparted. The result: the learning-by design students showed more intrinsic motivation, more rational and better balanced argumentation and better acquisition of structural knowledge in a post-test.

7.7. Learning in Virtual Seminars

Like the three models referred to above, a virtual seminar is – a special form of community learning. If we compare it to a real seminar we become aware again how much the pedagogical structure is rearranged in the virtual learning space. The interplay between autonomous learning and communicative learning is decidedly different. The individual part is much stronger as each participant remains an autonomous learner for long time units and is able to study *all* the contributions of all active participants in asynchronous seminars. In a way a virtual seminar is a cohort of autonomous learners who communicate and collaborate together in a mediated way.

Teachers and learners must adapt to the different learning situation. (Weinberger & Mandl, 2001). The teachers' role changes considerably, because they are expected not to teach the autonomous learners, but to moderate the seminar (Salmon, 2001). The learners have to develop individual strategies in order to be able

- to deal with the great amount of messages,
- to exchange information,
- to follow a discussion that is usually most complex, take an active part in it and concentrate on those aspects in which they are interested,
- to try to become "visible" in the group and to socialise with other class members in the virtual way,
- to concentrate on preferred aspects of the discussion,
- to construct knowledge,
- to cooperate with participants in small sub-groups,
- to ask for support and profit from it.

When the students have experienced a virtual seminar of this kind they will probably have become better »autonomous« learners.

Further research is needed in order to explore the real nature of this particular pedagogical structure and to evaluate current experiences. It can be facilitated by using a heuristic scheme presented by Helmut F. Friedrich and Friedrich W. Hesse (2001, p. 10), because this conveys major elements of distributed communicative learning:

INPUTS	**PROCESS**	**OUTCOMES**
Person	**Interactions with**	**Person**
Media competency Prior knowledge Strategies Preferences Motivation	Technology Learning content Other persons	Media competency Acquiring knowledge Knowledge transfer Motivation Attitudes Key qualifications
Group		**Group**
Distribution of knowledge Role taking Climate Cohesion History		Knowledge distribution Role taking Self-regulation Productivity Cohesion Climate
Learning environment		
Curricular integration Instructional design Technology Support		

8. Cultural History Interpretation

It is illuminating to refer also to the cultural history aspect of autonomous learning. This aspect is often neglected by those who are mainly interested in the technological problems of virtual learning and in the breathtaking advances of information and communication

technology in general, and by those who are burdened with their daily traditional teaching tasks. However, all of us should become aware of the deep-rooted transformation process which has begun to change our way of life and society at large. We must realise that the advent of digital learning has not only changed the learning environment and the learning behaviour. It has also caused a technological, social, economic and cultural shift. This dramatic shift has shattered the very foundations of learning.

The way in which we work and learn in the postmodern world of the 21st century will differ decisively from the way this was done in the 20th century. This means that the assumptions, ideologies and myths about the purpose of education will undergo a considerable change, will even become partly irrelevant. Previously the general purpose of education was to educate *knowledgeable persons*. But in the digital society the *order of knowledge* has changed considerably and will continue to change. Therefore, in the future the general purpose of education will be to educate self-learners. The inculcation of subject matter content will be substituted by a systematic development of skills like, for instance, self-directed inquiry, self-selection of contents, and self-evaluation. Autonomous learning will be internalised by the students, will become their second nature. This means that we have to interpret this critical pedagogical paradigm change and specifically the shift from expository teaching to autonomous learning, from receptive learning to active learning as integral and indispensable part of a general cultural transition we have to undergo.

If we focus our attention on this paradigm change in the context of cultural history we cannot but see that a drastically different culture is emerging. Malcolm S. Knowles, in the preface to "*Developing Student Autonomy in Learning*" (Boud, 1988) believed that "we are facing a turning point in human history" because of this paradigm change. This was prognosticated *before* the advent of the net and online learning, which intensified and accelerated this process. Today the relevance of this forecast has increased dramatically. We cannot but interpret the present importance of autonomous learning as a consequence of societal processes like individualisation, de-institutionalisation, and deregulation (Faulstich, 2002, p. 65). We have to come to grips with the change of our society from industrial to post-industrial, from modern to post-modern, from an information to a knowledge society. Oskar Negt (1998, p. 21) the eminent German sociologist, tells us that the conventional working and gainful employment society has come to a historical end. In the centre of this radical change we are challenged to reinterpret two fundamental categories of the civilising process of our bourgeois society: working and learning. The emergence of autonomous learning is an important feature of this reinterpretation.

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