Studien und Berichte der Arbeitsstelle Fernstudienforschung
der Carl von Ossietzky Universität Oldenburg

Band 5

Otto Peters

Distance Education in Transition

Developments and Issues (5th ed.)

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This volume has been made possible with substantial support of the Ulrich Bernath Foundation for Open and Distance Learning (FRODL)
http://www.frodl.org/

1st edition, April 2002
2nd edition, May 2002
3rd revised and extended edition, July 2003
4th revised and extended edition, November 2004
Reprint, June 2006, reprint, November 2007
5th revised, extended and updated edition, April 2010

Publisher: BIS-Verlag
der Carl von Ossietzky Universität Oldenburg
Tel.: + 049 441 798-2261
Telefax: + 049 441 798-4040
e-mail: bisverlag@uni-oldenburg.de

ISBN 978-3-8142-2201-1

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Acknowledgements

Chapter 1: "The Theory of the Most Industrialized Education" is a new manuscript, partly based on Peters, O. (2007, pp 433-436; 2007a, pp.57-68).

Chapter 2: "The Iceberg has not yet Melted: Further Reflections on the Concept of Industrialization and Distance Teaching" was first published in *Open Learning*, November 1989 and reprinted in Desmond Keegan (Ed.) "*Otto Peters on Distance Education*, pp. 195-210, London: Routledge, 1994.

Chapter 3: "The Revolutionary Impact of Distance Education" is a new contribution by the author. It is partly based on ideas presented at the conference "Education as Two-Way Communication" at the Fernuniversität on May 12th, 1991. This paper was published by G. E. Ortner, K. Graff & H. Wilmersdoerfer (Eds.): *Education as Two-Way Communication. Essays in Honour of Börje Holmberg*, pp. 28-34. Frankfurt am Main: Peter Lang, 1992.

Chapter 4: "The Greatest Achievement of Industrialized Education: Open Universities" was first published in Terry Evans, Margaret Haughey & David Murphy (Eds.): International Handbook of Distance Education, pp. 279-302. Bingley, UK: Emerald, 2008.

Chapter 5: "Concepts and Models" is based on a keynote speech delivered to the First National Conference on Distance Education in Manila, September 10th – 11th, 1998.

Chapter 6: "The Educational Paradigm Shifts" is based on a keynote speech given at the KNOU-UNESCO PROAP Workshop in Seoul, Korea, September 2–4, 1997.

Chapter 7: "New Learning Spaces" is based on the paper "Neue Lernräume", published in "Grundlagen der Weiterbildung: Praxishilfen" (1999), chapter 5, 5.1.50, (pp. 1–29). Neuwied: Luchterhand.

Chapter 8: "A Pedagogical Model for Using Virtual Learning Spaces" is based on the paper "Ein didaktisches Modell für den virtuellen Lernraum", published in "Grundlagen der Weiterbildung: Praxishilfen" 1999, chapter 5, 5.1.60, (pp. 1–24). Neuwied: Luchterhand. Reprinted in W. Marotzki, D. M. Meister, & U. Sander (Eds.) (2000). „Zum Bildungswert des Internet", (pp. 159–188). Opladen: Leske + Budrich.

Chapter 9: "Digitized Learning Environments: New Chances and Opportunities" is based on a keynote address at the International Open and Distance Education Symposion at the Shanghai Radio and Television University on April 15–17, 1998.

Chapter 10: "Online Learning: Visions, Hopes, Expectations and Limitations" is based on the paper "Online Lernen: Visionen, Hoffnungen, Erwartungen" (2001), published in „Grundlagen der Weiterbildung: Praxishilfen", chapter 5, 5.270, pp. 1–12. Neuwied: Luchterhand.

Chapter 11: "Information" and "Knowledge"- on the Semantic Transformation of Two Central Terms" is based on the paper "Der Wandel der Bedingungen des Lehrens und Lernens in der Weiterbildung: "Information und Wissen", published in Luchterhands "Grundlagen der Weiterbildung: Praxishilfen". Köln: Wolters Kluwer Deutschland, 2003 (5.430, pp. 1–38) and partly on the paper "Der Wandel der Bedingungen des Lehrens und Lernens in der Weiterbildung: Pädagogische Folgen der Transformation von Information und Wissen", published in Luchterhands "Grundlagen der Weiterbildung: Praxishilfen". Köln: Wolters Kluwer. Deutschland, 2003 (5.460, pp. 1–25).

Chapter 12: "Visions of Autonomous Learning" is based on a keynote speech at the Third EDEN Research Workshop "*Supporting the learner in distance education and e-learning*", held in Oldenburg, Germany, March 4-6, 2004.

Chapter 13: "The Transition of the Universitiy into an Institution of Independent Learning" was first printed in T. Evans, & D. Nations (Eds.) (2000): *Changing university teaching*, London: Kogan Page, pp. 10–23. The German version was published in R. Arnold, & W. Gieseke (Eds.) „Die Weiterbildungsgesellschaft", vol. 2, (pp. 234–258). Neuwied: Luchterhand, 1999.

Series Editors' Foreword

The ASF-Series is intended to contribute to research in *distance education and e-learning* and, as such, addresses a wider public. However, the Series is closely related to a joint project where Carl von Ossietzky University Oldenburg has joined forces with the University of Maryland University College (UMUC) to launch the *Master of Distance Education (MDE)*. The linkage of the Series with the program is a double one: (i) most of the contributors to the Series are in some way or the other involved in the MDE program, either as faculty or as visiting experts, some as students; (ii) various volumes and book chapters are used as required or recommended reading in the MDE courses.

Development in the field of distance education and practical requests from students led to a substantial re-orientation of the editorial policy of the ASF Series. In our field the role of *open educational resources* (OER) has been widely discussed. Students preferred the e-book versions for economic as well as practical reasons. Obviously they benefit for not having to buy additional new textbooks (which is a problematic request, especially when only a few selected chapters are actually used) is welcome. But digital text also facilitates citing and annotating. That we now can request students to read single chapters without burdening them with buying additional books will hopefully lead to an even wider and more extensive use of the Series.

> The ASF-Series is available as e-books through the Oldenburg MDE website
> Oldenburg MDE website: http://www.mde.uni-oldenburg.de/index.html;
> ASF Series: http://www.mde.uni-oldenburg.de/40574.html.

This new editorial policy to make the Series available as e-books also had some impact on this 5th edition of Otto Peters' *Distance Education in Transition: New Trends and Challenges*. It made it easier to discard some chapters of the previous edition which we had to in order to accommodate a substantial amount of new chapters while keeping the print edition to a manageable size of (and redundancies at an acceptable level). The discarded chapters are still available under the 4th edition which is still kept available.

More important are the additions. They are clearly highlighted in the new edition which groups the chapters in three main parts. Even a superficial comparison will reveal that the major change in the new edition is the addition of chapters (all assembled in Part I) revisiting the 'industrialization theory (of distance education) and its implications'. The editors of the Series (and obviously the author of the book) consider the industrialization formula and its influence in shaping theory and policy of the field of distance education as of continuing importance. Interpretations may vary: you may see it still as the best policy guideline to meet the ever increasing demand for especially higher education, or you may see it more as the backdrop, against which new types of distance education and e-learning get their distinctive profiles. In any case, you need to understand this theory in order to see how closely pedagogy (issues of instructional design), organization (institutions as systems) and economics (issues of cost-structure, scale economies) are interrelated. This is why it was of adamant importance to give MDE students, 'future leaders in the field of distance education and e-learning', according to the program's mission, a healthy grounding in this seminal theory. We are thankful to Otto Peters that he brought together some of the most relevant papers, re-wrote others and added new

ones to provides us with a comprehensive view of the industrialization theory and its history from the beginning of modern distance education to the present state of transition.

The remaining parts of the book group papers together around the two other major themes on which Otto Peters' work has focused his research in the more recent past: one concerns the impact of the new digital technology, the other brings into focus the learner. The reader will note that separating the two themes is slightly artificial given their intrinsic relationship. It is the new affordances of digital learning spaces that open up new opportunities and challenges for the autonomous learner. His analysis does not foreground the technical aspects but the pedagogical models enabled by these technologies. Here he inspects the whole interactive 'portfolio' of such learning spaces (content, teacher and peer interaction) rather than focusing only (as it is often done) only on the student teacher aspect. This enables him to see (for instance) how student content interaction in digital spaces may reach levels of sophistication which earlier distance educators hardly could dream of. The same applies of peer interaction. Peer interaction was completely absent in earlier mass media based distance education because there was no technology to support it.

Special attention should be drawn to chapter 11 at painstaking analysis of 'knowledge' and the 'information'. In today's discussion of the 'knowledge society' and the 'information age' such an analysis forces the reader to see how loaded with implications these lightly used concepts are.

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

The Editors
April 2010

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*, [title of 1st to 4th edition – The Editors] 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 centered 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, organize, 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 decades 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.

This trend can be observed most clearly at national and international conferences on this particular field of educational activity. Also traditional universities start experimenting with distance education, digitally enhanced distance education and online learning – after a long period of ignoring this method of teaching and learning. As A. W. 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." The idea is to provide new opportunities for lifelong learning. "These divisions also have the potential to become e-universities" (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. Open universities have been even a trend setter and are now in the process of moving "from the margins to the centre stage of higher education" (Guri-Rosenblit, 1999a, p. 281).

The main reason for the rapidly increasing interest in distance education is, of course, the unbelievable advances and proliferation of information and communication technologies. Its digitalization 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 individualization, better quality of programs, and greater learning effectiveness.

What does this mean in the concrete 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 counseling sessions. Likewise they even may take oral examinations and chat with fellow students or with persons interested in the subjects even in other countries. New dimensions for the pedagogy of distance education are opened up and compensate for deficiencies inherent in traditional forms of distance education. Distance education is "at a point of turning" (Daniel, 2001, p. 20).

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 analyze 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 these rapidly developing information and communications technologies 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 contents will be affected as well. Increasingly many new learning and teaching programs will have international and intercultural features. And it stands to reason that subjects taught by means of printed books will inevitably be different when disseminated by the Internet. It is certainly indicative and telling that experts at the Third 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 its transformation caused by the use of books. Now it will become necessary for us to distinguish clearly between 'knowledge' and 'information' as well as 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 're-engineering' 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 organized in quite another, highly decentralized 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 pedagogical patterns which could support them for being prepared for academic learning and teaching in the knowledge society? What are the prospects for online learning in the next ten or twenty years? Will the virtual universities, so often discussed these days, be ready and in a position to develop new pedagogical patterns?

The articles presented here deal with these problems. This book consists of a number of invited keynote speeches held at expert meetings in Seoul, Shanghai, Manila and Oldenburg during the last years as well as of two articles for books with the programmatic titles "The Educational Values of the Internet" and "Changing University Teaching" published in Germany and England in 2000.

Otto Peters
Hagen, July 2009

PART I:
THE INDUSTRIALIZATION THEORY AND ITS IMPLICATIONS

1 The Theory of the 'Most Industrialized Education'

This chapter revisits the original industrialization theory from 1967 and presents a rectification of a common and widespread misunderstanding. Many of those engaged or interested in distance education have adopted only a narrow and reduced idea of 'industrialized education'. This bars the way to a full understanding of what the theory intends to articulate. In order to prevent further misunderstandings this chapter will not only present the genesis and a precise explication of the theory, but also support and legitimize it by referring to seven of its dimensions. The two parts of this description and interpretation belong together.

Industrialization

Industrialization is a new epoch in the development of man and differs fundamentally from all previous epochs. It is without example in history, above all, on account of the basic changes not only in the production of goods, but in most spheres of human existence. Its influence is dramatic as it has shaped not only the nature of the modern economy, but also of modern and post-modern society and human beings.

As we look back over about two hundred years of industrialization and over about a hundred and fifty years of distance education it is important to distinguish historical periods of industrialization as each of them influenced and even marked distance education in specific ways.

The First Period

Since the end of the eighteenth century significant changes have taken place in the way in which physical goods are produced. These changes were caused by the use of machines and of new sources of energy (steam engines, oil). Capital investment and the rise of commercialism were typical new features. Many new jobs were established and the number of workers increased. An industrial infrastructure was developed: traffic on railways, new roads, and post offices. The concentration of factories led to the establishment of large cities (urbanization). This phase of industrialization caused massive technological, economical and social changes that brought about the 'Industrial Society'. One of these changes was the gradual departure from agrarian society, another, the emergence of two entirely new social types: workers and entrepreneurs. The mentality of workers changed: Often the pursuit of a better life led to upward social mobility.

The Second Period

Since 1870 the developments referred to have been continued and intensified. Industrial production was further rationalized by automation and later by robots. Industry boomed because of the rise of new technologies: steel, petrol, chemicals, motor vehicles,

aircraft, steam ships, electrification. The printing press was further developed. Many farm laborers migrated into cities. In 1970s and 1980s new structural changes of industrialization took place and transformed it into neo-industrialization and post-industrialization. Manual work declined, professional work predominated. Theoretical knowledge became important. More universities were established. Capital was globally diffused. Rationality and efficiency became paramount values

The Third Period

The most important criteria here are: advanced technology (networked computers, mobile phones), information-driven economy and everyday life, digitized society, international extension of economic activities, globalization, expansion of the service sector, increased significance of knowledge and knowledge media, the rise of the knowledge worker, the increased role of scientific research in economic development, virtual factories, virtual workplaces, the increasing role of services, of information and of theoretical knowledge. The changes are so far-reaching that the industrial society was also interpreted as the 'service society', 'information society', and 'knowledge society'. The designation "post-industrialism" (Bell, 1976; Stehr, 1994) is often used, but is misleading, because "in the face of the imperialistically extended 'regime' of capitalistic market economy and of neo-liberal concepts of order, the development will rather go to 'super-industrialism'" (Spinner, 1998, p. 318).

Continuous Relevance

Why have these three stages in the development of industrialization been sketched in this way? Because it is necessary to show that this process has passed through several periods and has not yet come to an end. Rather, it is being continued with more energy and success than ever before. This means that the theory that distance education is the most industrialized form of education must also be described and justified in different ways. It is also important to suggest again that industrialization not only had technical and economical features, but also cultural, social, and societal aspects, which caused and facilitated the creation, development and final rise of distance education. In this way it can be shown and emphasized that distance education could never have developed in pre-industrial societies. It is telling that the establishment of the first railways and of the postal system and the first experiments in distance education took place at the same time.

This new form of teaching and learning was also based on ideologies of industrialization, on the typical way of rational planning and working, on the idea of mechanizing and mediating working processes, and on the affirmative belief in technological and economic progress. Distance education was not created by pedagogues, but by entrepreneurs, who embraced this ideology and applied the new and successful methods of the industrial production of goods to education in order to make profit.

The argument is often heard that industrialization has come to an end and is now being substituted by the dominance of information and communication technologies. Therefore, a theory that suggests that distance education is "the most industrialized form of education" may no longer be valid. This does not comply with the facts. Basic principles of industrialization are being and will continue to be applied, especially in the area of consumption and in every day activities (Spinner, 1998, p. 312). It will also determine the activities of major international corporations. Industrialization is boosting because it is now information-driven. In large parts of the world, industrialization, including its

social, ecological and cultural consequences, will still be on future agendas. Finally, it is to be expected that new and different patterns of industrialization will develop in other parts of the world (Schmidt, 1998, p. 312). We must see that the era of digitization in the present information society is not bringing about the end of industrialization, but its escalation and reinforcement. Industrialization continues to permeate more and more areas of our life. Cultural critics envisage that this will end in the catastrophe of mankind (Anders, 1980; Virilio, 1998).

Genesis of the Theory

Today, educational experts, especially the 'digital natives' and 'digital immigrants' among them, cannot possibly imagine what the status of distance education was in the 1960s. Although it had been already practiced for more than a hundred years it was only a marginal affair. It was made use of by a tiny minority of persons who somehow did not fit into the main stream of education. What was most peculiar: distance education was not only ignored by the public, but also entirely disregarded by educational experts. Although many forms of teaching and learning had been carefully analyzed since the days of Comenius, Pestalozzi and Dewey, although generations of pedagogues had focused their attention on all kinds of learning, distance education was not seen, let alone described and analyzed. Pedagogical compendia were silent with regard to the existence of distance education. There was no research devoted to this form of education and there was no awareness of its specific features, its potential for future developments, or analyzed how far it differs from embodied instruction in the classroom or lecture hall.

In 1963 I was a member of the Education Centre of Berlin, which did not teach at a distance and did not deal with distance education at all. However, as governments at that time were interested in extending education to more people, the Minister of Education of the City of Berlin commissioned me to write an expert's report on correspondence education. I was not really the right man for this task, as I was not only an absolute novice, but also an ardent advocator of face-to-face group instruction. Hence I intended to write a critical declining report. However, after five weeks of intensive study I realized that distance education was used to a considerable extent in Canada, USA, and Australia as well as in the Soviet Union, its satellite states and in China. What was even more important: I found that distance education had several advantages that are missing in face-to-face instruction in school classes and lecture halls. I therefore asked the Berlin Minister of Education for more time and wrote the first academic book on this particular subject.

While writing this book I pondered on what distance education was, what it meant, what its characteristic features were, and what its essence and real potential were. This was necessary, as the people I met were of the opinion that face-to-face and distance education are practically and fundamentally the same, the only difference being 'distance' and the 'medium' used. In order to deal with this subject more systematically, I interpreted distance education in terms of a then current pedagogical theory, but failed completely. This theoretical exercise told me that distance education is "a reduced and denaturalized form of face-to-face education". This was, of course, dissatisfying. But I gained the insight that the academic terminology of theories of face-to-face instruction could not be used in this particular case, that distance education was something special, with its own possibilities and circumstances. The question arose of which terminology could be used in order to describe the inner structure of this form of education, so far still unknown with most educational academics.

In a second approach I de-compensated 'indirect teaching and learning', which is included in traditional education, and identified eight elements: written instruction, printed instruction, instruction by using learning and study aids, audiovisual teaching, broadcasted instruction, programmed learning, computer-aided instruction, and independent study. A closer inspection brought even twenty-seven form elements that had a certain affinity to distance education. Distance education could be constructed by using just one of these elements or by integrating many of them. The result of this analysis did not answer the question that was put at all, but demonstrated that many elements of conventional indirect teaching harmonize with distance teaching. After all, seen in this way distance education is not as terribly alien to the mainstream of education as most people think.

A Comparative Analysis

A third approach threw more light on the questions under scrutiny. I examined the prerequisites and procedures of teaching and learning at a distance and could see very clearly that distance education is a process that consists of a number of distinct events separated from each other, but still linked up and related. Events that occur spontaneously and combined at certain moments in the classroom are separated here by time and space and arranged in a sequence. We are in a situation that differs from face-to-face learning in a most radical way. It calls for a number of activities that are absolutely necessary in order to be able to teach, but are alien to traditional teaching and learning.

The following steps must be taken: intensive and long range planning, instructional design, development of writing of self-instructional teaching material, production of this material, recruitment of the students envisaged, distribution of the material, shipping it, corresponding with the learners, correcting and marking assignments, and administrating, including investing the necessary funds. I learnt that these activities are not only separated from each other, but are quite often performed by different persons as well. I recognized the principle of '*division of labor'*. Furthermore, I saw that these ten activities must take place one after the other and hence be '*regularized'*. The whole process is *rationalized* in order to aim at a great output with a limited input. And it can be realized only by using *technology* in the form of technical media and technical devices. This means that I had used four terms borrowed from theories of industrialization

Imagining this sequence of activities, I could not help but associate it with the *assembly line*, which revolutionized work in factories. From here it is only a short step to the idea that there are structural similarities between the industrial production of goods and teaching and learning at a distance.

This idea was so attractive that I engaged myself in a close analysis, in which processes of distance education and of the production of goods were compared. The question was: have these processes even more structural elements in common than those already mentioned? To the surprise of all my colleagues the finding of the study was that there are more than twenty of such congruencies overall.

> Rationalization, division of labor, assembly line, preparatory work, specialization, mechanization, automation and digitization, new forms of energy, planning, organization, controlling, formalization, standardization, change of functions, spatiotemporal separation, objectivation, capital intensive techniques, concentration, centralization, mass production, mass distribution

Findings

The following table describes these criteria and explains how far they can be identified in both distance education and in the industrial production process.

Criteria	**Description**	**Identified in distance education**
Rationalization	The "entire production line, from raw material to end product, is carefully analyzed to allow each single work process to be planned so as to make the most effective contribution possible towards clearly formulated business tasks" (Buckingham, 1963, p. 24).	The success of distance education is based on the efficiency of a 'production line' that consists of a number of specialized contributors: authors, course developers, administrators, distributors, correctors, correspondents, evaluators.
Division of labor	"With an extensive division of labour more people are able to carry out the work and wages can be lowered" (König, 1958)	Teaching is divided into several functions that are assigned to different persons: authors, instructional designers, media specialists, correctors, tutors, counselors, moderators, evaluators etc. This means that the teaching is detached from the original teacher or lecturer, disembodied and depersonalized.
Assembly line	Assembly-line work is characterized by the fact that the worker remains at his place whilst the work pieces travel past him (Buckingham, 1963, p. 20)	The production line resembles the Fordist assembly line as pieces of the course material are passed from one station to the next from their creation until dispatch.
Preparatory work	In a production situation economy, the quality and speed of the work processes depend on careful and efficient preparation that is carried out in special departments. Their task is to relate workers, machines and material to each other and to solve developmental and constructional problems. Scientific methods are used in order to analyze work processes systematically. They include empirical activity and time studies.	Distance education can be successful only when the production of printed or otherwise mediated course-material has been carefully prepared. A preparatory phase is necessary here as well. Educational policy and pedagogical goals are decided upon; capital investments must be planned and made. The possible demand for the teaching and learning must be estimated and explored, experts are to be invited, course teams established, the impact and the benefits of the envisioned teaching must be calculated, timetables agreed upon, production lines established. Scientific methods are instructional design and empirical surveys.

Specialization	Work processes are no longer performed by generalists, such as craftsmen, but by cooperation of specialists responsible for one part of the process only.	Persons involved in developing, controlling and evaluating distance education are no longer generalists as teachers in the classroom or faculty in the lecture hall, but trained specialist.
Mechanization, automation; virtualization	Manual labor is mainly substituted by using technical devices and machines, especially the steam engine, combustion engines, work machines, computers, networked computers	Distance education is based on the use of quite a number of technical devices: typewriter, paper, duplicating machines, printing press, post office, railway, cars, telephone, computer, and, since 1995, also the Internet and the Web. These technical devices are absolutely necessary, as neither teaching nor learning can take place without them. This is in contrast to oral instruction that, in its original form, can be performed without any of these technical devices and media.
New forms of energy	The steam engine was a fundamental innovation of the first industrial revolution whereas electricity is central in the second, and networked computers for third industrial revolution.	Whereas traditional teaching and learning is based on bodily energy distance education is mainly dependent on the availability of steam engines, petrol, and electricity.
Planning	Planning is no longer an individual and arbitrary activity, but must be performed in a systematic way by experts in special departments.	Teachers in the classroom have their individual and personal ways of planning their instruction over a year and from day to day. In distance education this activity must be done in a systematic and long-ranging way because too many persons may be involved in teaching and learning, major investments must be made, and often extremely large numbers of students are envisaged and have to be dealt with. Planning specialists are often employed to tackle this task.
Controlling	Controlling departments aim at comparing the results of the production to the original production goals. The data obtained enable management to make important decisions about the way production is run. These decisions may lead to restructuring the process.	The distance teaching institution has a section that analyzes continuously how a course is accepted, how the students learn and how the organization reacts to failures. Empirical methods are used. This section has the power to make important decisions about the way the course is altered, restructured or discontinued

Formalization	All phases of the production, most activities and interactions are unified and exactly predetermined according to fixed rules. This is a precondition of the cooperation of all persons involved in the production process and of the use of machines.	Whereas in face-to-face situations teachers and learners are free to change their learning spontaneously, this is not possible in distance education. Here the process of learning is largely unified and formalized. The teaching material must be designed in a defined format, which is necessary as it is to be multiplied ad libitum. It is presented in the observance of calculated rules. The presentation of teaching material, and even some parts of the pedagogical communication, takes place in a repeatable form.
Standardization	Products are limited to a number of types only in order to make them more suitable for their purpose and cheaper and easier to improve or replace.	Distance teaching institutions are forced to adopt a greater degree of standardization than is required in the traditional classroom. This is necessary because machines are used for producing, multiplying and distributing learning units, set books and magazines. It is also advantageous for the learners, because they get used to these formats, which facilitate learning. Students do not become irritated or confused by unusual learning material. As to the learning itself, even the goals can be objectified. Teachers in a classroom will adapt the goals of instruction to the students in front of them. In distance education, course developers and course teams will adapt the goals to the objective requirements of a great number of the enrolled students.
Change of functions	Rationalization, division of labor, and the use of machines have changed the functions of workers considerably. Industrialization led to a marked functional differentiation. A craftsman is a generalist. He plans a piece of work, acquires material, carries out the work and sells the product. In an industrial production process many specific functions are allocated to different persons. This means that the individual worker	To be part of a technological and organized process changes the function of the persons involved. Division of labor leads to the separation of functions that are traditionally united in one person, the teacher or lecturer. In distance education these functions are assigned to several specialists: planners, content providers, instructional designers, media specialists, writers, lecturers, printers, tutors, mentors,

	loses most of his original functions and becomes alienated from them.	counselors, moderators. The function of the learners changes as well. They become responsible for their own learning, they are inspired and enabled to learn independently.
Time-space separation	In pre-industrial living conditions the craftsman and the customer knew each other as they lived at the same location and dealt with each other at about the same period of time. In industrial production, however, the customer does not know the producer at all nor does the producer know the customer. They are separated by time and location, often to a considerable extent.	Teachers and taught are separated with regard to time and space.
Objectifying	Owing to the use of machines and as a consequence of specialization and differentiation, the production of goods loses its subjective character. Working becomes objectified. The production process can be repeated ad libitum and can often even be run without workers if it is automated. This objectifying is a precondition for constant improvement of the product and of mass production.	Teaching and learning in distance education is largely objectified, especially when it is programmed and automated. This involves a depersonalization of teachers. However, objectification is a necessary precondition for quite a number of advantages: teaching becomes a product that can continuously and empirically be improved, it can be multiplied by machines, it can be mass produced and adapted to any number of students, it can be sold. Furthermore: in the same way that industrial products are cheaper than the products of artisans, objectified teaching can be cheaper than face-to-face instruction, as it can reap the benefits of economies of scale.
Capital-intensive techniques	Generally, labor-intensive activities are replaced by capital-intensive technologies with tendencies towards automation. This leads to a reduction of costs and lowers the price of the product.	The possibility of mass production enables institutions of distance education to enroll large and even enormous numbers of students. In the same way in which goods of industrialized mass production are cheaper than products made by craftsmen, so that more people can afford them, industrialized education can be cheaper so that more students can be catered for than is possible in traditional educational institutions.

Mass production	Standardized products are mass-produced. Mass production is capital and energy intensive and enables the acceleration of production. Capital increases, expenditure per unit decreases.	The carefully and expensively developed high quality distance teaching course is the standardized object that can be easily mass produced. This enables distance teaching institutions to cater for large and even enormous numbers of students. The expenditure per course unit de-creases as well. The increased income makes it possible to employ better faculty and to offer better support.
Mass distribution	Factories not only mass produce, but also mass distribute physical goods. They run marketing sales departments that ship the goods to customers wherever they may live.	Distance teaching institutions establish dispatch offices that distribute and post the self-instructional learning material to thousands and thousands of students living everywhere in the country or abroad.
Concentration	Concentration is the inevitable result of rationalization and specialization in advanced industrial societies. It causes the agglomeration of manpower, capital, revenue and the trend towards monopolized markets. Concentration of power makes for greater profitability.	Distance teaching institutions, especially open universities, often become the biggest in the country. This leads to a concentration of funds, experts, teachers and technical equipment. The concentration of financial investment and of highly skilled manpower is a prerequisite for high quality teaching. When open universities produce more graduates than conventional universities they have also the tendency to monopolize higher education. Also administrative concentration is necessary.
Centralization	The integration of technical, economical, and political forces into one central unit due to new technologies of production, information and communication. Industrialized working processes are profitable only when a company has acquired size. Investments in machinery, organization, distribution, and marketing must pay off. It proves to be uneconomical to decentralize production as the many specialists must be given a chance to cooperate both in production and in sales and distribution.	Considerable sums of money must be invested in order to establish a viable distance teaching institution – for the preparation, development and testing of high quality self-teaching material and for evaluations. In order to be successful, the close cooperation of many experts and specialists must be organized. This is facilitated by their concentration at one location.

Finding so many concordances gave me a shock of recognition. At first I did not dare to contend in my reports that distance education differs from face-to-face education because of its 'industrialized' structure. For educational experts the juxtaposing of 'education' and 'industrialization' was a most egregious violation of traditional pedagogical thinking. They deplored the introduction of industrial terms into the traditional field of education. Further opposition came from those academics that were affected by ideas of the 1968 students' revolution and were opposed to the disruption of social face-to-face interactions by technology. In a situation like this, I suggested that the industrial process serves as a metaphor for the interpretation of distance education, which would mean that distance education is organized *similarly* to industrialization. But gradually I became not only convinced that "distance education is the most industrialized form of education" but also determined to maintain this.

Of course, teaching and learning at schools and universities are also industrialized, as are most areas of our life world. But this is only true to a certain degree, because such important elements as the organization of the assembly line and the separation of time and space are missing. The comparison tempted me even to assume that the situation of teachers and taught in classroom, seminars and lecture halls is still akin to that of pre-industrial craftsmanship.

Seven Dimensions of the Theory

When dealing with 'industrialization' the attention of most practitioners and experts is focused on the use of technical equipment, in particular the assembly line (Fordism), and on the production and distribution of physical goods. With regard to distance education this means that the concept of its industrialization would be therefore limited to the use of the printing press, multimedia, networked computers and the production and distribution of learning material. This, however, is only one aspect of industrialized education. The inherent congruence of distance education with industrialization is multifaceted. There are many more reasons why distance education is a typical form of industrialized education, and even a product of industrialization itself. The extent to which other aspects of industrialization have influenced distance education can be demonstrated by referring to seven additional dimensions of this theory. The fact that distance education can be called a product of industrialization in the first place will be described in detail by reflecting on the following seven dimensions.

The *historical* dimension arouses our attention. Having analyzed distance education from the point of view of the history of teaching and learning, we cannot but consider distance education as a structural forerunner of the comprehensive use of technical media for learning in the 20th and 21st centuries. The *cultural* dimension refers to the fact that industrialization created new basic attitudes towards work and a climate of public opinion that induced and encouraged individuals to begin learning at a distance. The *anthropological* dimension makes us aware of the phenomenon that industrialization changed the nature of man, separating him from agrarian man. The new types of the industrial man and the information man have emerged. Only this rigid change of mentalities and social circumstances enabled individuals to be ready for venturing into entirely new forms of teaching and learning. The *sociological* dimension clarifies that there were fundamental changes of attitudes and behaviors caused by the transformation from agrarian to industrialized societies. The *philosophical* dimension deals with the

meaning of the radical change of knowledge that is taught and acquired in distance education in virtual spaces and in post-modernity. The *pedagogical* dimension makes us aware of the emergence of a radical new model of learning and teaching, which differs from traditional education in significant structural and procedural ways and often becomes manifest in mega- and hyper-universities. It is modern in the sense that it is fully mediated from the very beginning; it is progressive, because it uses the technical media available in each period to a large extent, and it is fully industrialized. The *economical* dimension deals with the benefit of scale and the unique possibilities of mass education.

These seven dimensions of the theory show that distance education is interwoven with the process of industrialization in many more ways than most people think. It was not only created when the necessary industrial pre-requisites were available (railways, post offices, roads etc.), but became also a feature of the prevailing culture, especially the new ways of purposeful goal-oriented rational planning and the optimistic belief in progress and perpetual development.

Historical Dimension

For a long time, public opinion considered distance education as a strange and bizarre phenomenon, which was very special and used in specific cases only, a stepchild of education, taking place in the pedagogical underground. This section will show that distance education as industrialized teaching and learning was by no means far beyond the tradition of education. Rather, it will be shown that, because of its industrialization, distance education was a significant element in the whole development of teaching and learning, that it proved to be more progressive than traditional scenarios of teaching and learning, and that its creation was the starting point of mediated education that developed later so fully and is being implemented so widely in our time.

By way of an excursion it can be shown that traditional teaching and learning had to overcome similar difficulties to those that people have to face in distance education. It is easy to see that industrialization brought a decisive break with oral pedagogical communication. This break, however, is neither new nor extraordinary, because as it was already experienced in antiquity and even further back in archaic times, when sacred priests solemnly talked to selected disciples whose only task it was to listen, to remember their words and to repeat them. It is astounding how this archetypal pattern could last up to our time. This oral transmission of knowledge was a natural and live action. Teaching had not yet been objectified. However, after some time this natural communication was interrupted by material artefacts, man-made objects, which were used as (technical) media: papyrus, paper, writing utensils. As soon as parts of the teaching were written by a teacher and read by a student the natural communicative situation became an artificial one. Teaching was objectified, and became an object. This event was the root of distance education.

Teaching by writing – and not by talking – was already a serious breach of tradition even then. Plato was definitely opposed to this remarkable cultural change. In Phaidros he put his objections into Socrates' mouth. According to him, writing was inhuman as thoughts were presented externally and separated from the act of thinking. According to him, written words were a thing, a manufactured matter. It destroys memory and presents only the outside appearance of something that is important only because of a person's interior mental energy (cf. Ong, 1982, chapter 4).

Today we know that the use of writing was a most remarkable event in the history of teaching and learning. The phonetic alphabet was a "unique technology" (McLuhan, 1964, p. 83). According to McLuhan, writing changed the situation in several ways:

- It separated teacher and taught by time and 'distance'.
- It intensified the visual functions and diminished the role of the other senses of sound, touch and taste.
- It individualized the learner.
- It changed the way in which persons think and organize knowledge, because they are compelled to adopt and practice linearity.
- It increased the number of possible readers.
- It spelled the end of the priestly monopoly of knowledge and power, because everyone could have access.

It is worthwhile remembering these consequences, as they help to explain and to understand far greater and more serious structural changes caused by the industrialization of teaching and learning more than two thousand years later. Objections to this new breach of tradition were very similar.

Stages of Emancipation

Distance education is the last step in a long process of emancipating learners from teachers and institutions. The oldest archaic form of education can be characterized by the following six aspects:

- Only a few people of the ruling religious or political class participated.
- Originally, imparting knowledge and skills was closely connected to the performance of priestly functions.
- Instruction was permeated by special forms of domination of the teacher, who exercised power over the students.
- Instruction took place in small groups, often in the teacher's family.
- No technical media were used.
- Instruction was determined by an individual teacher, fixed places and fixed times.

In other words, education was elitist, sacral, hierarchic, group related, personal, and fixed with regard to situations.

When this model is compared with open and distance education today, the opposite aspects can be diagnosed. Obviously, the structural change over a period of several thousand years can be described by the following extreme parameters: elitist instruction became egalitarian, sacral contents and rituals became profane, the dominance of the teacher was substituted by self-regulation of the students, small intimate learning groups became larger and less intimate groups or even anonymous masses of students in mega-universities, personal interaction between teacher and taught became mechanized and automated by using a wealth of technical media, special teachers, places and times were removed.

This means that distance learners have been finally emancipated from six restrictions and exterior influences and have the convenient, but also demanding, opportunity of

becoming autonomous and self-regulated. The same cannot be said about traditional education in classrooms and the lecture hall. Open and distance education cannot be placed beside face-to-face teaching , but rather belongs to the hitherto final stage of the development of teaching and learning, because it has overtaken face-to-face teaching on the six lines of development, in part even considerably and distinctly. It has to be admitted that this is the final and intensified result of its industrialization. Digitized education continues this process of emancipation, as it provides many new possibilities for students to develop new independent activities as well as to enter new social and cultural spaces.

Cultural Dimension

Distance education can also be assigned to the period of industrialization because of its specific socio-cultural and intellectual climate. In this particular period, persons were disposed to adopt progressive attitudes and to strive for occupational advancement and upward mobility. The achievement principle, unknown before, guided and regulated persons, and not only in their occupational activities. It permeated a general atmosphere that was conducive to persons who decided to study at a distance. Distance learners profited from it.

This new atmosphere was caused by far-reaching transformations. According to David Riesman (1958), people in pre-industrial societies were "tradition-directed"; that is, their behavior was regulated and forced upon them down to the last detail by customs, habits, ceremonies, rites and etiquette. When society became industrialized, however, it developed new mechanisms of maintaining conformity. In childhood and adolescence people internalized new principles of the desired behavior. In this way, types of persons emerged who succeeded in determining their lives without strict direction by tradition. They became "inner-directed" persons. Only in industrialized societies they had the option and the ability of behaving in this way. New goals of life emerged, conditions of life changed radically, more and more people aimed at realizing career prospects. This was only possible by taking the initiative and by disentangling from tradition-directedness. Obviously, distance education would have been unthinkable in a tradition-directed society.

But there is more to it. People living in urban environments have learnt to deal with unknown persons who perform a single function only. They become accustomed to permanently receiving coded information, and they are able to deal with persons exclusively by means of technical media. They are familiar with new basic types of man: conscious man, emancipated man, homo faber, technically competent man and mobile man. Extreme types are "the radically organizing and manipulating man" and on the other hand the "radically organized and manipulated" man (Behrendt, 1962, p. 57). Workers, skilled workers, clerical workers, businessmen and entrepreneurs and, later, managers appear. All of them are part of the social environment in which prospective distance learners become ambitious, goal-oriented and motivated to start learning in this particular way. These changes to the basic types of man are profound ones. They might induce us to consider that a transformation of mankind has taken place. Distance students are not only influenced by this new way of living and working in an industrialized society, but they represent themselves as a new type of man. It can be postulated that only human beings who can be classed in basic types in industrial society can be able and are ready for teaching and learning at a distance.

If we focus on the period of neo- and late industrialism, it can be seen that the general atmosphere has changed considerably again. The major distance teaching institutions continued to organize their operation in an industrialized way. However, because of the influence of postmodern ideas and attitudes, students assumed new kinds of behavior. According to the American psychologists Wood and Zurcher (1988, p. 125), who conducted a comprehensive empirical study of the 'postmodern self', persons in postmodernity reject delayed gratification, but want it immediately; are not ready to endure distress, but develop rather a capacity for fun; are not so much interested in materialistic objectives, but rather in fulfillment of human values. If these findings can be generalized, it must be admitted that the originally very strong motivation of the traditional distance learner has obviously been diluted.

What can be said about cultural impacts on today's online learners? This new form of distance education was not planned by traditional pedagogues, let alone constructed and introduced. It is not based on conventional pedagogical traditions, but was imposed by those engineers who developed information and communication technologies. However, the proliferation of this form of learning cannot be explained solely by this unexpected and yet far-reaching technological impact. Online learning would not have been so easily adopted without the thorough digitization of most areas of society. This societal influence is so strong that it has even been possible for protagonists of online learning to disturb educational practices that up to now have been highly valued. Online learning is developing in a late industrial society in which the Net generation (Tapscott, 1997) has grown up with computers and the Internet ("Born Digital", Palfrey & Gasser, 2008), in a society in which communication by email has become customary and has even become a prerequisite for functioning in modern society, in which most forms of producing, managing, selling and entertaining are already digitized; in a society which is entirely in the grip of scientifically developed commercialism. This degree of technological change of society has never existed before. The networked computer is no longer a tool for achieving given or self set goals, but for most people it provides a new way of experiencing the world, a new way of being human. It is a unique cultural phenomenon.

The digitized world seems to be attractive to young people and prospective learners. They know that being a part of this technologically advanced society means being efficient in networked computing. Echoing the psychologist Wallace (1999), Conrad diagnosed a departure from postmodern attitudes by describing a new change in students' behavior. Some of them may be technology freaks, but most of them are excited and fascinated by a wealth of new possibilities of information searching, knowledge construction and interactive communication. Their motives are still the same as traditional distance learners: they are goal-driven and "infused with purpose, commitment, and responsibility" (Conrad, 2006, p. 27).

Anthropological Aspects

The problem arises whether the types 'distance teacher' and 'distance learner' are not only products of industrialization, but at the same time representations of a new phase in human development as well. They appear to be surrounded by technical media in such a way that they not only use them, but also depend on them. Watching these persons over a longer period we cannot help assuming that technical equipment and man already exist in a symbiotic relationship. If people continue to remain in this situation over years, the question must arise whether they are still the same people as those who habitually talk and listen to each other in face-to-face situations.

On the basis of Gehlen's theory that man uses media and technology in order to compensate for his biological deficiencies, for his lack of special organs and instincts to adapt to a particular species-specific environment, and for his 'morphological helplessness', distance teachers and distance learners could be interpreted as persons who substitute, intensify and release pressure on their organs. This explanation is convincing. Several of our organs – the voice, eyes, ears, forefingers, and memory – are not strong enough to penetrate distances and reach each other. In a more general sense, it could be said that in the era of industrialization man is forced to develop and use a complex configuration of media in order to become able to cope with new educational tasks in the advanced industrial, knowledge and communication society. His natural organs alone would not only be insufficient, but could not help at all.

These considerations lead to the insight that man has constructed complex technological systems in order to be able to react to new fundamental changes in society in the period of industrialization and digitization. This can be interpreted in an anthropological way by referring to the fact that "technology and being human have the same origin" and "technical activity belongs virtually to the distinguishing marks of man" (Gehlen, 1958, p. 100). This means that the very consistent and differentiated application in industrialized education could be understood as 'human self-heightening', which has enabled man to provide instruction and academic teaching to persons who live in isolation, are handicapped, or belong to extremely large groups of students in mega and hyper open universities. This achievement is truly epoch-making.

This assertion is supported by Heinrich Roth in his Pedagogical Anthropology. He maintains that man is "world open" and "open for the future" in the sense that he is not tied to his environment, not adjusted to adaptation, but rather to change. He "is the only being who is able to react to changes of his environment and who is best in experimenting with it" (Roth, 1966, p. 125). Industrialized education must be seen as the legitimate result of such a disposition. In so far it can be understood as an epoch-making thrust in the development of man.

On the other hand it should also be noted that substituting human organs by educational media will also have negative consequences, in the sense that it reduces the degree of involvement that is especially significant in teaching and learning. Advantages are necessarily connected to critical disadvantages. The more technical media are used the more they "diminish man's intuitive awareness of collective consciousness" (McLuhan, 1964, p. 79). Media objectify man's inwardness and increase his detachment. This, however, alienates him from reality.

Sociological Dimension

As sociologists explore and analyze social systems, including those on the net, and have dealt with structural changes caused by industrialization, the question arises whether they could contribute categories for further interpretations of industrialized education and prove once more that distance education is the most industrialized education.

1. Max Weber and Ferdinand Tönnies described the changes that took place under the dominance of purposeful thinking and rational action and the scientific-technical permeation of traditional social subsystems. Jürgen Habermas (1968, p. 60) summarized their thinking by remarking that they characterized this change by using pairs of concepts, for instance, gemeinschaft and gesellschaft, organic and mechanical

solidarity, primary and secondary relations, and traditional and bureaucratic dominion. These criteria could be easily applied to education in close proximity to each other as well as to education at a distance.

Proximity (face-to-face instruction)	**Distance (mediated instruction)**
gemeinschaft	gesellschaft
organic solidarity	mechanical solidarity
primary relations	secondary relations
traditional dominion	bureaucratic dominion

Table 1: Pairs of concepts characterizing the transition from traditional social subsystems to modern ones

This table suggests that oral face-to-face instruction is a traditional social sub-system and that distance education a 'modern' industrialized social subsystem and has a lead over face-to-face instruction.

2. Habermas (1968, p. 61) refers also to Talcott Parsons, who indicated that possible alternatives of value orientation can be used in order to describe changes from traditional to modern society. For the traditional society he used the terms affectivity, particularism, ascription, and diffuseness. For modern society he used affective neutrality, universalism, achievement, and specifity. It is interesting to see that distance education can be roughly characterized by the second set of terms. Distance education proves to be industrialized, with regard to these criteria as well.

Traditional society (face-to-face education)	**Modern society (distance education)**
affectivity	affective neutrality
particularism	universalism
ascription	achievement
diffuseness	specificity

Table 2: Alternative value orientations in traditional and modern societies.

Applying these value orientations to face-to-face group education as well as to distance education it becomes clear that the first one corresponds to traditional and the second to modern value orientations. In fact, because of its mediation through media distance education is affectively neutral, it must try to deal with issues that are not important to individuals or small groups at a given moment, but to great, and indeed enormous, numbers of students and that can be repeated over several years. The social position is not ascribed individually, but acquired by achievement only, and printed or otherwise fixed learning material cannot be improvised and tentative, but must be specified to the last detail in order to support the learner. Again, it may be said that face-to-face teaching is pre-industrial and distance education industrial.

3. Habermas (1981, p. 192) describes contemporary industrialized society in a two-dimensional way. He distinguishes sharply between "system" and "lifeworld" (from the German term 'Lebenswelt'). 'System' relates to the economy and to the political and administrative complex. It reproduces itself by influencing other systems,

especially 'lifeworld', by using its specific steering media money and power. 'Lifeworld' is that social area in which persons come to an understanding about norms, values and communicative practice. In the course of social development a partial changeover has taken place from communicative social integration of the lifeworld to functional system integration. At present, the systemic functions are reshaping lifeworld in a hypertrophic way. Lifeworld is becoming more and more objectified. System 'colonizes' lifeworld, strains its capacity and even explodes it. However, an indispensible difference between the two systems remains. System-integrative achievements can never replace social integration.

Distance education can be interpreted with the help of these two sociological criteria as well. Objectified teaching and learning can be associated with 'system' whereas live learning groups represent social integration and 'lifeworld'. In the framework of this theory it might be said that systemic integration has permeated many areas of social integration, including education. In this way traditional education was transformed into distance education. Accordingly we would have to say: objectified teaching and learning could never substitute social-integrative teaching and learning.

Educational Dimension

This chapter will make a case that distance and open learning has been created and shaped under strong influences of industrialization. The use of advanced transport technology, administrative techniques, specialization, division of labor, and economies of scale afforded a new and unique form of education. The significance of this new form of teaching and learning is underrated by most educationalists. A form of education in which teacher and taught are separated by location and time is considered unusual by them. Quite often, however, they do not see any substantial advantages in this particular form of teaching and learning that are missing in conventional education. Industrialization enabled educationists to create new advanced forms of education in order to meet new and significant learning needs caused by industrialization. Some of these are:

- *Facilitating autonomous learning.* Students are obliged to become active, assume responsibility and organize their learning with regard to time and location. In this situation they have many opportunities to become autonomous and self-regulated with regards to goals, methods and media. Quite often, presentational teaching and receptive learning are substituted by activated learning or self-learning.
- *Reaching adult students.* Great numbers of adults can be included into the student body. In this way adults are enabled to study at their working place or at home in order to qualify themselves further. Their learning needs are aroused by the constant developments and changes in industrialized production and distribution methods.
- *Achieving new educational goals.* In many countries, governments are bound to extend education in order to produce well-trained experts for improving their workforce. In other countries, governments are forced to widen educational opportunities and to alleviate social demand, others find it appropriate to offer a 'second chance' to those persons who missed the first chance for a number of reasons, or they wish to improve their country's cultural and social standards. However, these reformative goals cannot be reached by already overcrowded traditional universities, because their capacity remains limited. Even the foundation of additional campus-based universities cannot

help much. In an emergency situation like this, industrialized distance education helps to solve these problems in a substantial way.

- *Increasing access.* Many universities have established distance teaching sections in order to increase the number of enrolled students markedly. Governments have established single mode distance teaching universities. The most striking examples are the more than 80 open universities all over the world, which are often the biggest universities in the country. Twenty of them are mega-universities (Daniel, 1996: Daniel, Mackintosh & Diehl, 2007, p. 814), each catering for more than one hundred thousand students, and four of them are "hyper-universities" (Daniel, 2007), each teaching over one million students. Again, industrialized education is able to cope with educational demands were caused by industrialization itself.
- *Consolidating continuing education.* In most countries, continuing education has never been an original objective of universities. This is the reason why faculties have been reluctant to take over these new tasks, which became necessary because of far-reaching changes in further developed industrialized societies. Academics may also have been afraid of altering their identity as scholars if they engaged in these new tasks. Capacity problems have been another reason. The main obstacle, however, was that adults cannot attend campus-based lectures and seminars because of their employment and family obligations. Consequently, innovative projects in continuing education were often dealt with as side issues only. Here we are confronted with an emergence situation without a real alternative. Industrialized education, however, could easily overcome these difficulties. This form of education enables universities to reach adults wherever they live and to enroll, teach and train them at a distance. New forms of continuing education could be substantially established. In addition to that, the much postulated lifelong learning could be developed as well.
- *Establishing new types of university.* The most radical innovation caused by the use of advanced industrialized approaches, technical media and new methods of teaching and learning is the creation of new types of university: single mode universities, dual mode universities, virtual universities, corporate virtual universities, online universities, partnerships of universities with industrial corporations, online universities established by consortia.
- *Alleviating poverty*. Article 26 of the Universal Declaration of Human Rights in 1948 requires that everyone "has the right to education. (…) Technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit" (see UNO, 2008). It is not necessary to note that this demand is not satisfied at all, as this fact is obvious. "There is still a yawning gap between this 60-year-old ambition and current reality for most of the world" (Daniel, 2008a). There "are four billion poor people in the world who aspire to better lives" (Prahalad, 2006). Distance education has already contributed to filling this gap, especially through the worldwide activities of the Commonwealth of Learning.
- *Learning online.* The impact of digitalization on teaching and learning is much stronger than was the case in earlier periods of industrialized education. Academic pedagogues are impressed by the great changes caused by this new way of communication. They see that new cultural and social spaces can be generated with the help of information

technology, especially Web 2. Such new spaces not only penetrate the everyday culture of persons in all age groups, but also have a share in changing it. Significant cultural contexts are transformed that will result in changes of ethnicity, self-construction and gender (Grell, Marotzki & Schelhowe, 2009, p. 271).

- *Qualifying the meaning of distance education.* The proliferation of online learning during the last fifteen years has brought a clearer definition of distance education. More students than ever before are engaged in distance education – for different reasons. According to Ted Nunan (2008, p. 855), the traditional mission of distance education had been to provide access for all learners who were in some way handicapped, e.g., by geographical, economical, personal or political disadvantages. This image of distance learners is no longer adequate, as there are many of them who are not handicapped at all but like the 'convenience' and 'flexibility' of this form of leaning. This leads him to distinguish between two models of distance education, which he calls (1) distance education as "access and equity rights-based, welfare model" and (2) distance education as "convenience citizen consumer model".

Economic Dimension

Owing to its industrialized structure, distance education has had a close affinity with business and commercialization right from the beginning.

Economic considerations were the main motives of the founders of the first correspondence schools, who were private entrepreneurs and by no means state educationists. The same can be said about the proprietors of most commercial correspondence schools and colleges of the nineteenth and twentieth century; about many universities that hoped to obtain additional income by exporting their teaching by mail and online; about many governments who established open universities and extended them into mega- und hyper-universities (Daniel, 2007) in order to provide access to many more students at lower costs; and also about those major international companies that establish corporate universities in order to raise the qualification of their employees.

The reason for this dominance of economic aspects is the very application of industrial approaches and industrial technology to the teaching and learning, which implied the chance to reap the benefits of scale. A typical method of new factories in the nineteenth century was mass production of goods combined with mass distribution over a geographical area. The profit gained by this method was incomparably higher than the income of an artisan. The quite unusual, unorthodox, but for businessmen convincing idea was to apply the same industrial methods and technology to education. It could be objectified with the help of media and then mass-produced and mass-distributed. The more students enrolled the higher the profit – access was not limited by the size of classrooms in brick and mortar buildings. In this way, distance education departed from teaching and learning in classrooms in schools and universities, which remained more or less on a level comparable to cottage industry.

The globalization of communication led to the emergence of a global educational market that is dominated by commercial competition.

As distance education is not bound to places or times it lends itself more easily to transnational systems than local schools or on-campus universities. Their peculiar industrialized structure enables distance learning institutions to export education on a large

scale through international cooperation and the establishment of world-wide instructional systems (e.g. Penn State University's World Campus). This led to the establishment of an international market place for teaching and learning materials, software and hardware. During the last decades the original financial motive for running distance education institutions has been intensified and these have proliferated at an incredible pace worldwide. Large organizations are formed in order to succeed in a competitive market: there are single-mode distance teaching universities, for profit distance teaching institutions, partnerships and consortia and virtual universities. Some of these new organizations compete with traditional universities and reap the benefit of being more flexible. A special kind of profit-making is practiced by 'universities' that do not teach and do not confer grades, but act as virtual brokers. As such they make money by merely referring prospective distance students to other distance teaching institutions.

The impact of increased commodification (Nunan, 2008, p. 861) on distance and online education has consequences. Not only is distance education considered a commodity that can be merchandised (this has always been the case), but this trend increases more and more and is about to change traditional education and pedagogical thought. Specifically business attitude and atmosphere is infusing this particular kind of education. Even the theories of distance education are impaired and mirror this kind of thinking and acting, which remain alien to original educational goals and their implementation. Pedagogical terms are substituted by business terms, which devaluates fundamental pedagogical ideas. The teacher or the teaching institution is now called 'provider' and the learner is referred to as 'customer'. Knowledge is a commodity, guidance and counseling, if provided for at all, assume the function of a 'service'. We are observing a massive impact of industrialization here as well.

The term 'service' is associated with another serious aspect. The commercialization of distance education is promoted by the World Trade Organization's General Agreement on Trade in Services (GATS). This organization supports and intensifies the trade in services in a free market. Distance education is considered such a service. "Thus GATS will in the future continue to accentuate and promote the transition of education, from being a publicly owned and funded cultural service that is central to the social and cultural goals of each nation to being a private good subject to the market orientation of suppliers and consumers on an increasingly transnational scale." (Moore & Kearsley, 2005, p. 300). This development is supplemented and supported by an equivalent attitude of the learners: consumerism. They consider learning as a personal investment and expect not only adequate service, but also "marketable diplomas" (Moore & Kearsley, 2005, p. 301) or degrees, which they value much more than intellectual and personal development. Ross Paul and Jane Brindley (2008, p. 442) have even noticed a new "sense of entitlement" with their students as they "expect certain results for their investment".

This chapter cannot be concluded without mentioning the grave abuses that were inherent in this particular method of teaching and learning. Seemingly, the distance between 'provider' and 'customer' tempted many educational entrepreneurs to accumulate vast amounts of money for little service. Commercial correspondence schools in particular attracted many new learners by means of alluring advertisements and hard selling. They asked for high fees for a long time in advance. 'Degree mills' spoilt the image of correspondence education for a long time. After the Second World War, these abuses became a public nuisance and had to be curbed by legislation in several countries,

among them Norway, The Netherlands and Germany. The emergence of global education extends the market for distance education further. Regardless of much criticism (Ess, 2003; Chambers, 2002; Hawkridge, 2005) we can see that many traditional universities and new web-based universities are reaching out to attract additional students wherever they may live on this globe. This causes considerable competition. Ellie Chambers and Kevin Wilson (2008) see that the appearance of major international corporations, for instance, Microsoft and Pearsons, on the educational world-market, is regarded "as a direct challenge to the integrity of state-supported higher education".

Interpretation

What is the function of the theory that *distance education is the most industrialized form of education* in the practice of education? Generally speaking, theories accomplish an understanding of reality. This theory helps to arrive at a new and more adequate understanding of distance education. Its foremost and significant goal is to make it crystal clear that there are *two* forms of education that could not differ more sharply: face-to-face education and distance education. Their structural difference necessitates this distinction. Insisting on this structural difference helps to contradict those practitioners who believe that education remains always education, whether it is imparted directly or with the help of media. The theory makes it evident that dealing in these two different realms requires different educational concepts, different pedagogical approaches, different behaviors, and often even different goals. It also indicates that distance education loses significant advantages of face-to-face group education: experience with its typical directness, immediacy, spontaneity and simultaneity.

The following aspects can be referred to in detail:

- The theory opens a macro-pedagogical perspective that covers the totality of the participants' activities. The focus is no longer on the micro-pedagogical aspect of teacher-student communication only.
- The theory is comprehensive as well in the sense that it includes and relates to each other all functions necessary for realizing teaching and learning: planning, developing, distributing, supporting and evaluating. Each of these activities contributes to the quality of the aspired learning.
- The theory explains why entirely different teaching and learning behaviors have emerged that, however, are typical and necessary due to the division of labor, specialization, team work, mediation through multifaceted media and especially to the separation of teachers and the taught by time and location.
- The full understanding of this theory makes it easier for participants to behave and to act in conformity with this particular system of teaching and learning. It transforms participants into parts of the system, which prevents dysfunctional pedagogical activities.
- The theory shows clearly that it is absolutely wrong to replicate and transplant successful pedagogical functions of face-to-face education into systems of distance education, which is often done. Such experiments must fail because of the structural uniqueness of distance education.
- The theory drives home the idea that in order to exploit the real advantages of distance education not only a smoothly running administrative-technological

system is needed, but also groups of specialists that develop "very high quality multi-media learning materials produced by multi-skilled academic teams" (Daniel, 1998, p. 26). Approaches in which just one professor is asked to write a manual with recommendations to read a series of articles and of set books, and a secretary is commissioned to distribute these manuals to students of the same university, is a sorry example of a misunderstanding of industrialized education.

- The theory projects the traditional legacy of distance education into our time and into the future: the humanitarian task of providing access for *all* learners, with special focus on those disadvantaged by distance, by precarious economic conditions, by belonging to discriminated minorities, or by being disabled. Obviously, this mission is now relativized by a growing number of privileged students who do not learn at a distance because they are forced to do this by unfavorable circumstances, but rather for reasons of convenience only.
- The theory reveals the potential of distance education for enabling students to become self-regulated autonomous learners more easily, as it challenges them to reach this ambitious, superior educational goal.
- The theory suggests that industrialized and digitally enhanced education transmit competences to the very persons who are needed in this complex, multi-faceted and highly industrialized information and knowledge society.
- The theory explains and proves that distance education is not only advanced with regard to its present technological standard, but also related to the future, as distance education has always employed the available technologies in each period of its history – contrary to face-to-face group instruction.
- The theory brought up and discusses the possibility of educating more students at lower costs.
- The theory gives a new perspective on extending education *for all*, on the possible establishment of *mass instruction* in 'developing' and highly industrialized countries, and even on striving after *mass higher education*.

Taken everything together, it might be predicted that industrialized education may help to pave the way to an information-driven educational system that might be more adequate to our rapidly changing information and knowledge society.

2 The Iceberg has not yet Melted: Further Reflections on the Concept of Industrialization and Distance Teaching

The reception of the „theory of the most industrialized education" was not at all favorable in Germany because of the zeitgeist in the sixties and seventies which was opposed to the faith in technological progress, to the planning euphoria, and to the calculability of processes. However, in other countries it aroused considerable interest after David Sewart, Desmond Keegan and Börje Holmberg had published an English translation of the first version of the theory in 1983 and Desmond Keegan had presented the theory in his book "Foundations of Distance Education" in 1986. Since then the theory has been discussed internationally – up to the present. Unfortunately, the theory was too alien to many readers. This caused quite a number of misunderstandings. This article was written after having been asked by Alan Tait to react to these misunderstandings in 'Open Learning'. Reading them today serves as an additional approach to the essence of the theory.

When reviewing my book "Die didaktische Struktur des Fernunterrichts zu einer industrialisierten Form des Lehrens und Lernens" (Peters, 1973, *The educational principles of distance education: research into an industrialized form of teaching and learning*), Fred Jeavons (1986, p. 165) used a striking metaphor when saying that "theories are like icebergs" in order to point out that quite often only one part of the visible tip becomes known whereas the submerged nine tenths remain invisible. With the help of this metaphor he wanted to explain that only one chapter of the book on the comparison between the teaching and learning process in distance study and the industrial production process had become visible and was hence being discussed, whereas four more chapters containing the theoretical underpinnings remained in the dark, partly because they have not been translated into English. This could be the reason for the existence of a number of misunderstandings. Being invited to respond to such misunderstandings I would like to adopt this metaphor. I consider it to be well chosen for three additional reasons.

First: Icebergs break away from their original surroundings and often drift into new areas where they do not normally belong. The use of characteristics relating to the industrial production process in explaining the teaching-learning process in distance study was certainly new and unheard of, and in the minds of some not even appropriate or desirable.

Second: Icebergs are often seen as a danger. Many readers when they come across the term 'industrialized teaching and learning' think of smoking chimneys and dirty manufacturing plants and become afraid that these will soil the pure world of learning. Also at a more abstract level, people have strong reservations as they feel that something entirely unfamiliar and dangerous has entered education.

Third: Icebergs change their appearance and become smaller. Jeavons (1986, p. 168) referred to this aspect when he wrote that "even the finest icebergs can melt".

Misunderstanding 1

> *I must be a proponent of the process of industrialization in the field of distance education, because I have described the process in detail and at length, and I must be trying to bring about and further this process.*

Nothing could be more wrong. This reminds me of the oriental potentates who put the blame for unpleasant news on the messenger and had him hanged. I have not advocated the industrialization of teaching and learning. It was only that I drew attention to this development which nobody had seen until then, and tried to analyze it. I acted as a witness. Most importantly of all, I am not opposed to other forms of teaching and learning, and especially not to face-to-face elements or other forms of the "guided didactic conversation" (Holmberg, 1981, p. 30) in distance study. I do not want to dehumanize the instructional process in distance learning.

In fact, the case is quite the contrary. In order to prove this I have to refer to an invisible part of the iceberg. In my book (Peters, 1973) I devoted a chapter to the problematic nature of industrialized forms of teaching and learning. I discussed the structural incompatibility of industrialized teaching and learning with a locally organized educational system. Furthermore, I stressed the process of alienation which takes place when students are confronted with technical artefacts instead of live human beings. Personal relations become indirect and depersonalized, and lose much of their reality. This is symptomatic of the great rationalization of society which is going on irresistibly and which leads to "disenchantment with the world" (Max Weber, 1951, p. 566). Finally, I suggested that dominant political groups might easily seize power by increasing their influence not only in the administration, industry, military, and the transport and communications systems, but also through a centralized industrialized system of education. Such a system would fit easily within an interrelated and integrated mega organization, and could be used to manipulate people in a subtle but efficient way. There is the danger that people would become more and more instrumentalized in such a system (Peters, 1973, p. 208).

Misunderstanding 2

> *As I have made a study of the similarities of distance study and educational technology I must be an ed tech fan. Jeavons (1986, p. 166) called me "a great technological optimist". Schwittmann (1982, p. 155) is worried and calls my description "very problematic". Ehmann (1981, p. 231) goes so far as to mistake me for a member of the Society for Programmed Instruction (Gesellschaft für Programmierten Unterricht), which I have never been.*

Nothing could be more absurd. Of course, I studied the rise of educational technology in the seventies with great interest. This was part of my job. Certainly, I described the rightly significant role it had in the process of industrialization in education. However, I have never been a protagonist of educational technology. On the contrary, I devoted a chapter to a description of the dangers of a technological model of distance study; the overemphasis on technical devices, the inevitable reduction of possible learning objectives, the fragmentation and compartmentalization of the learning process, the dominance of technical rationality at the cost of 'critical rationality'. Obviously this part of my book is also part of the hidden iceberg.

Perhaps I should repeat what has been said again and again, most recently by Shale (1987, pp. 15-21); educational technologies have not worked in distance teaching universities as their more enthusiastic proponents initially thought they would, notwithstanding the theoretical and empirical accomplishments of the last two decades (see, for instance, the massive volumes by Romiszowski 1981, 1984, 1986, 1988). The reasons for this are manifold: The skills and techniques of educational technology have been too complex and time consuming to be acquired by academics in addition to their teaching and research duties. The idea that experts in educational technology should assume a mediating function and impart their expertise to academics individually or in course teams has only been partly realized.

On the other hand it would be wrong to say that academic teaching at distance teaching universities has remained unscathed by educational technology. We can register at least the following changes: academics have learnt to plan and to prepare their teaching material carefully and well in advance of delivery. They have assumed an experimental attitude with regard to their own instruction. They have become used to looking at their courses as 'products', which can be improved with the help of relevant data. They have allowed experts to discuss problems of teaching with them, individually or in course teams. They have used mass media and have transformed their instruction according to the requirements of those media, and have enjoyed the fact that they can reach out to thousands of students at one time. They have learnt to use some of the educational technology jargon. On the whole, there is no doubt about it: this part of the iceberg has melted considerably.

Misunderstanding 3

> *The interpretation of distance study as an industrialized form of teaching and learning was part of the* zeitgeist *which prevailed in the formative years of the first open universities (Shale, 1987, p. 15). It might have been justified in the seventies but after the disillusionment of the eighties it has lost much of its relevance (Ehmann, 1981, p. 233; Jeavons, 1986, p. 165).*

I do not see it this way. The industrialization of teaching and learning is only a small part of a pattern of enormous social change. Industrialization has changed and will go on changing our lives fundamentally whether we like it or not: people now work, spend their leisure time, buy, eat and communicate with their relatives and friends in different ways. They also think in different ways and have developed attitudes not known by their grandparents. It is unlikely that education can resist this process. Further, it might be misleading to assume that the technologization of education peaked in the seventies.

We will probably have to face even greater changes of this kind in education if we are seriously to strive for egalitarian educational systems. In the same way as it will not be possible to feed, clothe and house nearly everyone in the developing countries properly without industrialization, so it will not be possible to provide education. The industrialization of education represents a long term process of historical and anthropological dimensions and not just the consequences of a decade of enthusiastic reform. I dealt with this in Chapter 5 of my book (Peters, 1973), yet this is almost forgotten in the debate about the 'industrial model' of distance study, the only exceptions to this oversight being found in the work of Bååth (1979, p. 7; 1981, p. 212), Keegan (1986, p. 85), and Rekkedal (1983, p. 79).

Misunderstanding 4

> *The concept of industrialized teaching and learning is more or less typical for single mode distance teaching universities (namely, those teaching only at a distance), but not for dual mode institutions (that is, those teaching both traditionally by face to face methods and also at a distance). The issue now is single mode (industrialized) versus dual mode institutions. Furthermore, 'the supremacy' of the single mode institutions 'is challenged' (Jeavons, 1986, p. 167).*

Dual mode and single mode institutions differ in their application of the principles of industrialization only relatively. Dual mode institutions also have to develop learning materials, in Deakin, for example, using the selfsame course team approach (division of labour, collaboration of experts, long range planning, financial investment). They have to duplicate and despatch them using machines and technical media (mechanization) and often they have to keep track of their students with the help of a computer (automation). They cannot, however, exploit the advantages of mass production and capitalize on the economics of the large-scale operation which enables singlemode distance teaching institutions to employ the best teachers and experts in the market.

To sum up, dual mode institutions are partly industrialized. They are somewhere on a continuum between conventional face-to-face teaching and learning and the instruction of single-mode institutions.

Misunderstanding 5

> *By identifying the characteristics of industrial production processes in distance education I have developed a 'theory of distance education' only and not of actual education (Rebel, 1983, p. 175).*

I did not do this! I limited myself to describing the structural differences between traditional teaching and learning and distance study. In spite of this, distance teaching remains teaching and distance education remains education. Both forms remain, of course, the object of the current theories of instruction and education. Distance education, therefore, can be analyzed and interpreted according to the teaching models of scholars such as Skinner, Rothkopf, Ausubel, Egan, Bruner and, as Bååth (1983, p. 76) has shown so convincingly. It can be developed with the help of pedagogical concepts like, for instance, 'independent study', 'open learning', 'contract learning' or 'video tutored instruction'. I never maintained that my characterization of the structure of distance study could or should replace them. Its industrial structure is just one aspect of the phenomenon which has to be taken into account.

It is true, that, in 1973, I referred to Paul Heimann who had envisaged the emergence of a 'new pedagogy' because of the growing importance of technical media in instruction, and it may be that I shared this idea and hoped to contribute to it. But I never called my 'comparative interpretation' a theory.

This being so it is, of course, pointless to refer to the criteria which a theory of instruction must meet as described by other authors and to measure my comparative interpretation against them (Holmberg, 1985, p. 25).

Misunderstanding 6

> *In distance teaching universities there are two areas. One is industrialized namely the collection, production, storage and distribution of teaching material (here the university functions like a* business *enterprise); while the other is not, it is "more in the nature of traditionally conceived academic areas" (Kaye, 1985, pp.1432, 1436; Kaye & Rumble, 1981, p.179).*

This is certainly not the whole truth. In fact, I did not limit my comparison of the teaching and learning process of distance education and industrialized forms of work to the obvious factory or business enterprise areas of distance teaching universities, but extended it (and this is more important), to the actual teaching and learning. In order to illustrate this by an example I shall refer here to the most striking feature of this development. Traditionally, a professor performed many teaching functions. He or she prepared, invited the students to meet in a lecture room or at home, created a special learning atmosphere, and motivated the students, implicitly or explicitly. The professor transmitted knowledge to the students, using voice and body as media, and decided when and how to use the blackboard or other media. The professor initiated and took part in pedagogical dialogs, acted as tutor and counselor, examined the students and selected students to help in research.

Due to the application of the principle of division of labor, and the cooperation of specialized experts, the personal unity of all these activities is broken up and the functions mentioned are assigned to specialists, groups of specialists or even specialized sections. By so doing, the role of the traditional professor is reduced mainly to the function of a subjectmatter specialist, as members of the course team relieve him or her of many tasks of instructional planning. Media specialists, evaluation experts and instructional designers might be involved. Tutors and counselors are involved at a distance in study centers. A bureaucratic organization coordinates the many separated teaching functions. Most phases of the teaching-learning process take place without the professor's intervention.

The parallel development in the world of work is obvious. The craftsman planned, organized, worked with tools and sold the products him or herself. In the industrialized working process this unity of action is divided into many specialized functions in departments for research and development, production, marketing, sales and so on.

As this radical change in instructional method corresponds naturally with a change in learning behavior, it is appropriate to apply the term 'industrialized' to both teaching and learning in distance education.

What about research? Is it not organized in the same way as in traditional universities? Yes, but if we take a closer look at it we see that even in traditional universities, especially in the natural sciences and technological disciplines, the process of research has assumed the characteristics of industrialized work processes and takes place in organizations which are similar to factories. Helmut Schelsky (1963, p. 192) has described this, quoting Max Weber, who pointed to the division of labor in this field back in 1919: "Research becomes a continuous acquisition of knowledge, a production process, which must devalue the single contribution." (1951, p. 575). He referred to Helmut Plessner, who found that "mechanization, methodical ways of proceeding, depersonalization of the production process regulate the production of material as well as of intellectual goods"

(1924, p. 472). The division of labor, the cooperation of specialists, the use of machines including the computer, and the possibility for exchanging and substituting individuals in the research project show that the process of industrialization has changed research fundamentally compared to the time when the personality of the individual professor had been of exclusive significance.

Hence, in distance teaching universities the process of industrialization has permeated not only the administration, and the production and dissemination of teaching materials, but also teaching and learning itself and often also research. It is of comprehensive and central significance.

Misunderstanding 7

> *Distance education can be industrialized in so far 'as it employs the technology of the twentieth century' and 'produces an unvaried product in large quantities, and therefore, at low cost'. The analogy, however, should not be carried too far. The mediating functions of the support services of tutors and counselors cannot be industrialized (Sewart, 1982, pp. 27, 28).*

This concept of industrialization is, indeed, a narrow one. There is much more to it. Tutors and counselors do not act autonomously, but perform well defined functions in a teaching-learning system. These functions are derived from the instruction designed by a course team or a professor. This is a clear result of the division of labor. They could not work without the rest of the university, especially not without the course material. In a special sense they are instrumentalized as they are normally not expected to teach in their own right. They are specialists and may accumulate experience in their limited field of activity which is greater than that of ordinary academic teachers. Thus they become experts. High quality teaching becomes possible because of the contribution of such experts amongst whom the work has been divided. They are connected with the teaching-learning system administratively by some sort of supervision, academically by their loyalty to their faculty, and medially by the computer. As they receive relevant information about their students and their learning achievements via this medium, their tutoring and counseling could be called 'computer-aided' (mechanization, automation). They also use other technical media, such as the telephone, as well as the personal letter and in some cases a student magazine.

There is no doubt that industrialized teaching and learning leads to the building of complicated systems in which tutors and counselors play an important part, but a part. As such their work is also 'industrialized'.

Misunderstanding 8

> *The 'industrialization idea' does not do justice to all conceivable forms of distance education. It is perfectly adequate to describe activities of large correspondence schools, of the Open University, of large teaching systems based on radio or TV courses. But what about... very small correspondence schools, entirely run by two or three persons? (Bååth, 1981, p. 213; Duignan & Teather, 1985, p. 42).*

The industrialization of the production process went through many stages beginning with the simple work of small manufacturers and ending with complex and often fully automated enterprises. Thus, the work originally done by a craftsman became more and

more industrialized. This development can be studied by looking at the growing importance of technical devices in this process. Their purpose is to free people from routine and hard physical work and to make the process more cost-effective.

In the preindustrial period tools were used as extensions and reinforcements of the human body, which at the same time was also the source of the energy needed. The teacher in the classroom acts as a craftsman, using the energy of the body when communicating with students. The pointer and the blackboard are bodily extensions.

The situation becomes entirely different when someone teaches at a distance even in its most simple form. For explanatory reasons I refer to the extreme of one person teaching another by means of personal letters. Here a technical device is used and takes over some of the functions of the teacher. In fact, the letter teaches instead of the teacher. It is possible for the student to learn and relearn from it many times without using the energy of the teacher. The teacher, however, needs a certain amount of organization at home or in the office (at least he or she must procure and store stationery and have a calendar and a list of names). Most important of all, the teacher must be able to rely on the help of communication and transport systems (mail, railways, bicycles and so on), now used as media for carrying instruction. Thus, a considerable organizational infrastructure helps to bring about the teaching-learning process which is only possible with division of labor between the teacher and the communication and transport systems.

This new way of imparting knowledge reduces routine work, is labor saving and can also be more economical than face-to-face teaching even before the teacher decides to duplicate the written lessons and capitalize on the large scale productivity.

Analyzing this first and most simple form of distance study we can already recognize tendencies towards the structural elements of industrialization. It is certainly no coincidence that the first correspondence schools were founded and the first railway and postal systems established at the same time, when industrialization began to change our lives.

Misunderstanding 9

> *It is a misconception if someone argues that distance study is structurally different from conventional forms of study. Distance study "is no more than a method of teaching" (Hopper, quoted by Keegan, 1980, p. 18). "It differs primarily in the means, the method itself" (Mackenzie, Christensen & Rigby, quoted by Keegan, 1980, p. 18). Rebel (1983, p. 171) analysed conventional teaching and distance education and found "more similarities than differences between them".*

In contrast to this I should like to suggest again that distance study is structurally different from traditional face-to-face instruction. I refer to the following obvious characteristic features which can be discerned at first sight: indirect (symbolic) interaction versus direct interaction; highly individualized learning versus learning in groups: course material centered versus teacher centered instruction; the student being responsible for making decisions as to the time, place, sequence and frequency of self-learning activities versus the teacher being responsible for organizing and delivering instruction.

At a higher level of reflection I stress that distance study is different because it has been developed by the application of the following principles:

- Division of labor: many people have to cooperate before learning can take place.
- Planning and organization: the various specialists have to work on projects which are subject to detailed prior planning. Their work has to be coordinated by bureaucratic procedures which are organized by the project management.
- Mechanization: distance study is not possible without mechanical devices, for example, the letter plus the communication media of the post office, printed matter, radio and television, audio or video cassettes, or the computer for the marking of assignments or computer-based tuition representing the highest level of mechanization, namely automation.
- Objectivity of teaching behavior: the teaching which is traditionally performed subjectively in the classroom or lecture hall becomes objectified in the sense that it becomes an object which can be manipulated. It can be improved, adapted, changed and duplicated and lends itself to mass production.
- Scientific control: as distance study is the result of the cooperation of specialists, the efficiency of the teaching can no longer be judged in the same way as is done by the teacher in the classroom: experts have to do the evaluation.
- Alienation: in the same way as workers become alienated by strict division of labor, so people involved in the teaching system may become alienated as they often have only limited routine work to do with limited responsibilities. Furthermore, the students have a predisposition to become alienated as they may be used to instruction based on personal interaction yet have to take part in a teaching-learning process that is predominantly depersonalized. A feeling of isolation and frustration can be the consequence of this.

Thinking along these lines, one cannot but conclude that distance study is *sui generis* as it is the most industrialized form of teaching and learning.

Misunderstanding 10

> *Keegan (1980, p. 18) finds the radical separation of the educational principles of distance education and conventional education objectionable. He offers a quotation from R. S. Peters in which the 'culminating stages' of education are characterized in the following way: "There is little distinction between teacher and taught; they are both participating in the shared experience of exploring a common world. The teacher is simply more familiar with its contours and more skilled in handling the tools for laying bare its mysteries and appraising its nuances. Occasionally in a tutorial this exploration takes the form of a dialogue. But more usually it is a group experience. The great teachers are those who can conduct such a shared experience in accordance with rigorous canons, and convey, at the same time, the contagion of shared experience in which all are united by a common zeal." Then Keegan goes on to say: "There is a huge gulf between this statement and the industrial process that Otto Peters described" and he accuses me of having "misinterpreted what occurs in conventional education, especially at university level".*

To my mind Keegan's quotation confirms my findings that the educational principles of the two forms of instruction are totally different. Developing industrialized instruction means losing things that might be dear to one's heart: the excitement of direct interaction, the feeling of belonging and, possibly, the warmth of human relations. But at the same

time you gain something you can never have in conventional instruction, namely, a very powerful opportunity for teaching students who have so far been denied education. This change has parallels in the development of industry. The craftsman quite often puts his or her personality into the piece of work, so much so that he or she likes it and would rather keep it than sell it. This sentiment is lost when the production process is rationalized and mechanized. The process of alienation begins.

The separation of the two modes of instruction could also be demonstrated by analyzing their different advantages and disadvantages, opportunities and dangers. In distance education you simply cannot have the 'sharing of experience in exploring a common world' between a well liked and esteemed teacher and a learning group as the basis of instruction. Distance students cannot enjoy 'the contagion of a shared enterprise'. The interaction is indirect, emotion-free, and depersonalized. On the other hand, continued experiences in the learning group can never induce a student to develop the strategies and tactics of self-instruction needed in distance study or the unparalleled self-confidence and self-reliance of its successful students, not only in its 'culminating stages'. However, if the process of industrialization becomes stronger and permeates conventional instruction as well, there might be a time in the future when the pedagogical structure of distance education and conventional education will become similar, if not identical.

If, for instance, university teaching were reformed according to current models of ‘open learning’ and ‘independent learning’, and became strongly individualized under the systematic guidance of a mentor; if each student were asked to develop a curriculum for him or herself: if study activities were no longer organized into 'classes' and a great deal of the instruction were taken care of with the help of learning packages prepared by supra regional research and development centers; if the student learned to initiate professional activities and experience geared to his or her course of study; if he or she were able to work with a personal computer, using electronic mail and profiting from teleconferencing, then 'the huge gulf' between the two modes of instruction might disappear.

This is even more likely to happen if distance study improves its present structure. Supraregional, preplanned, and pre-prepared teaching material could allow also for greater individualizing of learning in order to meet the real needs of the students. Counseling and tutoring could be developed more strongly. More students could acquire the courage and ability to initiate and to manage self-help groups, and if students also learned to use the emerging techniques of electronic communication successfully, then distance teaching might become more a reformed form of conventional study.

In both modes of instruction it will be the strong relationship between the mentor or counselor and the student which will become the backbone of the individualized course of study. Their meetings will probably be precious events, direct interaction in its finest and most efficient form. It is here they can convey ‘the contagion of a shared enterprise'. It is clear that such mentor-student relationships can be made possible only because other teaching functions are taken care of with prepared teaching material which is produced industrially.

Final Remarks

What will happen to the iceberg? Will it become smaller and disappear? Will it continue to exist? Is the comparative interpretation outdated after so many years? The many allusions

and more extensive reactions to it in the literature, both affirmative and controversial, indicate that discussion of my concept of distance education as an industrialized form of teaching is still alive. This is, by the way, slightly to my amazement.

Indeed, the 'comparative interpretation' has often been referred to as one aspect of the definition of distance study (Keegan, 1980, 1983, 1986; Holmberg, 1981, 1985, 1986, 1987; Fritsch, 1984; Kaye, 1985: Nilsen, 1986). It has been used as a theoretical construct in the field of offline and online computer assisted distance education (Andrews & Strain, 1985, p. 143), in an interpretation for a research design (Rekkedal, 1983, p. 23), because of its implications for cost effectiveness (Curran, 1985, p. 26; Turnball, 1988, p. 430), and as a concept for formulating suggestions for reducing early student dropout (Roberts, 1984, pp. 60, 64, 65).

Seemingly, the discussion will continue. There is no evidence that people either want or are able to resist, let alone stop, the changes brought about by the process of industrialization. In due course, it will also affect new conventional teaching and learning projects. Dealing with it is not a figment of mind but, an important element of sociological and pedagogical research.

3 The Revolutionary Impact of Distance Education

This chapter will make the case that distance education has been a revolutionary concept and practice right from its beginnings in the middle of the nineteenth century and up to the present day. It was revolutionary, because it caused a breach between traditional and mediated teaching and learning and developed entirely new pedagogical approaches. The development of distance education passed through three distinct phases. In each of them, a new type of teaching and learning at a distance emerged: correspondence education, multimedia distance education and online learning. These three types differ from each other, but conform in their basic structures. Observing these three phases provides the insight that antiquated 'correspondence education' was in fact a forerunner of modern multimedia digitized distance education. The revolutionary concept of distance education has disrupted conventional forms of education, with the consequence that significant pedagogical features have necessarily been lost. A discussion of the 'side effects' of the described development shows how radical and far-reaching these revolutionary changes have been.

Introduction

During the last four decades the world of education has seen the emergence of a comparatively new concept: teaching and learning at a distance on a large scale. The attraction of this new concept has led to the establishment of many new distance education units and distance teaching universities in many countries. They have attracted and catered for millions of additional students and changed higher education considerably in those countries.

It will be shown that this is not a singular and isolated occurrence caused simply by the employment of new technology, but the continuation of a revolutionary process, which started as early as at the first half of the nineteenth century.

- At that time, entrepreneurs ventured to teach in a completely different manner. They merged teaching and learning with the strategies and technical devices of the industrial production of commodities and established a new form of teaching and learning that represents the first radical pedagogical change. The phase of 'correspondence education' began.
- In the 1970s and 1980s, the development of correspondence education was continued, reinforced and effectively changed by a new educational philosophy and the use of new and powerful technical media – hallmarks of reinforced industrialization. This caused a drastic structural change of teaching at a distance again which was also the reason why this form of education was renamed and has been henceforward called 'distance education'.
- Since the middle of the 1990s the concept of distance education has been subjected to a third fundamental change. Again, this was caused by new developments of advanced industrialization, e.g. the rise of information and communication technology and of net technology. By integrating these technologies, distance education improved its pedagogical possibilities, quality and value. The newly established third phase brought the application of new pedagogical strategies, which nobody could have thought of or

predicted. The trend towards virtual education becomes discernible. The age of digitized education has begun.

These three phases show that the traditional concept of oral education was industrialized in three key steps. Each one caused material conceptual changes. The correspondence education phase remained unknown or was ignored for more than a hundred years. This may be the reason why the extraordinary significance of these revolutionary changes was not seen and recognized for a long time up to the 1960s. The highly mediated distance education of the second phase, however, attracted the attention of many more educational experts, due to the use of mass media radio and television. And the third phase is acknowledged by even more specialists coming from more academic disciplines and corporate sectors.

This chapter does not describe a transformation of traditional modes of learning and teaching. Rather, it will focus on the creation of entire new educational systems that have brought about these three abrupt revolutionary changes. By virtue of these three decisive key steps, distance education has acquired a great potential for solving educational problems today, and possibly even more so in the future. This could have unforeseeable consequences – probably both positive and negative ones.

Is it Permissible to Call the Described Changes 'Revolutionary'?

Critics may object to the plan to describe distance education as a revolutionary concept and practice. They may assume that this term is greatly exaggerated. Usually they suggest explaining the emergence of distance education as an 'evolution' or 'transformation'. This requires some additional clarification. The term 'revolution' is defined by social and political scientists as 'radical and profound change'. It denotes 'major and sudden alterations' not only of government, but also of technological, economic and social conditions as well as of cultural values (e.g. industrial revolution). Furthermore, the term includes "a fundamental departure of previous historical patterns", "constitutes the challenge of the established order", and requires that "the new order is radically different from the preceding one" (Wikipedia, June 20, 2009).

With these criteria in mind it appears evident that the cultural and social custom of face-to-face teaching and learning was radically and abruptly changed by creating and practicing correspondence education, distance education and online learning. These new formats require also a fundamental departure from traditional pedagogical patterns and approaches. They challenge and seriously disrupt the established order of teaching and learning. Finally, the new order of teaching and learning is 'radically different' not only with regard to its methods and media, but also to its general educational goals as well as to its particular students. A remarkable change of attitudes, values, curricula and even the concept of 'knowledge' show the consequences of theses changes. Hence, it can be deduced that distance education is indeed the achievement of a remarkable revolutionary process.

Part I: Three Revolutionary Phases

Phase 1: The Era of 'Correspondence Education'

For about one hundred and fifty years, this forerunner of distance education comprised two main activities: the distribution of printed material and postal tuition of individual learners. Both activities became possible only after intensified industrialization in

England, which led to the change from a rural to an urban economy. A new factory system increased the division and specialization of labor and the use of machines brought mass production and the rise of early capitalism. Improved transport became necessary and was provided by the development of railways and roads. The fundamental idea that led to the concept of correspondence education was to apply industrial methods of purposeful thinking, organizing, producing, distributing and communicating. Written or printed paper was mechanically duplicated, mass-produced, dispatched by the Penny Post, and two-way communication by correspondence was organized. The motive was to make a profit by selling mass-produced learning material and by enrolling great numbers of students. Students were recruited by advertising. After the spread of industrialization in Europe and in the United States the proliferation of this new form of education followed.

The humanist mission of correspondence education was "to provide access to education for all learners, no matter how dispersed or disadvantaged by economic, personal, or political situations" (Feasley & Bunker, 2007, p. 25). Often it was extended as well to underserved and yet ambitious people in particular, to "learners at the back door" (Wedemeyer, 1981). During the years from about 1850 to 1970 correspondence education developed gradually on the primary, secondary, post-secondary, tertiary and continuing education level in many disciplines and was provided for both in the public and commercial sector in many countries. It replaced and supplemented the learning people acquired in traditional schools.

The revolutionary consequences of this first conceptual change of education were hardly seen or have been underestimated. It is, however, important for us to recognize that early correspondence education already caused a radical conceptual breach of traditional learning and teaching. Conventional face-to-face teaching and learning, which dates back to antiquity and even further back, was disregarded and a new pedagogical concept was designed and implemented. Indications of this breach are:

- breaking the space-time barriers to learning,
- separating learner and teacher,
- requiring the use of several technical devices and media,
- delivering education to dispersed students,
- replacing oral communication by asynchronous mediated communication,
- using the mass production of printed material for mass education,
- reaping the benefits of scale,
- teaching people who had been so far excluded,
- attracting underserved and severely restricted persons,
- regarding education as a commodity.

These are extraordinary structural changes. They can be called revolutionary as they signify a departure from forms of traditional learning and the beginning of a new approach. The pioneers of correspondence education did not intend to re-arrange, re-construct, innovate or enhance conventional higher education, but designed and implemented on the contrary a new system of learning. As the principles of division of labor, specialization, mechanization, mass production and commercialization were applied, the distinct and decisive influence of industrialization permeated teaching and learning. Industrialization was emerging at that time and was already changing society.

The new system of teaching and learning was in accord with serious technological and social developments current at that time.

On the other hand, the new pedagogical concept disrupted accustomed procedures of teaching and learning, destroyed the habits and the behavior of teachers and students, de-personalized learning and reduced the customary dominance of teachers as well as their ability to really share the student's feelings or emotions.

Only today are we able to realize that this new concept, introduced mainly in the middle of the nineteenth century, provided a firm basis for new phases of distance education in the second part of the twentieth century and today.

Phase 2: The Era of 'Distance Education'

The second major conceptual change took place in the 1970s and 1980s. It was strongly influenced by the availability of a variety of new technical media. Among them were mainly

- multiple media,
- broadcasting (television and radio),
- audio- and video cassettes,
- professionally developed specific self teaching courses,
- the technological extension of classroom teaching by video conferencing and satellite – especially in the USA.

The connection of several classes or universities by video conferencing was not a new form of distance education, but rather the extension of traditional face-to-face teaching. The other media, however, transformed correspondence education of the first era in many ways and changed its organization considerably. Their impact gave distance education a lift and enhanced its status.

The most characteristic change was the growth of commercial distance teaching institutions, the establishment of new units for distance education at universities, which called themselves now 'dual mode universities' and even of 'single-mode distance teaching universities', an entirely new phenomenon which, however is of great importance. Sarah Guri-Rosenblit (1999, p. 281) referred to them by saying that "they can be viewed from many respects as forerunners in facing and dealing with challenges that confront higher education systems all around the globe". Outstanding examples of these new distance teaching universities were the 'open universities' which are to be dealt with in chapter 4.

In addition to the changes brought about by correspondence education, the revolutionary consequences of this new concept are:

- Often the mass media print, radio and television, and video were combined as integral parts of teaching and learning in order to enhance traditional correspondence education – not occasionally, but continuously.
- Multimedia learning and teaching is realized to an unbelievable extent (audio and video cassettes, experimental kits, telephone, facsimile and computers).
- Support is centrally organized and has high priority

- Further developed strategies of industrial organization are adopted: purposive rationality, goal-oriented systematic action, modern bureaucracy, advanced technology and systems approach.

When these changes are compared with all pedagogical reform efforts of traditional schools or universities, it can be seen that this phase brought a bold reformatory approach and a far-reaching innovation.

Phase 3: The Era of 'Integrated Digitized Learning'

In the 1990s another radical changeover to a new era of distance education took place. At the time, industrialization was continued and transformed into hyper- or post-industrialism. Universities acquired paramount importance and more universities were needed. The "culture of real virtual reality" (Castells, 2001, p. 375) changed the way in which we experience reality and communicate.

This era is being profoundly influenced by the unexpected impact of digital information and communication technology. The advent of the Internet and the World Wide Web transformed not only the way we live and work, but of necessity the way in which we learn and teach. New concepts of online learning are being formulated. It stands to reason that distance education is affected by these changes in many new ways again.

The close connection of distance education to this new phase of industrialism was aptly seen by Anthony Bates (2008, p. 230): "One rationale for e-learning is that it is not only a product of a knowledge-based economy, but also a means by which to develop appropriately skilled workers for a knowledge based economy." However, the reinforced industrialization of learning is affiliated with increased commoditization. More and more teaching and learning are being interpreted as 'services' which is a term of industrialized merchandizing.

The new importance of 'knowledge' and of institutions of higher education has caused many adults to acquire more academic knowledge and induced universities and corporations to venture into distance education and online learning. Online learning, however, requires changes in attitudes and the necessity to develop entirely new forms of learning and teaching again. Also the prospect of having to deal with qualitatively and quantitatively different forms of knowledge is caused by the influence of this up to now last period of industrialization.

The third impact of a new technology on distance education has been strong, dramatic and is on-going. The media used so far in distance education (e.g. print, radio and television, audio and video and cassettes) are now supplemented by networked computers. And: More and more courses are already taught online exclusively, which implies another radical pedagogical change again. Even virtual universities have sprung up.

What are the main characteristics of this entirely new technology? It provides that

- several media can be combined and used for the presentation of data (multiple media),
- many new forms of interaction are possible, and
- information can be searched, stored and retrieved at any time.

The new technology of networked computers allows for the integration of these three main technical functions for educational purposes. Bates (2008, p. 222) concludes: "Thus the Internet (including the Web) is the potentially most powerful educational technology."

After having described how distance education has been practiced in its three revolutionary phases it is, of course, banal to repeat that it differs thoroughly from face-to-face teaching in class rooms or lecture halls. But it is not banal to consider that these differences are not accidental and transitional, but structural and irrevocable. They represent new features that are recognizably different and separate from face-to-face education. They mark an abrupt departure from established pedagogical procedures again.

Part II: Further Revolutionary Changes

Revolutionary breaches have not only changed the structure of teaching and learning three times, but affected also other dimensions of education. Three of such consequences will be dealt with: the establishment of new institutions, the appearance of new types of students and the emergence of a new learning and teaching behavior.

New Types of Institutions

The use of new technical mass and digitized media led to the establishment of a surprising number of new institutions of teaching and learning. The following main models can be distinguished:

- Distance and virtual education units in conventional universities (e.g. extension departments in the USA)
- Commercial distance and virtual universities (e.g. University of Phoenix)
- Universities that are educational brokers of distance or digitized courses in cooperation with traditional universities (e.g. Excelsior College)
- Collaborations and partnerships (e.g. National Technological University in the USA, Western Governors University)
- Virtual universities as spin-offs of traditional universities (e.g. Penn State's World Campus)
- Autonomous virtual universities (e.g. University of Maryland University College)
- Worldwide consortia (e.g. World Universities Network, Universitas 21)
- Public distance teaching universities (e.g. The Television University of Shanghai)

These eight models have developed into a great variety of organizational variants. Bates (2008, p. 219) found a striking diversity of them. In 2003 he distinguished 13 different types of distance education organization. Especially the possibilities of online learning made for the growing role of the private sector of distance education. These structural institutional changes show how profound the revolutionary impact of new technology has been.

New Types of Students

Another striking dimension of change is the appearance of new groups of students. They indicate the revolutionary impact even more distinctly. Many of them are absolute newcomers and do not fit at all into conventional concepts of students. They are not channeled through a school system and are not unified by having graduated from

secondary schools, but come from many different fields of experience. We must try to understand them as a "diverse, heterogeneous and changing body of people" (Evans, 1997, p. 123). They come from a plurality of different social, ethnic and regional cultures. This is the reason why it is difficult to characterize them in general terms. In spite of this, a description of students in each of the three phases will be attempted.

Phase 1: In the era of correspondence study the characteristics of distant students were described in this way: From "infancy to old age" they "engage in learning on their own initiative, part time, motivated by self-perceived needs, concerns and aspirations. Such learners set their own goals, exercise a high degree of autonomy and evaluate their progress at a distance from teachers and institutions" (Wedemeyer, 1981, p. XXVI). These new learners used their own learning environments at home, at their work places or in libraries. Their learning was often interrupted by work, family and unexpected experiences. Their learning was not their principal, but only a subsidiary occupation. They had accumulated more life, work and family experiences. The costs of their learning are usually paid by themselves (Wedemeyer 1981, p. 145).

Phase 2: A second major revolutionary change occurred when distance teaching universities opened their doors and facilitated access for students who were hitherto denied entrance. In this way student populations were expanded by the inclusion of these newcomers. In contrast to correspondence students who comprised nearly all age groups these students are adults, most of them in employment. In the USA sixty-one distance teaching institutions reported that 90 per cent of their students were employed in 1998 (Moore & Kearsley, 2005, p. 163). The working student is typical in distance teaching universities as well. Among these students the following sub-groups can be distinguished:

- "Those who enter education because they lacked the chance to study when younger.
- Those who dropped out from higher education and want to resume their studies.
- Those who graduated from universities, but want to acquire additional qualifications.
- Those who want to study just for personal fulfillment.
- Those who have already retired but want to begin or to resume academic studies.
- Sometimes distance teaching universities also have special arrangements for students coming from discriminated groups or for people with a low income." (Schütze, 1986, p. 21).

The background of these students also shows how much they differ from conventional campus-based students. Maria del Pilar Urzainqui Dominguez (1996, p. 39) distinguishes six subgroups: professionals, unemployed, housewives, prisoners, foreign residents, invalids, as well as artists and athletes.

Apart from these students there are special groups of persons: those who have to live abroad or are isolated, military personnel in all parts of the world and their dependents, travelling sales representatives, sailors and the severely disabled.

The bulk of these new students live in 'developing' or threshold countries. They cannot afford to attend campus universities because of their restricted conditions of life. Most of them suffer from economic weakness, are not only unemployed, but are also poor, come from underprivileged groups or are members of ethnic and cultural minorities. Many hope to acquire competences and skills that may help them to get a first job. Seemingly, their long-

term motivation for university study is much stronger than it is with students in industrialized countries who already have a job and are trying to qualify for a better one.

Phase 3: In the era of integrated digitized learning many new students are enrolled, especially in departments of Electrical Engineering, Computer Science and Economics – and not so many in Human Sciences. These students like searching for information on the Net, communicating and collaborating with classmates, tutors and faculty members. They assume computer-based self-regulated modes of learning. They differ from traditional students in the same way as they differ from typical distance students. They consist mainly of a typical group of mid-career online students who are highly "goal- and relevancy oriented" and "motivated by professional advancement, external expectation, the need to better serve others, social relations" (Howell, Laws, Williams & Lindsay, 2006, p. 231). A different type of students has emerged.

Under the pressure of the new technology, their role as learners has changed in a specific and unexpected way again. As they are 'digital natives' who have grown up in a world networked with computers, they have acquired skills and strategies that most faculty members do not have. Even if they try to keep up with these students and the technical development they remain 'digital immigrants' (Prensky, 2001, p. 1; Paul & Brindley, 2008, p. 438). These new students have developed a special, entirely new way of self-study consisting of non-linear ways of thinking and learning, of strategies of searching and finding information on the Net, the ability to shift activities rapidly and of multitasking. Negative consequences of this development are that they resist deep learning and critical reflection. As they are performing many learning activities independently, they quite often become self-confident, interested in methods of learning, and expect their university to respond to their changed approaches to learning. Many develop a consumer's attitude by thinking that it is possible to buy education and supportive services (cf. Paul & Brindley, 2008, p. 439).

It is evident that the appearance of such students did not comply with the conventional concept of students.

New Challenges

Universities are confronted with these new groups of students. They must be accommodated. This will force them to tackle and solve new and so far unusual tasks: Among these are

- responding to the digital ways of learning displayed by the students,
- implementing the use of advanced communication technology,
- adapting curricula to the learning needs of such diverse groups of students
- adjusting to the new attitudes of students,
- enabling and supporting autonomous and self-regulated learning, and
- dealing with the problem and creating new concepts of 'mass education'.

These tasks will transform universities, their mission, their programs, their academic identity and their outlook. This is another aspect of the revolutionary impact of distance education.

New Learning and Teaching Behavior

Distance education is mediated instruction. In fact, teaching and learning at a distance cannot take place without media. The necessity to use different kinds of technical media changed traditional learning and teaching behavior beyond recognition. Agents of such changes were printed material, mailing systems, telephone, laboratory kits, radio, television, computers and the net – whereas traditional teaching and learning is generally likely to stick to traditional forms of oral instruction (Pauling, 2007, p. 398). New technological configurations and scenarios have been designed for the benefit of the home-based learner and the distant teacher. They have caused drastic structural changes to the learning-teaching process.

Learning Behavior

Can anything differ more sharply than the learning behaviors of traditional and distance students?

Distance students who were accustomed in traditional educational institutions to learn together with classmates who are physically present, are confronted with the task of learning by themselves with no fellow students or co-eds in the same room. In order to achieve this, they are compelled to develop strategies of self-instruction. They have to adopt certain regulating functions of the educational institution and of the teachers and accept responsibility for their own learning. They organize study plans in which they fix the times, duration, sequences and places of their learning. Advanced students are also expected to become autonomous and self-regulating in planning and controlling, and even evaluating, their learning activities. Normally they are highly motivated. However, they must also be able to sustain their motivation over long periods. It takes stamina more than anything to earn a degree by distance education. This caused the late Lord Perry to describe the situation of his students at the Open University like this: “That they have a tough time is indisputable. Ours is the most difficult way of getting a degree yet invented by the wit of man” (Perry, 1976, p. 167).

In distance education the main change in learning behavior was that listening and speaking were substituted by reading and writing as well as by exchanging letters with the teaching organization. In addition to this, students had to write assignments or take written tests. Often students are also expected to view or listen to educational broadcasts, to remain in contact with tutors by telephone and fax, and to take part in face-to-face meetings in study centers. In the course of their studies they have to improve their skills of acquiring knowledge by reading, develop study techniques of their own, learn how to spend their time of study economically, how to distinguish between important and less important activities, and how to deal with learning difficulties.

Digitized learning environments challenge students to develop and practice entirely new learning behaviors again and much more deeply: They might search information worldwide on the net, to compare and connect information, to estimate its relative value for their learning, to transform information into meaningful knowledge, to find their way in a chaotic kaleidoscopic world of information, to acquire information also in non-linear ways, to learn with hypertexts and hypermedia, to demonstrate their knowledge by presenting it to their classes or by publishing it on the internet, to take part in video or computer conferences and virtual seminars, and to profit from news and chat groups. They learn how best to deal with virtual tutors, how to participate in virtual group

discussions successfully and how to organize self-help groups. Finally, students have to learn how to develop a habit of meta-cognition. This means that they acquire strategies and skills for observing and evaluating their own learning. They use this knowledge for regulating and evaluating cognition in their learning. All these new elements of learning behavior show again the departure from traditional ways of learning. They mark the most definite departure from traditional procedures.

If we compare the new learning to the traditional one on a higher level of analysis, we become aware of the powerful impact of the knowledge society on distance learning. If traditional learning can be described as linear, causal, logical, hierarchical, systematical, concentrated, located and with a closed curriculum, learning in the virtual spaces of the knowledge society can be characterized by opposite terms: it is non-linear, non-causal, not constructed logically, but is associative, random, decentralized, fluid, opaque, dislocated, distributive and the curriculum is open (Peters, 2004, p. 100). These are indications that a new educational epoch is in the offing.

Teaching Behavior

Can anything differ more sharply than the teaching behaviors of faculty in traditional and distance education? In distance education they are affected fundamentally by abrupt and radical change as well. Before being involved in distance education they had developed habitual skills in holding classes, lecturing and conducting seminars in face-to-face group situations. In distance education they are thrown into an entirely new situation and many of their former qualifications are of little use. These are the main changes:

- They are separated from their students by time and place. Hence they are isolated in the same way as their students.
- The principle of division of labor is applied. The traditional comprehensive task of a teacher is subdivided into several educational functions that are assigned to several specialists. This causes significant role changes. The teachers are no longer the "sage on the stage, but the guide on the side" (Lockwood, 2004, p. 9). And they are expected to cooperate with instructional designers, media specialists, tutors, moderators, evaluators and experts in assessment and quality assurance in course teams.
- They do not teach 'classes' any longer, but larger numbers of students at a time. This alone transforms learning and teaching considerably. This holds especially true with regard to the media that can or must be used, to the kind of interaction possible, to the general atmosphere, the degree of emotional involvement as well as to contents and curricula.
- Teachers do not really 'know' their students. They cannot make close contact with them. They can only imagine what they may be like and develop general ideas about them. And yet it remains important to be informed about their contexts, as this affects the development of learning material and the way in which they are to be supported. Therefore, teachers help to initiate and evaluate research projects for establishing and retaining reliable records of the students, for surveying them at selected points of the learning process and for interviewing them. Sometimes students or prospective students are invited to take part in course development teams.

- In virtual educational environments the change of patterns of behavior is even more dramatic. Here teachers are expected to acquire an entirely "new set of learning competencies" (Anderson, 2006, p. 79). They must be able to expose virtual learning content, exercises and background material, activities that are still somewhat related to traditional teaching competencies. Entirely new, however, is the task of establishing and maintaining virtual communication with persons involved in the learning and teaching. They have to learn how to conduct virtual seminars, how to motivate virtual students, how to organize and to inspire the virtual contributions of tutors and how to communicate indirectly with their students. This means teaching by writing, developing teaching material, preparing broadcasts for radio and television and developing evaluation schemes. In addition to this, teachers are impelled to acquire new competencies in virtual curriculum building by using learning objects. All these new tasks require a thoroughgoing pedagogical reorientation.

The historical importance of this breaking away from traditional teaching and learning cannot be overestimated. For thousands of years, teachers and their students remained in a fixed space-time-relationship: they had to meet at the same place and at the same time in order to be able to teach and learn. In distance education this fixation disappeared. This means more freedom, more flexibility, more new possibilities for faculty members, but also more insecurity and handicaps.

A new type of teacher and learner behaviors has emanated from distance education.

Part III: Overriding Issues

Mental and Sensitivity Problems

Distance students differ from traditional students in their awareness and experiences of their lives. Learning at a distance may be a significant project for them, but in most cases employment is, and remains, central to them. Therefore learning can only take place part time. Often these adult learners are also involved in social, church, sports or political activities that reduce their time for learning even more. The typical psychological problems of adolescent students no longer affect them, but new difficulties arise: a notorious lack of time, scheduling problems, insecurity with regard to their academic success, and how to deal with stress. Fortunately, many of them exhibit role behaviors that are characterized by responsibility, independence and autonomy. This may help them to alleviate the hardships caused by overload.

There is also another typical difference. Their rapport with the teaching institution and with faculty and classmates is not real, but symbolical. Therefore, their attitude is more aloof and their loyalty not as strong as it might develop, e.g. in face-to-face college classes. They do not see themselves as members of the university in close contact to each other, but more as isolated 'customers' who expect to be served. This particular situation not only affects their mental state in general, but specifically also their attitude towards their own learning.

Finally, they do not belong to the traditional age cohort of students, but are in different stages of their life cycles. Therefore the purpose of their learning differs as well. It may be no longer a preparation for improving their chances to obtain employment or a vocational or professional change, but the acquirement of new competences for improving career prospects or satisfying a general desire to learn. Many of these students are already

graduates of another university, work as professionals and have achieved considerable social status. Therefore the general educational level of students is on average higher, but also more diverse than in traditional universities.

In many countries all over the world distance teaching universities have attracted and served new groups of students: adults in full or part-time employment. If we compare these students with students at traditional colleges or universities, the drastic change that has taken place again becomes evident. Before this revolutionary change adult students were exceptions in higher education. Now they represent the whole student body at distance teaching universities. The "profiles of higher education learners are changing" (Howell et al., 2006, p. 230). This holds true in industrialized as well as in 'developing' countries. We are experiencing a profound change that marks a new epoch in the history of education.

Side Effects

The continuously increased industrialization of distance education has brought a great number of educational advantages described above. They foreshadow great possibilities for meeting new educational challenges in the future. Experts believe that distance education has the potential for educational reform in order to adapt it to requirements of the mass society. It may even be expected that distance and online learning enable students in ways with which they could live and work successfully in the post-industrial and postmodern society. However, it would be most naïve not to see and not to consider the grave educational losses that industrialized education has brought as well.

As distance education is structurally thoroughly industrialized, it can be characterized as education that is completely 'mediated'. As such it is not real, but in fact unreal. This is not a singular feature, but part of a general phenomenon. Critics of contemporary culture describe how the reality that we perceive is shrinking in our modern and postmodern era and how it is being replaced more and more by a world that is also only mediated through and presented by mass media. This means that we are becoming accustomed to living in two worlds, a real world and an artificial, mediated one. At present, we have reached a stage in which mediated reality dominates. To make matters worse it is quite often no longer possible to compare critically this mediated reality with reality itself.

Mediated and virtual education corresponds exactly to this general cultural development. Enthusiastic protagonists of distance education and online learning, who disregard traditional forms of education and advocate a complete change, must be asked whether the continued exposure of students to mediated education excludes them from valuable and indispensible life experiences. This would have serious consequences that cannot be ignored unthinkingly.

The followings aspects may clarify the issue:

- In distance education virtual communities replace the real communities of learners, teachers and tutors "including their distinctive traditions, histories, rituals and so on" (Ess, 2003, p. 25). These significant components are lost.
- Distance education means that the pedagogical communication is disembodied. Bodies are divorced from educational situations. No longer can certain personal manners be produced. Overtones of oral information are not heard. Non-verbal communication cannot contribute to learning. Relations between persons of flesh and blood are not possible. Human feelings cannot actually be detected, and a great number of the effects of socialization do not take place. Students in distance education and online learning are

deprived of the experience of direct group communication. Sherry Turkle, a widely acknowledged psychologist at the Massachusetts Institute of Technology (MIT) and one of the first experts in "Life on the Computer Screen" wrote: "Optimists (…) believe computers could partly reverse the growing social isolation (…) But is it really reasonable to assume we could revitalize the idea of community by sitting alone in our room, tapping messages in our networked computers and fill our lives with virtual friends?" (Turkle, 1998, p. 382).

- Specific impacts of the real learning spaces are lost. Learners and teachers cannot become accustomed to their 'home room', cannot develop a feeling for it and become conscious of it, and they cannot feel sheltered and safe. The learning space cannot become the scene of successful learning experiences or failures.
- The "interdependence of all actualities in the same situation in learning space" (Lewin, 1982), the "close interaction of all factors in a learning situation" (Winnefeld, 1971) and the "dynamic interacting processes of rigid reciprocal relations" (Heimann, 1962, 1976) are essential pedagogical criteria for describing processes in the learning group. Not only are they no longer significant, but have disappeared altogether, as they cannot be applied in distance teaching situations.
- Learning and teaching can no longer be experienced as a unity of space, time and ritualized interaction. Therefore learning events can no longer be positioned and float somewhere in uncertainty. The context of space and time, which has been significant for learning and remembering, is lost. The often quoted formula "lost in cyberspace" is telling.
- Students do not experience the originality of persons and authentic objects or situations. Persons, objects and situations are represented merely symbolically, by print or images, which can be repeated often. Only a secondary deduced reality of learning and teaching can be reproduced. The aura of persons and events is lost.
- The usual social, cultural and historical context of teaching and learning volatilizes or is decreased.

Such losses are deep and far-reaching. Live experiences of learning and teaching are reduced, parceled out, disrupted. This skepticism is not very common. Optimistic progressiveness and enthusiasm for technological advances induces pedagogues and students, especially the younger ones, to ignore such deep changes and to disregard the qualities inherent in traditional education.

However, the problem of how to deal with the consequences of the revolutionary impact of distance education is complex. It is not easy to arrive at solutions. Total or radical change is always disruptive. When we move into a new house we have to leave an old one behind. However, opinions are split between older and younger generations.

Seemingly the issue may no longer be poignant to those who are already convinced that the revolutionary impact of distance education is just another hallmark of a general societal change in which the world is becoming irrevocably digital. This process will continue in spite of justified objections and reservations. This may lead to a situation similar to that of historical rural man who had to come to terms with an industrialized society. The change from industrial man to post-industrial informational man has similar anthropological dimensions. The digital "natives" (Palfrey & Gasser, 2008) of the "Net generation" (Tapscott, 1997) who have grown up using networked computers continuously for computer games and information gathering will differ intellectually

and attitudinally from digital immigrants. They will have assumed a new sense and sensibility and quite a different outlook. It may well be that members of this generation will no longer lament the loss of traditional pedagogical conditions and of valuable elements of our *Lebenswelt* as they represent an entirely new type of person.

Summary

Having described and interpreted the development of distance education so far it is safe to claim that its industrialization has caused three fundamental structural changes. Each of them emerged from a different historical, socio-political background in specific stages of industrialization, each of them brought entirely new pedagogical concepts and their implementation. Each of them was based on advanced educational technology, especially print, multimedia and networked computers; each of them established new institutional settings, attracted new types of students and elicited new teaching and learning behavior. We have experienced a revolutionary adaptation of teaching and learning to new technological and social conditions. There is no other form of teaching and learning that has broken away from tradition so sharply, that is so flexible and conducive to further societal changes of the post-industrial knowledge society. Distance education achieved a first significant breakthrough in the reform of higher education.

4 The Greatest Achievement of Industrialized Education: Open Universities

This chapter provides information about an outstanding phenomenon that most educationalists are scarcely familiar with: the establishment of more than eighty single-mode multimedia distance teaching universities in many countries in the world over the last decades. The specific feature of these open universities is that they were inspired by and patterned on the model of the British Open University and in accordance with its inherent philosophy. These 'open universities' differ sharply from conventional campus-based universities as they aim mainly at adults in employment and use special configurations of multi (mass) media and methods of distance education. They have contributed to meeting large scale learning needs arising from social and economic change through organizational innovation and the exploitation of technology (Farnes, 2000, p. 76). They "are charting new territories in higher education" (Daniel, 2007, p. 1).

Part I: Advanced Orientation

During the last four decades we have seen a new development in the history of distance education: the emergence of single-mode "distance teaching universities" worldwide. These universities are modeled more or less on the Open University in the United Kingdom. This development caused a sensation among educationists in the 1970, as the establishment of large universities catering exclusively for distance students was an incredible innovation.

Forerunners

However, before analyzing this new type of a distance teaching university it is appropriate to remember that they had some forerunners that operated mostly unnoticed: the University of London, the University of South Africa and the four All-Union Correspondence Teaching Universities of Applied Sciences in the Soviet Union. Each of these universities dealt with the problem of teaching at a distance in their own new way and thus contributed to the development of distance education.

The *University of London* was established by Royal Charter as early as 1836. This university did not teach at a distance at all, but limited itself to conducting academic examinations and to conferring the "London External Degree" (Bell & Tight, 1993). The candidates were expected "to study on their own and to work towards this degree without any guidance or help" (Perry, 1976, p. 2). Many of them registered at this university because they were living in one of the colonies of the British Empire and could not afford regular academic tuition at the Universities of Oxford or Cambridge. However, they were supported by several English *correspondence colleges* that specialized in preparing students for sitting examinations at the University of London. In 1900, the University of London began to provide teaching and support *itself* for external students. At present the "University of London External System" offers a flexible way to study for 41,000 students. This university was "the first unconventional model of an examining university whose degrees are accepted world-wide" (Wedemeyer, 1981, p. 69). It is remarkable because of its world-wide reach, and its radical insistence on autonomous learning.

The *University of South Africa* (UNISA) was established in 1873 by Royal Charter as an "examining university" as well. It was not until 1946 that it assumed the functions of a regular distance teaching university by establishing a correspondence study system. UNISA is the oldest single-mode distance teaching university. Teaching takes place by providing a

study guide, formal and informal printed courses and study packages, a brochure, support by answering questions online, and advice in several regional administrative branch offices. At present this university caters for nearly 200,000 students and is therefore a mega-university as well (Daniel, 1996).

There is no doubt that the University of South Africa has made a considerable contribution to the increase in the equality of educational opportunity. This can be verified simply by referring to the large number of students currently enrolled who were unable, for whatever reason, to study at a traditional university and who have received an opportunity to obtain a university education. Even more convincing is the high absolute number of graduates from the university. Both figures must be evaluated even more positively because they contain considerable numbers of Africans, Indians and colored, from the previously disadvantaged majority and the equally disadvantaged minorities. During the period of racial segregation this university was the only institution of higher education that enrolled white and colored students alike. Consequently, the university takes pride in the fact that notable persons, for instance, Nelson Mandela and Desmond Tutu and several African political leaders, earned their degrees here. Certainly we have to honor this achievement. UNISA has fulfilled a remarkable humanitarian mission.

In the former Soviet Union four All-Union Correspondence Universities of Applied Science were founded in the twenties of the last century. Whereas most universities were expected to offer correspondence courses in addition to their standard face-to-face tuition on a local and regional basis only, these four autonomous universities enrolled correspondence students only who lived in all parts of the Soviet Union. Once a year the students were required to be present in Moscow or Leningrad in order to take part in face-to-face consultations, hands-on seminars and to sit an examination. This quite often meant that students had to put up with long railway journeys, which in some cases were extremely long.

The Rise of the 'Open Universities'

For pedagogues and educational reformers it was nevertheless a bolt from the blue when the first Open University was founded in the United Kingdom in 1969. They realized that this Open University was not just another distance teaching university but an entirely new type of an institution of higher education, because it was based on new educational ideas and pedagogical approaches. As such it was not comparable to its forerunners nor to any other university in the world. In spite of the solid skepticism of academia, experts became aware that this radical innovation could help to approach and tackle serious educational problems – including those that cannot be solved at all by campus-based universities.

The sudden appearance of this new university was nothing less than a pedagogical marvel. Soon educational and government experts in many countries were struck by this novel university, analyzed it and used it as a model for innovating higher education in their own countries. To date, more than eighty such universities have been established (see Table 1). The global spread of this new model of academic teaching and learning and the adoption of its typical structural elements within the relatively short time of about forty years is an absolutely new phenomenon in the history of education.

Overview

The following list is included to demonstrate how many open universities have been founded during the last decades and to give an idea about the size and significance of the *open university movement*:

No.	**Year of foundation**	**Name of open university** (original or in English)	**Acronym**	**Country**
1	1960	Beijing Open University, *(former name: Beijing Radio and TV University).**	OU Beijing	China
2	1969	**The Open University**	OUUK	United Kingdom
3	1970	Athabasca University	AU	Canada
4	1972	Universidad Nacional de Educacion a Distancia	UNED	Spain
5	1972	Korea National Open University	KNOU	Korea
6	1973	Open University of Israel	OUI	Israel
7	1974	Allama Iqbal Open University Islamabad	AIOU	Pakistan
8	1974	FernUniversität in Hagen	FU	Germany
9	1977	Universidad Estatal Costa Rica a Distancia	UNED,CR	Costa Rica
10	1977	Universidad National Abierta	UNA	Venezuela
11	1978	Sukhothai Thammatirat Open University	STOU	Thailand
12	1978	Ningxia Open University	NiOU	China
13	1978	Liaoning Open University	LOU	China
14	1979	**The Open University of China**	OUC	China
15	1979	Tianjin Open University	TOU	China
16	1979	Hebei Open University	HOU	China
17	1979	Shanxi Open University	SOU	China
18	1979	Inner Mongolia Open University	IMOU	China
19	1979	Shanghai Open University	ShOU	China
20	1979	Zhejiang Open University	ZOU	China
21	1979	Anhui Open University	AOU	China
22	1979	Fujian Open University	FOU	China
23	1979	Shandong Open University	ShOU	China
24	1979	Nanjing Open University	NOU	China
25	1979	Ningbo Open University	NiOU	China
26	1979	Qingdao Open University	QOU	China
27	1979	Xiamen Open University	XOU	China
28	1978	Guangdong Open University	GOU	China
29	1979	Guangxi Open University	GiOU	China
30	1979	Heinan Open University	HOU	China
31	1979	Guangzhou Open University	GuaOU	China
32	1979	Jiangxi Open University	JOU	China
33	1979	Henan Open University	HOU	China

34	1979	Hubei Open University	HuOU	China
35	1979	Hunan Open University	HunOU	China
36	1979	Wuhan Open University	WOU	China
37	1979	Sichuan Open University	SOU	China
38	1979	Chongqing Open University	ChoOU	China
39	1979	Shenyang Open University	ShOU	China
40	1979	Guizhou Open University	GuiOU	China
41	1979	Chengdu Open University	ChOU	China
42	1979	Yilin Open University	YOU	China
43	1979	Heilongjiang Open University	HOU	China
44	1979	Dalian Open University	DOU	China
45	1979	Changchun Open University	ChaOU	China
46	1979	HRB Open University	HOU	China
47	1979	Shaanxi Open University	ShaaOU	China
48	1979	Xi'an Radio and TV University	XOU	China
49	1979	Ganzu Open University	GaOU	China
50	1979	Qinghai Open University	QiOU	China
51	1979	Xinyiang Open University	XiOU	China
52	1980	Shenzhen Open University	SheOU	China
53	1984	Bingtuan Open University	BOU	China
54	1985	Indira Ghandi National Open University	IGNOU	India
55	1986	National Open University,	NOU	Taiwan
56	1986	Yunnan Open University	YNRTVU	China
57	1987	Kota Open University	KOU	India
58	1987	Nalanda Open University	NOU	India
59	1987	Payame Noor University	PNU	Iran
60	1988	Universidade Aberta	UA	Portugal
61	1989	The Open University of Hong Kong	OUHK	China
62	1989	Yashwantrao Chavan Maharashtra Open University	YCMOU	India
63	1990	Open University of Sri Lanka	OUSL	Sri Lanka
64	1991	Madhya Pradesh Bhoj (Open) University	MPBOU	India
65	1991	National Open University	NOP	Taiwan
66	1991	Al-Qud Open University	QOU	Jerusalem
67	1992	Bangladesh Open University	BOU	Bangladesh
68	1993	The Open University of Tansania	OUT	Tansania
69	1994	Dr. Babasaheb Ambedkar Open University	BAOU	India

70	1996	Karnataka State Open University	KSOU	India
71	1996	University of the Philippines Open University	UPOU	The Philippines
72	1997	Netaji Subhas Open University	NSOU	India
73	1997	The Hellenic Open University	HOU	Greece
74	1997	The Open University of Kohsiung	OUK	Taiwan
75	1999	Uttar Pradesh Rajarshi P. Rajarshi Tandon Open University	UPROU	India
76	2002	National Open University of Nigeria	NOUN	Nigeria
77	2002	Tamil Nadu Open University	TNOU	India
78	2002	Pan Arab Open University	AOU	Kuwait
79	2002	Arab Open University Branch	AOU	Bahrain
80	2002	Arab Open University Branch	AOU	Egypt
81	2002	Arab Open University Branch	AOU	Lebanon
82	2002	Arab Open University Branch	AOU	Oman
83	2002	Arab Open University Branch	AOU	Saudi Arabia
84	2005	Krishna Kanta Handique State Open University	KKHSOU	India
85	2005	Pundit Sunderlal Sharma Open University	PSSOU	India
86	2006	The Global Open University	TGOU	India
87	2006	Uttarakhand Open University	UOU	India
88	Proposed	Wawasan Open University College	WOUC	Malaysia
89	Proposed	Cyprus Open University	COU	Cyprus

Table 1: List of open universities

** The former Central Radio- and Television University and the 44 former provincial radio and television universities have been renamed in open universities in 2009.*

Open Virtual Universities

Some of these open universities have already transformed themselves from an open distance teaching university with integrated digitized pedagogical approaches into complete "open virtual universities". VOC started even as a virtual university.

No.	**Year of foundation**	**Name of university**	**Acronym**	**Country**
1	1995	Universidad Aberta	UA	Portugal
2	1995	Virtual University Catalonia	VOC	Spain
3	2005	University of Maryland University College	UM-UC	USA
4	1993	Capella University	CU	USA
5	2009	African Virtual University	AVU	Kenia and nine more African universities

Table 2: List of open virtual universities

Characteristic Features of Open Universities

Openness

Most of the listed distance teaching universities call themselves officially "open". In these cases this has not been the adoption of a popular term, but signifies an ambitious long-range reformatory project. It was already announced by Lord Crowther, the first Chancellor of the Open University, in his 1969 inaugural address (cf. Tunstall, 1974, p. X): *"We are open 'as to people'; 'as to places'; 'as to methods'; and finally' to ideas'."*

According to this programmatic commitment "openness" does not refer to the abandoning of the requirement of university entrance qualifications in the first line, although this particular provision was especially spectacular for reasons of institutional policy. Observers voiced enthusiastic consent and vehement opposition especially with regard to this particular regulation. But according to the presented definition of openness, also universities which still insist on university entrance qualifications can nevertheless be "open" in many ways.

Important is that these open universities usually offer extensive continuing education programs which can be studied if entrance qualifications are missing. Usually, substantial parts of the respective student body, often ten thousands or even hundred thousands of students, are involved in these forms of open learning. Furthermore: The new institutions are open as to adults, gender, places, methods, technical media and contents of learning. Important is the goal of being open for the underprivileged und underserved of society. "Education for all" and "Equality of educational opportunity" and "Equity" are the catchwords of these open universities. Insofar it is correct to include distance teaching universities who do not call themselves officially "open university", but belong to the groups of universities whose founders were inspired and encouraged by the sensational success of the Open University UK in the above list of fifty open universities.

"Imported" or "indigenous" models?

The term "open" has become well-liked and even trendy worldwide during the last decades. Therefore it is often adopted also by universities which originate from other educational concepts. The Chinese Radio and Television Universities, for instance, are distance teaching universities of a special kind. Although "(m)odelled on the British Open University" (Runfang, 2008, p. 329) and similar to it with regard to their use of the mass media radio, television and print, which are also combined with local tutorial face-to-face group meetings, these institutions naturally adapted to the socio-economical and political conditions of their country. This can be said about all replications of open universities abroad. In China this meant, for instance, "vocationalism in curricula, Confucianism in their teaching methodology" and "control by central and local governments". This is the reason why Wei-yuan Zhang and Namin Shin in their comparative study found that the Chinese RTV Universities are "indigenous" – whereas the Indira Gandhi National Open University and the Open University of Hong Kong are "imported" institutions (Zhang & Shin, 2002).

However, because of the overriding importance of their substantial contribution to distance education, which is scarcely known and should be recognized in the west (see Box 1) the Chinese Radio and Television Universities are included in the list of open

universities as well. This seems to be appropriate for a number of reasons. Some of them started early to call themselves informally "open", for instance the former Radio and Television University of Shanghai. At the same time Chinese Radio and Television Universities were also informally referred to as "open universities" in literature (e.g. Ji Dingquan, 2004), and above all: Since 2009 the former Central Radio and Television in Beijing and the 44 regional Radio and Television Universities have adopted the official designation "open universities". Together they represent the present Open University of China (OUC).

The adoption of the designation Open University of China (OUC) is so far the latest significant occurrence in a remarkable reform movement which started in 1969 when the Open University of the United Kingdom was founded. This movement brought the adoption of the concept of the "open university" and the proliferation of autonomous single mode distance teaching universities worldwide. They initiated, supported and realized a radical new approach to higher education and provide new opportunities for the establishment of "mass higher education". At the same time they show that the concept of "industrialized learning" is still valid and legitimized even in the period of post-industrialism.

Box 1: The Open University of China (OUC)

The Chinese Open University is a single mode distance teaching university. It emerged from a developed and consolidated system of radio and television universities that was established in 1979 everywhere in the country. The present Open University of China consists of the Central Open University in Beijing, 44 provincial open universities and about 1,000 local open universities. They offer multimedia courses through digital radio, satellite transmission, digital TV, printed material, audiovisual material, networked computers as well as through obligatory face-to-face session in local tutorial centres. Target students are learners preparing for jobs in business and industry, learners living in rural areas, in remote areas, in areas inhabited by minority groups as well as disabled persons. Faculties consist of academic teachers specialized in distance education as well as of about 1,000 eminent scholars especially for giving TV lectures. This system of open universities is probably the largest distance teaching organization in the world and falls into the category of "mega-universities" (Daniel 1996). The total number of undergraduates at present is 690,000. However, this system is also responsible for teacher training and in-service training and for adult higher education. This means that – taken all together - the number of all undergraduates exceeds one million. From 1990 to 2008 the number of graduates amounted to 20,820,000. After a long and extensive evaluation project the Ministry of Education considered the Open University "as an independent educational form in the modern national educational system and the lifelong learning system" and greatly welcomed it "as an important form of lifelong learning for the general public". *Source: http://en.crtvu.en/about/structure, 12.11.2009*

Specific Features

The emergence of so many entirely new institutions of higher education is remarkable in several ways.

- They are usually the product of governmental planning and fulfill a national mission.
- They provide educational opportunities to a larger segment of the population.
- They reach previously unreachable: new groups of students who have up to now been barred from enrolment.
- They introduce and consolidate formal and informal studies for adults.
- They show an inherent tendency towards large-scale operations, even towards mega-universities, a previously unknown phenomenon. Quite a number of them cater for several hundred thousand students, and CCRTVU and IGNOU for over a million. These mega-universities "provide a powerful response to the crisis of access and costs" (Daniel, 1999, p. 8).
- They pave the way from elitist to mass higher education.
- They cross regional and national boundaries easily and promote educational globalization.
- They have constructed a new model of higher education that is thoroughly industrialized. They apply management methods, organizational techniques, advanced technical communication media and new appropriate methods of teaching and learning. This means that the pedagogical structure of higher education has been changed drastically as well.
- They accumulated rich and detailed experience with the systematic use of multimedia and new information and communication technologies in higher education.
- They are beneficial in terms of cost effectiveness.
- They mark a significant departure both from conventional higher education and from traditional correspondence education.
- They are just emerging from non-traditional status" (Keegan, 2004, p. 98) and moving into the center of main stream of higher education.
- They are a milestone on the way towards the transformation of a university into an institution of independent learning.
- They are in line with universal post-modern trends of "delimiting" and "destructuring traditional institutions" and "individualization" (Kade, 1989; Arnold, 1996).

Different Degrees of Awareness

Educational specialists are aware of the powerful impact of these open universities on the innovation of higher education. They call the new institutions "the most dynamic and revolutionary component of education" (Yibing, 1998, p. 3), and their emergence "perhaps the most important" event "since the birth of the ancient universities in the Middle Ages" (Garcia-Garrido, 1988, p. 200), "the most radical challenge yet to the traditional concept of a university" (Keegan & Rumble, 1982, p. 24), and "the most developed stage yet in the evolution of a concept of a university" (Keegan, 1993, p. 67), "a revolutionary change, a breakthrough in higher education" (Guri-Rosenblit, 1999, p. XVII), and "a distinct phenomenon in the evolution of tertiary distance education over the last 150 years" (Curran, 1996, p. 21).

On the other hand, the international spread of open universities, although very significant because of its pedagogical, social, and educational innovations, has not yet become part of the collective consciousness, and even most educationists are scarcely aware of it, especially in countries in which open universities could not be founded or succeed.

Part II: Origins

The appearance of these open universities in so many countries all over the world in the last three and a half decades was not a coincidence. It was the product of the simultaneous occurrence of new educational ideas, convictions and challenges, the impact of new technical media, of new pedagogical approaches, economical needs, and the growing awareness of the legacy of correspondence education.

New Educational Ideas and Challenges

A deeper understanding of the motives which led to the foundation of such an extraordinary new institution of higher education can only be obtained by a short view on the "movement towards open learning" (see Paine, 1988). In the 1960s and seventies educators and politicians were exceptionally reform-minded in many countries. They believed that the welfare of society can be considerably improved by education. An intellectual, social and political climate existed in which the "open learning movement" could develop.

After the Second World War higher education was "still the domain of upper and upper middle classes in Europe" (Ramanujam, 1995, p. 17). In many countries universities tended to work in seclusion, in Germany in "remoteness and freedom" (Schelsky, 1963) and in Great Britain in a "narrowly elitist educational system" (Bell & Tight, 1993, p. 133). Experiments were made with alternative organizational forms of higher education as a reaction to the ideas of "Open Learning" and "Education for all". The opinion spread that gifted persons of all classes should be admitted to higher education. "Equality of educational opportunity" was the catchword. "Education for All" became the motto of the Open Universities of Hong Kong and of Korea. Meanwhile "Equality of educational opportunity" is even considered "an imperative for world security" (Daniel, 1999, p. 5).

In the seventies open learning experiments became "the most important innovation in post-secondary education" (MacKenzie, Postgate & Scupham, 1975, p. 502). They widened access to university study for persons who could not attend conventional full time higher education, provided part-time higher education, succeeded in applying modern technical communication media and developed new ideas about adequate curricula and individualized and autonomous learning.

In Great Britain the trend towards open learning impressed many educationists and politicians. Their ideas were collected and reviewed by Nigel Paine (1988). The first realizations of the concept were the Open Tec Programme, the Open College, and the National Extension College. The Open University was to follow. In the USA the discussion of this new approach was lively as well and led to quite a number of experimental efforts. According to Charles A. Wedemeyer this movement was a reaction to "the general societal uncertainty respecting all conventional education, the effects of continued industrialization, the push for civil rights and full democratization, the unrest of youth in the sixties, political radicalism, changing needs and lifestyles, the yearning for some measure of control over

personal destiny, disillusionment with institutional inflexibility, even a growing sense of the importance of education throughout life – all of these continued to the eruption of concepts and innovations that have marked a watershed in all levels of American education, not only in higher education" (Wedemeyer, 1981, p. 60). In this situation reformers strove for the establishment of "non-traditional" and "alternative" forms and institutions of higher education for adults (Cross, 1981). High ranking committees explored the possibility of such new approaches (Commission, 1973; NAEB, 1974; Gould & Cross, 1977). Famous foundations financed them.

New Technical Media

The advent of television gave a boost to the ideas of those who favored the use of broadcasting for educational purposes. Enthusiastic instructional designers believed that radio and television could not only transport but also innovate and enhance education. A new academic discipline – educational technology – emerged in this period. It was to become especially important in open universities, which quite often established special units for the application of educational technology. The idea of mass higher education developed. Harold Wilson, the leader of the British Labour Party, announced the establishment of a "University of the Air", based mainly on radio and television, in 1963.

New Pedagogical Approaches

The supporters of this movement envisaged that by the application of new technical (mass) media and the development of innovative teaching methods could be achieved. They expected to that also a new learning behavior would be elicited. Behind these educational goals were strong political, economic and social motives.

A fundamental message of this movement was that the acquisition of knowledge, skills and attitudes should be open to all. Nobody should be excluded (principle of egalitarianism). Traditional educational barriers were to be removed, e.g. the financial difficulties of those whose income is too low, gender-specific educational practices, unfavorable socio-cultural milieus or membership of minority groups (principle of equality of educational opportunity). Furthermore: Learning should no longer be bound to defined life cycles or to defined locations and times. It must be possible to learn at any time and everywhere (principle of lifelong and ubiquitous learning). Teaching programs should not be completely developed and determined beforehand in an empirical-scientific manner, but should be 'open' for unforeseen developments in the build-up of individual ability to act (principle of flexible curricula). The course of learning should not be stipulated rigidly and independently of the students, but start from and be shaped by their individual value perspectives, interests and experiences (principle of learner-orientation). Students should not be the objects but the subjects of the teaching process. For this reason, learning and teaching institutions should be created in which students can organize their learning themselves (principle of autonomous learning). Learning itself is not initiated and steered by means of ritualized presentation and reception processes, but by discussion and active management of the student (principle of learning through communication and interaction).

Economical Needs

The movement towards open learning created a general atmosphere of educational optimism and raised hopes for innovation in higher education, but this did not really lead to the establishment of open universities. The ulterior motive for a revolutionary change of this nature was the desire to overcome economical needs. It was the need to surmount economic stagnation in industrialized countries and economic backwardness in developing countries. The real factor that led to the establishment of open universities was the determination of politicians to improve their countries' economic situation. The examples of Great Britain, Germany, India and China show this clearly.

The Legacy of 'Correspondence Education'

When government officials and educational planners explored possibilities of producing a more educated and trained workforce in order to solve acute economic problems they could not overlook previous experiences with teaching at a distance in higher education. This was facilitated as in those years this kind of learning was analyzed for the first time by academics (Holmberg, 1960, 1977; Peters, 1965, 1967, 1968, 1971; Wedemeyer, 1971, 1977; Moore, 1976, 1977). The "legacy of distance education" (Daniel, 1998a) attracted their interest not only because it was based on printed material – another mass medium – and communicated by post, but also because it represented a humanistic tradition by reaching the needy, underserved, and socially disadvantaged as well.

In Britain there is a long and varied tradition of correspondence education at the level of higher education which reaches back to the middle of the nineteenth century (Bell & Tight, 1993). Universities in the USA started correspondence study courses as part of their university extension programs at the end of the nineteenth century. (Houle, 1965; Bittner, 1920; Bittner & Mallory, 1933). In the former Soviet Union, correspondence study ("study without interruption of employment") was one of the official three modes of study at most universities – besides on-campus and evening study (Anweiler, 1963). Their unconventional approach to educating workers in such an extensive way attracted the attention of Harold Wilson when he visited this country (Guri-Rosenblit, 1999, p. 8). He was to become the most influential originator of the idea of a University of the Air which prepared the way towards the first Open University in Britain.

The origin of open universities was a complex societal process. Only the merger of these five developments can explain the nearly simultaneous appearance of open universities in many countries of the world in the same period of time.

Part III: Educational Issues

New Educational Policies

Stimulated by ideas and ideology of the movement towards open learning a growing number of governments and educational experts became interested in distance education and decided to experiment with it on a large scale? There had been a general effort to adapt learning and teaching to the requirements of technological progress and of the changing post-industrial knowledge society. Demographical developments and social, economic and technological changes and their acceleration had created new and pressing educational needs. For instance, in the 1970s, it became necessary "to increase the number of graduate teachers and qualified scientists and technologists" in the United

Kingdom (Rumble & Harry, 1982, p. 170). The acute problem was how to educate more graduates in addition to those coming from traditional universities. The idea was that distance teaching universities could help to tap the pool of adults who wish and are able to receive a higher education, but had had no chance to do so. Its realization is a distinct turn of educational policy.

Walter Perry, the first Vice-Chancellor of the Open University in the United Kingdom, explained the willingness of governments to establish distance teaching universities in this way: "The biggest singular factor probably is that an increase in the number of educated people in a nation is achieved faster this way than any other." He stressed the speed in which "very few teachers…reach lots of students". His second explanation was that "the cost per student is very low, indeed" (Perry, 1986, p. 17).

Accomplishing Educational Reform

Usually, governments venturing into the establishment of new distance education provision hoped to achieve particular goals of educational policy as well. Many tried desperately to bring about equality of educational opportunity. The "spread of egalitarianism in education" was another general goal (Perry, 1986, p. 1).

Luis Manuel Peñalver, the then Minister of Education in Venezuela and first Rector of the Venezuelan Universidad Nacional Abierta, who wrote a book on "La Revolucion Educativa" in 1976, argued that three broad principles have become significant for this university: "Democratization, innovation, and autonomous development". Even more: with the help of the new distance teaching university the educational system should be transformed from "an elite-oriented system of education into another, able to meet the new demands of massified education". He considered this response to the educational needs of his country to be an "educational revolution" (Rumble & Harry, 1982, p. 190).

Walter Perry (1986, p. 4) explained the ultimate goal of the establishment of the Open University in a similar way: He referred to the Robbins Report, which "insisted that the places in higher education should be made available to all those capable of profiting from them. There was a growing awareness of the national need for trained brain power, and for the extension of opportunity to all classes of the population, as a possible step towards the replacing of the elitist system that had been prevalent in Britain for many years.

Considering the reform steps realized at open universities the goal awareness and determination of its founders deserve credit. They created a complete new institution of higher education and applied entirely new forms of delivering education in order to achieve educational goals that had so far been neglected. They intended not only to produce more graduates in a new way, but also to establish a new system of effective academic continuing education and to make practicable contributions to the development of lifelong learning as well as to the combination of work and university study. All these measures had been discussed widely for decades by educationists and politicians, but only the foundation of open universities enabled them to succeed to a large extent.

Adaptation to the Educational Paradigm Shift

Open universities appear strange and unaccustomed to protagonists of campus-based education. They deplore the clear departure from their teaching traditions. However, these new open universities correspond to current educational trends. We "are witnessing throughout the world a transformation in teaching and learning which has all the hallmarks

of a paradigm shift, a fundamental shift in the way we think about knowledge and learning" (Hall, 1996, p. 10). There are shifts

- from teaching children and adolescents to teaching adults,
- from the admission of small to much larger numbers of students,
- from traditional types of students to new types of students,
- from oral communication to mediated communications, and
- from traditional functions of higher education to new functions.

It is easy to see that open universities have already shifted dramatically. They enroll mainly adults working for a living, they extend higher education to extraordinary great numbers of additional students, they focus on mediated and have developed a model of higher education that is student centered, based on vocational and professional experiences and on continuing education and also cares for the underprivileged.

The Reason of Success in Educational Policy

John Daniel, the second Vice-Chancellor of the Open University UK, has revealed the secret of the extraordinary success of open universities by giving a specific reason. He relates three characteristic problems of higher education to each other that have discomforted educational planners and politicians for a long time: access, quality and cost.

"Throughout history, education has been constrained by the iron triangle of quality, access and cost. When access is increased, people fear loss of quality. If costs are increased to prevent loss of quality, access will go down again, and so on. For conventional classroom education there is no way around this conundrum. Open and distance education is revolutionary because it does allow, through division of labour, specialisation and the economies of scale created by media and technology" the access-quality-cost triangle to be re-configured. Access can be increased, quality can be improved and costs can be cut, all at the same time. This is the revolution that open universities have achieved." (Daniel, 2008, p. 7).

Mandates

Universities are generally characterized by their performance of two main functions: the production of new knowledge, new understandings through research and the education of secondary school leavers in order to prepare them for professional careers. Open universities are to perform the same functions, but with different groups of students, by employing different methods and media and under entirely different circumstances.

In order to demonstrate how open universities differ from conventional universities we examine the reasons why they were founded. What are their mandates? Most open universities are expected to carry out particular tasks in order to fulfill a national mission. This can be illustrated by the following examples of some arbitrarily selected open universities.

Open university	**The open university is to**
UNED, CR Costa Rica	"widen educational opportunities" and to alleviate "social demand at a lower unit cost which could be achieved by expanding conventional universities" (Rumble & Harry, 1982, p. 75)
UNED Spain	"provide a second chance to those who for various reasons had lost the first" (Rumble & Harry, 1982, p. 151)
UNA Venezuela	provide "education for democratization, education for innovation, education for autonomous development" (Peñalver, 1979, p. 15)
OUUK United Kingdom	"increase the numbers of graduate teachers and qualified scientists and technologists" (Rumble & Harry, 1982, p. 170)
FU Germany	create additional capacity for academic study and thus increase the capacity of the German university system, develop a system of academic continuing education, and be engaged in the reform of university teaching (Peters, 1981, p. 14; 1979, p. 19)
OUNL The Netherlands	exercise an innovative influence on traditional universities, increase opportunities for adult education, for the disadvantaged, for women, for life-long learning (Leibbrandt, 1997, p. 102)
Arab Open Universities	"to provide higher education to the widest possible spectrum of learners" (http://www.arabou.org/synop.htm)
IGNOU India	establish a new flexible and cheap system that offers opportunities to those excluded from the formal system, equalize educational opportunity, and break the rigidities of the traditional university system with regard to curricula and modes of study (Perry, 1997, pp. 121-122), democratize higher education, promote education, training, research and extension activities based on the rich heritage of the country, promote education of the disadvantaged groups of the population (Ramanujam, 2002, p. 133)
BOU Bangladesh	provide formal and non-formal programs in order to take the university to the doorsteps of the common man and woman; emphasis is laid on non-formal programs for enhancing their skills (Ali, 1998, p. 158)
CCRTU China	"improve the general cultural and scientific standards of the whole nation", "educate more people at lower costs", "develop the Chinese economy" by educating millions of additional engineers and secondary-school teachers (Peters, 2001, p. 187). – "To provide higher education opportunities for business, the army, other members of society; to set up modern distance education public service support systems for colleges, universities and other educational institutions through the use of RTVU education resources" (www.crtvu.edu.cn)

Table 3: Examples of 'national missions' of open universities in nine countries

All in all these goals differ in several points from those of conventional universities: Open universities endeavor to expand the country's resources, produce more graduates at lower cost, provide for more equality of educational opportunity, cater for new groups

of adult students, develop additional forms of professional qualification, innovate higher education, and assist in developing and democratizing the country.

Organization

Open universities have to be organized in an unusual, specific way as they are expected to perform also tasks that are alien to all academic traditions. This was difficult before 1969 as there was no workable model for an organization of this type. Planners could not base their projects on experiences that had already stood the test of time. The first successful organizational model was created by the planners of the Open University of the United Kingdom. The full and detailed first-hand account on its organization, written by its first Vice-Chancellor, assisted many planners to take the Open University (UK) as a model (Perry, 1976, p. 214).

Two Main Organizational Systems

A fundamental problem of open universities is coping with two main tasks: organizing teaching and research and constructing and running a reliably functioning technological-organizational system that enables faculty to use technical media in order to communicate with students who do not assemble on a campus, but live and learn elsewhere. The unusual task is to integrate the system of knowledge production, course creation and dissemination and support into this complex technical system, which is a significant precondition for teaching at a distance at open universities.

The organization of *research and teaching* follows, as a rule, traditional patterns. This is naturally influenced by the prevailing national cultures of higher education. The respective academic units are "faculties", as for instance at the OUUK, UNED, FU, OUSL, AU, and KNOU or "departments" (Guri-Rosenblit, 1999), whereas the OUHK and OUB use "schools". The motive for establishing these units is to continue concentrated disciplinary research mainly in traditional ways in order to attain and preserve their academic respectability. At the Fernuniversität the departments have established 14 institutes for special disciplinary research. Some open universities innovate university teaching by promoting interdisciplinary projects on an ad hoc basis, for example the Open University of Israel up to 1996 (Guri-Rosenblit, 1999, p. 180).

How far does this organizational system for research and teaching differ from that of conventional universities? At first sight and with regard to faculty not very much. It is natural and understandable that academics of newly developed open universities have a tendency to establish organizations that correspond to those of traditional institutions. One reason for this is that they are erroneously committed to extend "education of equal value to that which could be received by traditional education" (Feasley & Bunker, 2007, p. 24). When different educational goals require different methods and media and when teaching aims at different students open learning must necessarily differ as well. It is this adaptation to new tasks which increases the value of open learning and not its comparability to campus-based instruction. By fulfilling these new tasks in new ways open universities should even be better – as being more adapted to societal changes. In spite of this faculty often believe that traditional academic organization is a precondition for academic success and respectability. Therefore, open universities are mostly patterned on traditional universities, but only as far as research and curriculum development are concerned.

The organization of the *operating technological system* fulfils these tasks: course creation, production and distribution, student services, management of tutors and counselors and quality control (Rumble, 1992, pp. 48-79). These functions are often performed in central service units, for example: (1) Instructional Design and Educational Technology, (2) Computing, (3) Student Support (4) Library and (5) Distance Education (and Institutional) Research. In order to perform these functions open universities run units, for example, "Technical Production and Distribution", "Study Centres", "Support Services", "Cooperation with Broadcasting Corporations" and "Quality Control".

In most of these units pedagogical and technical functions merge in a unique way. This means that, ideally speaking, all persons are dedicated to the mission of distance education and consider themselves as part of the complex teaching and learning process. All are committed to making the system work by professional communication and cooperation and they all develop a special expertise that cannot be found in conventional universities.

Governance

Open universities are usually managed on the respective patterns of traditional universities: There are presidents (or rectors, vice-chancellors), deans, academic faculties, schools, departments and university libraries. However, the technological-organizational system requires that they fulfill tasks alien to traditional universities: developing pedagogical implementation strategies, devising and applying regulatory mechanism in order to balance these complex systems, observing the sub-systems empirically (institutional research), defining strategies for change and controlling (coordinating dates, costs, quality).

The way in which the technological-organizational system is managed does not remain outwardly, but penetrates and influences all institutional parts and all activities. In fact, it merges even with the creation of knowledge. This also changes the very process of acquiring knowledge, of learning.

The necessity of this kind of involvement of the chief executives can be illustrated by my personal experiences at the Fernuniversität. A key problem of this newly established open university was to make it perfectly clear to all newly appointed faculty members, tutors and counselors that teaching at a distance is not traditional teaching transported by technical media. They had to gradually gain an accurate and deep understanding that teaching at an open university not only differs from teaching at conventional universities, but constitutes quite another pedagogical approach that must be fully understood and internalized. Finally, the traditional university must be transformed into an institution of independent learning.

This means also that both the executive head and the administrative head and their staff have to perform new and unusual tasks: to elicit a new attitude towards adult distance students; promote an understanding of the necessary role change of teachers, of the division of labor and cooperation with instructional designers and media experts in course teams; and provide insight into the necessity of applying management, evaluation and control techniques. According to my experiences, these processes take time, years even, but they develop by being involved in the complex teaching and learning processes. The chief executives of classical universities would never be expected to discuss pedagogical issues with their professors and staff.

Technological Structure

Open universities have a particularly close relationship with their technical media. Technical media and devices have constitutive significance, because these universities have to rely on quite a range of them. Without technical media and devices they could not exist. For this reason they are often called "media universities". They use technical devices for the production and delivery of teaching materials, and, even more importantly, to improve and enhance the pedagogical structure of teaching and learning. It is fair to say that open universities are pioneers in the application of modern technical media.

This task can only be fulfilled with the necessary number of staff, who must be balanced in the right way. In order to illustrate this by an example I will refer to the Fernuniversität, which caters for 45,000 students. In 2006 it employed

- 76 full professors (tenure),
- 353 lecturers and academic staff (full time),
- 397 mentors, students, assistants (part time),
- 711 non-academic staff (full time).

This composition of personnel differs from conventional universities as a relatively small number of full professors have to deal with a large number of persons who perform many specific functions.

The most common technical media used for teaching purposes are print, radio, television, audio and video cassettes, computer, the net, correspondence, e-mail, telephone and fax. Two approaches in particular are typical and represent marked innovations: multimedia and networked computers.

Multimedia

When the Open University of the United Kingdom was being planned and founded 'multimedia' was the slogan chanted by many educators in many countries. The use of several combined technical media to make teaching more attractive and effective was recommended by instructional designers. However, classical universities remained skeptical and found it disconcerting that the Open University decided to cooperate closely with BBC. The combination of print, radio and television meant the absolute departure from important academic traditions and conventions. In fact, this was the boldest pedagogical innovation in the history of learning. To reach masses of students who cannot attend regular lectures and seminars at a university and to develop teaching broadcasts professionally was a formidable challenge. Radio and television were particularly attractive and the cheapest way of delivering teaching programs into the homes of many students. Small wonder that in 1982 many open universities (for instance AU, CCRTU, UNED CR, OUI, AIOU, and UNA) had followed the British example and used radio and television as transport and teaching media (Rumble & Harry, 1982, p. 214).

The adoption of this multimedia approach created new and interesting pedagogical problems. Should educational radio and television broadcasts be used as delivering technology or as teaching media? Should these media offer regular obligatory or only supplementary optional learning programs? Which is to be the major technology? In the beginning most people thought that television would be the dominant medium because of its appeal and glamour. However, when A. W. Bates (1982, p. 9) analyzed the use of radio

and television in five open universities (AIOU, AU, OUI, OUUK, UNED) he found that there was a "move from broadcasting". It had changed from the center to the periphery of the learning environment. This process was partly influenced by the experience of students who found it more practical to work with audio and video tapes, but more so by a new awareness and reappraisal of the teaching power of print.

Printed course material, specially designed to meet the needs of distance students, now became the characteristic component of distance education. Rumble and Harry (1982, p. 212) observed that the situation was marked by a curious mixture of public identification with and stress on the use of educational broadcasting and the playing down of their real basis in correspondence teaching and the use of print". It is no small wonder that the Open Universiteit of the Netherlands and the Fernuniversität in Germany go without television. They use it for public relations purposes only.

In distance teaching universities in the Far East the role of broadcasting is quite a different one. At China's Central Radio and Television University television and radio broadcasts play an outstanding role. Here they represent the dominant media mainly used for delivering education. The system is reinforced by regular satellite transmissions that link the Central Radio and Television University in Beijing to "the network of 34 other open universities throughout the country" (Keegan, 1995, p. 116). The same can be said about the Japanese "University of the Air". The Korean National Open University also teaches mainly by TV and radio broadcasts (62 hours per week by TV and seven hours daily by radio). Their pedagogical concept is to use these media for presenting lectures. The carefully designed and tested course material seems to be alien to these open universities. Printed material has complementary functions only.

Different academic learning cultures are the reason for this approach. In these countries students venerate their professors and wish to see their faces on the screen. In China and Japan the outstanding role of these broadcast media can also be explained by the necessity to transmit the pronunciation of the words, which cannot be presented in print because of the ideographic characters of the script (Peters, 2001, p. 196).

Networked Computers

The advent of computers and the internet in the 1990s started to change the pedagogical structure of open universities again. The combination of these technologies provided a new distribution mode, an inconceivable potential for interactive information and communication and a unique possibility for enabling students to become autonomous learners.

All open universities started exploring the new virtual learning spaces. Course units and later whole courses were distributed and taught on the Net, virtual seminars and virtual examinations became standard components. Many units for developing new forms of learning and collaborating on the Net were established (Eisenstadt & Vincent, 1998). Quite a number of open universities assume and perform already functions of a future virtual university (Ryan, Scott, Freeman & Patel, 2000; Tiffin & Rajasingham, 1995, 2003; Hoyer, 1998; Unger, 2003; Rajasingham, 2004). The Universidad Aberta changed from its traditional distance education structure even to a completely digitized structure in 2005. Since 2000 the University of Maryland University College offers three complete digitized Master Courses.

It is true that "the development and utilization of interactive teleconferencing technologies and computer-mediated communication have accelerated both within distance teaching universities and classical universities" (Guri-Rosenblit, 1999, p. 141). It might therefore be assumed that this new approach is not a real characteristic of open universities. However, open universities were prepared to adopt and integrate this innovation in a distinct way. Teachers and students already had the attitudes, strategies and experience that support and facilitate the change that has become necessary. Advantageous institutional circumstances are added here, because at open universities not only the whole teaching body, but also the whole administration, a costly, complex organizational-technical operating system and various support measures are all geared exclusively to the learning requirements of distance students. Learning in distance education is structurally strikingly close to learning in virtual spaces.

Distributed and asynchronous learning, so often referred to as innovations of online learning, are nothing new to open universities. They have already developed special strategies for bridging the distance between teachers and students in pedagogical ways (Moore, 1993), whereby this is not always a matter of geographical distances but also of mental, social and cultural 'distances'. Teachers have already developed a positive attitude towards technical media based on thirty-five years of experience. An analysis of the development of the Fernuniversität shows that long before the advent of personal computers and the Net there were 34 isolated technical and pedagogical approaches to online learning, a development that is without parallel in conventional universities (Peters, 2003, pp. 91, 109).

As more and more students expect to be taught also in the digitized way it is of particular interest to see how this new technology is presently being used as an addition to distance education techniques. This can be illustrated by an example. The University of Athabasca

- develops special course home pages,
- provides students with additional online resources,
- recommends web activities,
- uses asynchronous computer conferencing software,
- adds community building tools to courses, and
- uses educational social software that allows for
- quite a number of new modes of interaction.

If we look forward to the near future online learning will soon be entirely adopted and become the standard way of teaching and learning. The pedagogical structure will then change radically as learning material is always available, communication is enhanced, cooperation and collaboration is possible and greatly facilitated, learning objects can be used, a wealth of information is at hand world wide, a high degree of connectivity can be reached, and great possibilities for developing autonomous and self-regulated learning are afforded (cf. Anderson & Kuskis, 2007, p. 297). The networked computer will facilitate this transformation greatly. Small wonder that the network "continues to constitute the single most important structural and organizing principle in the short history of distance education" (Woudstra & Adria, 2007, p. 565).

How far has online learning already penetrated learning and teaching at open universities? Bates (2008, p. 219) found already in 2002-2003 that in the public sector 12 per cent of distance students were already learning by using online programs exclusively. According to

him, the overall trend is towards more on-line courses and fewer print-based courses in distance education.

Pedagogical Structure

Six Components

Even the most sophisticated educational media are futile if they are not used in a pedagogical way. Teaching and learning at open universities grew out of the critique of traditional university teaching. They do not intend to reform traditional teaching and learning. They are in a continuous process of developing new systems of teaching and learning.

The pedagogical structure of teaching and learning can be characterized by the configuration and interplay of the following six components.

- The permanent, and not just occasional, use of the technical media already referred to.
- In many cases, the self-teaching course material. It is carefully planned, designed, developed and produced by teams of professional experts: subject matter specialists, television and radio producers, educational technologists and instructional designers, print editors and course managers. High quality courses can be developed in this way, which also include video and audio cassettes or home experiment kits. Although the development of this type of course material may take a year or longer, developing high quality self-teaching courses in this way becomes cost effective as soon as it is mass-produced and studied by a great number of students.
- Reading of recommended articles, reports and set books provided for by the system.
- Support in study centers. Typically, open universities establish nets of regional and local study centers where face-to-face counseling and tuition, classes, discussions and group work take place and where tutors or mentors contribute to the teaching learning system.
- Mediated communication between faculty and students by post, telephone, fax or email.
- Digitized learning. Computers, the Internet and the Web have grown during the last fifteen years at an unbelievable speed. Increasingly, students are studying their courses on-line or off-line with the help of CD-ROMs or DVDs. Communication and interaction with faculty members, tutors and fellow students develops in unforeseen dimensions. A significant asset of this digitalization of learning is the easy access to an inexhaustible supply of information.

Pedagogical Goals

It is necessary to understand that teaching and learning at open universities is based on a complex and integrated mix of approaches to learning. It requires new pedagogical approaches and new patterns of teaching and learning behaviors.

Working in such a distinctive learning environment, open universities strive to reach the following educational goals:

- New attitudes towards students are to be generated. This means that curricula and teaching modes must be adapted to the life situation of adult students. Peter Jarvis (1981, p. 24) suggested referring to principles of andragogy rather than to those of pedagogy.

- The benefits of curricular flexibility are to be reaped. Because teaching and learning does not have to take place at fixed times and at fixed places, the study programs can be flexible. Programs for continuing studies, up-date and refresher courses and programs in cooperation with the labor market can be developed, which means a great amount of variety can be achieved. Developed and tested courses can be changed and improved as soon as this is necessary. Modular units can be combined according to individual preferences. Entirely new approaches could be developed (Peters, 2003a). Printed courses can be easily adapted to scientific advances and changes in the working world with the help of other information and communication media. The most radical curricular flexibility can be achieved by enabling students to design and practice considerable parts of their learning themselves. Online learning in particular provides many new possibilities for the development autonomous learners.
- Advantage must be taken also of methodical flexibility. Open universities do not replicate traditional expository teaching and receptive learning. They are able to explore and to exploit the wealth of new possibilities provided by distance and online education to create new approaches. This assumes the significance of a pedagogical paradigm shift. The goal to be pursued is that of "guided self-learning" and, ultimately, autonomous, self-regulated learning.

Critical objections to this system of teaching and learning are rare. Tunstall (1974, p. XVII) pointed to paradoxes, problems and dilemmas (too many drop outs, abolition of lectures, inequality between one OU student and another). Doug Shale (1987, p. 9) referred to "innovations that did not work out" (technology did not really revolutionize higher education, radio and television are more difficult to use than was originally expected). Simpson (2005, p. 1) argued that "distance education will fail unless it can increase its rate of student success".

Students

In how far students of the second phase 'Open learning and distance education' differ from correspondence students has been described already in Chapter 3 (p. 43). This section deals with some typical aspects of students at open universities only.

- *Age:* Students vary considerably in their age. At the Open University Hong Kong the youngest is 20 and the oldest 72 years old (Annual Report 2004-2005, p. 69). This may be typical for all open universities. Sarah Guri-Rosenblit (1999, pp. 67-69) compared the students of five open universities: OUUK, UNED, OUI, FU and AU and presents the following findings: The median age ranges from 30 to 34 years. This is to be expected, because open universities are principally universities for adults. However, 10–30 percent of the student population of UNED, OUI, and FU are under 24 years old. Some open universities wish to relieve overcrowded conventional universities and admit younger students as well. For instance, at the Open University of Israel the under-24 age group constituted 46 per cent in 1996 (Guri-Rosenblit,1999, p. 69) and in China's Central Radio and Television University, which is to provide higher education for the great number of school leavers who remain unemployed, the median age was 24 years in 1994 (Runfang & Yuanhui, 1994, p. 70).
- *Educational background*: Four groups of students can be distinguished: (1) second chance students who are studying for the first time in their life with or without formal entry qualifications, (2) graduate students who wish to continue their studies after

some years in gainful employment, (3) those in possession of several degrees who are eager to acquire another one, and (4) ambitious persons in senior positions in business and industry who wish to qualify themselves for their further professional development. It is telling that at OU Hong Kong 57.5 per cent of the students are managers and professionals (Annual Report, 2005, p. 69). All these data indicate that the educational level of open university students is on average markedly higher than at conventional universities. The composition of their students varies from country to country due to different economical and cultural differences.

- *Gender*. Women are slightly in the majority at OUI and AU and in the minority at OUUK and FU (Guri-Rosenblit, 1999, p. 67). They are in the majority at Shanghai CRTU (Huang Qingyun (ed.), 1997, p. 11) and OU Hong Kong, with 54.6 per cent (Annual report, 2005). On the other hand women, at the Open University of Tanzania are with 13 per cent markedly in the minority (Bhalalusesa & Babyegeya, 2002, p. 584).
- *Status.* Open universities distinguish between graduate and postgraduate students, full-time and part-time students, single course students, and continuing education students. Open universities that teach via radio and television broadcasts are also open to the public and often have millions of free listeners and free viewers – an unexpected realization of the slogan "Education for All".
- *Courses.* Students in full employment usually enroll in degree programs as *part-time students* or even as *full-time students*. In Britain, the Open University dominates in the provision of part-time undergraduate places for adults. They have established twice as many of these places as all other institutions in the country (Runfang, 2008, p. 286). In Germany, a third group comprises students at *conventional* universities who are eager and permitted to use the pre-prepared course material of the Fernuniversität and to acquire experience in studying at a distance. Many students enroll in *non-degree education and training programs*, for instance at UNED; OUUK, FU, PNU, UPOU, KNOU and STVU Shanghai. They usually constitute a considerable section of the student population, in particular in developing countries. In order to learn something about the nature of these programs we can take a look at those at STVU Shanghai: "In-service training", "Professional qualification", "Leadership Education", "Continuing Education" and "Programmes for the Aged" (Information Brochure, 1997, p. 15). Bangladesh Open University even has the explicit mandate to emphasize non-formal education. Here, half of the students are enrolled in non-formal studies in order "to make them more conversant with things that touch their lives: health, hygiene, nutrition, agriculture, environment and what not!" (Ali, 1998, p. 158). This open university performs the task of improving the living conditions of its students. In order to remind us of the humanitarian mission of distance education, Vice-Chancellor Ali (1998, p. 158) reports that "a focus of the BOU is on the needs of the poor and underprivileged people of society".

Faculty

It is not easy to describe the teaching academics at open universities. It is not possible to draw a clear picture of them, because teaching is organized in an industrialized way in the form of "systems approach" (Moore & Kearsley, 2005, p. 33). This means that the task of teaching is divided into several functions, which are performed by different persons: subject matter specialists, mass media experts, educational technologists, tutors,

mentors, moderators, counselors, markers of tests or essays, evaluators, external course-writers. All of them cooperate and convey a diverse picture of the teaching process.

In spite of this the *academic faculty* is naturally of overriding importance. The professors and their staff are not only 'subject matter specialists', but also and often mainly responsible for research in order to produce new knowledge. This is important for gaining recognition and prestige in professional associations and the scientific community. Both enhance the quality of teaching, motivate students and improve the status of the institution. Usually a considerable core of fully-fledged and full-time professors with tenure is responsible for the academic development of their disciplines. If there is only a small nucleus of full-time professors who are compelled to cooperate with changing part-time academics from other universities, the university can neither develop its own scientific accomplishment and academic identity, nor establish its academic reputation.

Full professors conduct their research, train their academic staff and take an active part in university committees very much in the same way as at conventional universities. But they differ entirely in their teaching behavior. They do not lecture, but engage themselves in course writing together with experts of educational technology in 'course teams', or together with members of their staff. They are challenged by quite another teaching-learning environment. They are ready and able to deal with adult students and to take into account their special living conditions, to work with technical media (of necessity and not as an option), to explore new virtual learning spaces, to develop a favorable attitude to professional upgrading and life-long continuing education and to be an active, adaptive part of a complex technical-organizational system. Above all they are to develop a habit of cooperating with experts both inside the university, especially with educational technologists, instructional designers, and outside, in particular external course writers and leading representatives of their disciplines.

Cost Structure

Open universities were founded in the belief that they are able to cater for far more students than conventional universities at lower costs. This belief was based on the experiences of first generation correspondence education, which distributed self-teaching printed material with minimal or no two-way communication. This led to the idea that mass production and mass distribution of objectified self teaching material must have the benefit of economies of scale. Because open universities are able to enroll students from a wide catchment area they are able to reach great numbers, often even extraordinarily great numbers, of students, and can, indeed, reap the benefit of economies of scale.

This belief was partly confirmed by the experience that the industrialization of teaching and learning could bring the cost down. Ford managed to mass-produce first-rate cars in an industrialized way that were relatively cheap and could be sold to broad sections of society. In a similar way it was thought that education could be mass-produced and distributed and become available for broader sections of society at lower costs. This is exactly what takes place at large open universities. The assumption that this industrialized form of teaching is cost-efficient is furthermore substantiated by the argument that teaching great numbers of students without providing and maintaining the expensive infrastructure of campuses at many places must be particularly cost efficient.

The idea of the cost efficiency of mass instruction is convincingly supported by a Chinese experience: an eminent professor lectures in front of several TV cameras in a

studio run by the Central Radio and Television University in Beijing knowing that more than several hundred thousand students everywhere in this huge country are listening to him attentively and taking notes at the same time.

All these notions were reaffirmed by Sir John Daniel (1999, p. 39), the second Vice-Chancellor of the Open University in Britain, who speaks of the "superior cost effectiveness of the mega-universities, but not necessarily of the smaller distance teaching institutions". A government review of the UKOU compared the costs per graduate with three other institutions in 1991. "The UKOU costs were significantly lower, between 39% and 47% of the other universities' cost…" Daniel referred also to similar results at the Centre National d'Enseignement par Correspondence, Radio and Télévision in France and CCRTU in China.

However, it is extremely difficult to quantify the cost efficiency of open universities (Rumble, 2004; Hülsmann, 2000). It is necessary to examine the development cost, unit cost production, distribution cost, support cost and relate these to the number of students. Much depends on the kinds of media that are used. If open universities base their teaching mainly on print, radio, and audiocassettes they are likely to profit from scale economies (Rumble, 2004, p. 45). If they employ new and advanced media, develop intensive support systems, tutorial services and integrate optional or obligatory labor-intensive face-to-face meetings in study centers, the advantage of scale economies will shrink. During the recent past the cost structure of *online learning* has also influenced the costs of distance education. Seemingly it will be "nearer to face-to face models than first- and second-generation models of distance education with their economies of scale (Rumble, 2004, p. 48).

Academic Excellence

Are open universities able to excel in teaching, given the technological and pedagogical structure described here? Sarah Guri-Rosenblit (1999) made a comprehensive and thorough study of five open universities in five countries. According to her this main lesson can be summarized: "Massification and flexible access do not necessarily imply the lowering of academic standards. Even in mass-oriented universities it is possible to provide high-level learning opportunities and insist on high exit requirements" (p. 240).

According to John Daniel (1998, p. 26), the key to such a success is "1) well-designed multiple media teaching materials, 2) personal academic support to each student, 3) efficient logistics, and 4) faculty who also conduct research." The OUUK, where this approach is practiced, achieved excellence. In a government evaluation it ranked 10th out of 101 UK universities for the excellence of its teaching program, just behind Cambridge and Oxford (Daniel, 1998, p. 3; Keegan, 2000, p. 78). Students like the way they learn at this university. In the 2005, 2006, and 2007 National Student Surveys the Open University ranked even first with regard to students' satisfaction. This means that it is more popular with its students than any other publicly funded university in the United Kingdom. The students expressed their satisfaction with regard to the teaching, assessment and feedback, academic support, organization and management, learning resources, and personal development (The OU, 2006/2007, p. 10).

International Cooperation

There are a number of organizations existing in the world on regional and global level (Observatory, 2004) – three of them are important: the European Association of Distance Teaching Universities (EADTU), which comprises six European open universities, and

the Asian Association of Open Universities (AAOU) which is an alliance of 36 open universities. The International Council for Open and Distance Education (ICDE) is working on a global level – the latter having formal consultative relations with UNESCO. The proceedings of their conferences show in particular how much these open universities are engaged in exploring the possibilities of online learning. A global survey of respective current open university research is published by the International Research Foundation for Open Learning in Cambridge (UK).

Part IV: Conclusion

The significance of open universities can be demonstrated by interpreting their emergence as the beginning of a new era in the history of distance education. It is an era of profound innovation, which affects pedagogical, political and social aspects of higher education.

The establishment of about 80 open universities during the last decades is an outstanding innovation. It shows in a nutshell that higher education can be totally changed with regard to its pedagogical goals, groups of students, curricula, methods of acquiring knowledge, media and advanced technologies. It is significant to see that these open universities represent a new type of university that is in accordance with marked political and educational trends: the democratization of university study, mass higher education, lifelong education, adult higher education, professional qualification, collaboration with the labor market and globalization.

The very fact that the concept of the open university was adopted and realized by so many governments all over the world shows that the new model of a university corresponds with changes of post-industrial virtualized knowledge society. Another indication of success is their sustained growth, which has led to the emergence of a significant number of mega-universities (Daniel, 1996). Börje Holmberg (1996, p. 567) predicted that "most probably the future will see a further strengthened open university movement". Ten years later we can see that he was right. Even more: open universities are in the process of moving "from the margins to the centre stage of higher education" (Guri-Rosenblit, 1999a, p. 281).

The specific experiences of open universities will have special relevance when the "university of the future" comes to be designed and implemented. Conventional universities have also started to provide distance education courses and to explore the possibilities of virtual learning spaces. This means that they are entering the realm of distance teaching and enriching their arsenal of pedagogical media and methods. There will be a trend towards a new type of university. The university of the future will probably be based on four fundamental pedagogical approaches: distance education, online learning, scientific discourses face-to-face, and many forms of intensified professional support, all of them have already been developed, tested, experienced and consolidated at open universities. Open universities "can be viewed from many respects as forerunners in facing and dealing with challenges that confront higher education systems all around the globe" (Guri-Rosenblit, 1999a, p. 281). Insofar, open universities are trendsetters. According to Sir John Daniel (2001, p. 135) open universities and open learning will have a central role in the 21st century. The ultimate general goal will be the gradual transformation of the university into an institution of independent learning (Peters, 2004, p. 203).

5 Concepts and Models

This chapter deals with the fact that distance education is a format of learning and teaching which is by no means clear-cut and fixed. 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 criticized 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 globalization 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: theorizing 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, criticize 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 analyzing 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 realizing 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,
- the contribution to university reform, and
- the 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 practiced 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 internalized 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 behaviors 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 recognize 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 Behaviors

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 behavior required in distance education.

Students have to develop and get used to and even internalize a new approach, because they have to organize 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 behavior 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 realized 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 practiced. In addition, such models can be fixed or even become 'petrified' if they are institutionalized. 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,
- the hybrid models.

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 analyzing 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 institutionalized when the University of London was founded in the middle of the 19th century for the benefit of those who could not afford to enroll 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 practiced 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 skeptical 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 centers 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 digitalization 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 centers. 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 democratization 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 realization.
- 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 realized 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.

Analyzing 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 organize 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 digitized learning environment. This is a

most convenient learning situation. Students have access to even the remotest teaching programs 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 counseling 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 endeavor 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, also called 'remote classroom', was developed in the USA and has become popular there mainly during the last ten years, especially in multi-campus organizations. 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) 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, 1998, p. 28) and recommends computer conferencing on the net instead.

In spite of all the skepticism 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 digitized 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 (see also chapter 13 in this volume). 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.

6 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 digitized formats of learning. These shifts require new learning and teaching behaviors. 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 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 reorganization of teaching and learning is necessary.

The Uniqueness of the Phenomenon

If we analyze 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) criticized 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 marvelous technical achievements alone would not have stirred up even conservative professors in our tradition-bound universities and have caused them to produce CD-ROMs, DVDs and podcasts 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 (ICDE) (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 specialized 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 industrialized 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 organized 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 communication technologies and digital 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 characterize 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 characterized 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 industrialized 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 fulfillment of human values,
- is not so much interested in achievement, but in self-realization,
- 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 'dialog conversation', which transforms the participants and the object being discussed
technical ('technocratic') rationality	humanistic rationality
efficiency	personal development
precise facts	global approaches
specification	generalization
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
organization is set prior to activity	organization will emerge from activity
positivism	epistemological pluralism
science imbued with discovery and determination	science imbued with creativity and indetermination

Table 1: Change of curriculum categories as consequence of the educational paradigm shifts. (Source: Doll, 1993, pp. 5-7).

According to this table the paradigm shift emphasizes 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 Digitized Learning

Really dramatic paradigm shifts will occur in the digitized 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 programs, 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 behavior and learning behavior 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 memorizing and recalling selected contents.

Some of the consequences of this shift go even further. According to the ICDE Task Force mentioned (Hall, 1996), student productivity will become more important than faculty productivity. Likewise, student learning styles will be in the center 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 programs, 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 counseling 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 (UK).
- 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 digitized 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

Analyzing 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. 11) 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 member 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 (see also chap. 13) 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 programs 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 mechanization 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 dehumanizes the processes of teaching and learning and thus becomes detrimental to education.

PART II:
DIGITAL LEARNING SPACES

7 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 by 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 characterize 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) analyzed 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 'hyperspace' 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 generalizing 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" (1976, 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 behavioral 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 center 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 recognized 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 individualizing, independent and activating learning, and at the same time invited them. There are analog 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 digitalized 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 behavior, 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 analyze 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 behavior, not only of students but also of teachers. Their ritualization 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 memorize. The sacred character of the contents was matched by the forms in which they were transmitted, which were characterized by the honor 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 secularization, 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 digitized 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 signalize, 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 symbolized 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 characterize 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 digitized 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 endeavor 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 endeavor 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 behavior 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 organized 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 asynchronicity of communication.

The Transposition of Traditional Learning and Teaching Behavior

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 behavior 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 will fail to recognize the enormous instructional potential of the digital learning environment and its media and methodical variability. Both of them 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 recognizing, seeing through, analyzing 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 recognized. There will probably be a similar development in the pedagogy of the digitized 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 organizational 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 realize 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 monologs 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 digitized 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 analyze the digitized 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.

8 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 recognized 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 behavior 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 modernizing 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 recognize 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:

- Presentation of information
- Storing
- Retrieval
- Communication
- Collaboration
- Browsing
- Multimedia
- Hypertext and hypermedia
- Simulation
- 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 analyze 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 characterizes 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 programs 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 objectification 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 dialogs 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-organized teaching and research groups.

6. *Browsing.* Browsing, surfing and navigating in the net extend 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 behavior 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 programs presented by hypertext and hypermedia enable the learners to develop self-regulated, autonomous learning styles. They allow for strictly individualized, 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, 1998). 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 program 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 practicing 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 summarize 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 recognized, tried out and integrated in the arsenal of learning processes available for instructional design, the misuse of computerized 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 digitized 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 programs 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 characterized 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 familiarizing 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 „modernize" learning.

Learning by Expository Teaching

Traditional teaching and learning behavior 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 encyclopedias (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 behavior can be increased. We should bear in mind the cumulating, intensification and acceleration of presentation stimuli and modes (multimedia 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 heteronomous, 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 programs 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 programs can be presented in a demanding and impressive manner (multimedia space), a tutorial-type dialog 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 criticized 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 behaviorist manner into the objects of their teachers. The development of these programs is based above all on

varieties of instruction technology (cf. Romiszowski, 1981 p. 165) and models of systematic instruction design (cf. Issing, 1997, p. 201).

Autonomous, Self-regulated Learning

Another form of learning places students in the foreground, and not teachers. It believes that they are capable of planning, organizing, 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) 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 characterize 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 practiced 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 individualizing 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 behavior and even more teaching behavior. 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 program. 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 individualization 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 practiced 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 practiced (Peters, 2001, p. 149). It is not serial thinking which is aimed for and practiced, but multichannel, 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 (1966). 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 programs and search them for relevant information (information space, communication space).

Skeptics 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 memorizing 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 internalize 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 optimize 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 practicing, 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 practiced 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 emphasized 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 realization 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) materialize 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 criticize 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 specialized 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 behavior 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 asynchronous 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-realization 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 emphasized 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 programs and multimedia (presentation space, instruction space, multimedia space). This gives rise to many new opportunities. The multimodality of multimedia should be emphasized 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 visualize 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 program PowerPoint represents only one dimension of their multitudinous possibilities. Numbers are converted into colored 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 visualization 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 endeavors. Structural communication (Hodgson, 1974/75; 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 practiced 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, decentralized, 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 focused 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 Behavior

The greatest innovation effect can be verified if we analyze the extent to which teaching and learning behavior 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 organizing skills (cf. Lange & Hillebrand, 1996).

This means that students must be ready for, and capable of recognizing, actual learning goals and learning possibilities on the basis of changes to their lives and work, be willing to plan and organize their learning independently and to absorb and organize 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 behavior. 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 emphasized to a much greater extent. In this respect as well, students learning autonomously are an important result of the digitalizing of learning.

Teachers

Lecturers are also affected by the far-reaching structural changes. Teaching behavior is determined by a displacement of the center of gravity – away from presentation and towards moderating, counseling 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, 1999; 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),
- organizing 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 standardized "granular objects" or "component based instructional units" from centralized 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 emphasized 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 program 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 *individualization* of learning provides new and increased chances. *Communication* and *collaboration* are easier to establish and to realize 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 realized.

In contrast, *asynchronicity*, 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 asynchronous. 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 modernization 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 7 – 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 asynchronicity. 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 socialization 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 ritualized social interaction. This is why learning experience cannot be "localized" and float, so to speak, in the indeterminate. The spatial and temporal contextualization, 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 civilization 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 digitalization 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.

9 Digitized Learning Environments: New Chances 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 centers, printed teaching material and educational radio and TV presentations provide ample proof of this. The teacher or the program 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 industrialized "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 counselors. 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, however, will have to be emphasized 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 behaviorists 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 practiced first in digital learning environments, especially as twenty years of experience were already available. Drill and practice programs 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 analyze 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 colorful, 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 digitized teaching and learning which we probably will not be able to answer by means of experience gained with analog 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 digitized 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, recognizing, 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 realized 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. Color 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 practicing. The multimedia presentation on the screen can be seen in high resolution and brilliant colors. 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 behavior 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 behaviorist 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 organize 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 favorable 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 behavior 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 dialog,
- 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" programs,
- 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 programs 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 counseled 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, asynchronously 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 programs, integrate audiovisual sequences or even digitized printed teaching texts is a misuse, because its specific potential is not even seen, let alone actually realized. These examples show how the presentation of conventional forms of expository teaching and therefore of externally controlled learning 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 behavior are being extended into the digital age and this causes us to misunderstand the special opportunities provided by digitized learning environments.

This has to happen, because what is being developed at present in the sector of digitized 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 digitized 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-organized and self-assessed learning. The digitized learning environment provides

even now unusually favorable 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 digitized 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 digitized 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 programs 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 digitized 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 favorable 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 digitized learning environment:

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

Learning in Hypertexts

Hypertexts consist 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 behavior 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 digitalized 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 catalogs and abstracts. Digitized 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 counselors 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 programs. 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.

From the point of view of pedagogies, these virtual seminars play an important role because they individualize the heavily structured course range on the model of industrialized 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 counseling in study centers 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 criticize 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 behavior 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 behavior that is created in these two basic forms of digitized 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 programs 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 counseling 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 digitized 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

Digitized 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 programs 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 characterized 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 digitized 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 digitized learning environment will have great significance for the future of distance education. Helmut Hoyer, the present Rector of the FernUniversität, emphasizes this statement by telling visitors that the university of the future will look “much more like a distance teaching university than a traditional one” (Hoyer, 1997).

10 Online Learning: Visions, Hopes, Expectations, Limitations

Conditions for teaching and learning will be increasingly determined by innovations in online learning. This means that teachers and learners will be confronted with new pedagogical criteria and strategies. Those who wish to be introduced to the new learning field and who think about its increasing importance and further development may be stimulated by reading the following futuristic considerations and by becoming aware of possible pedagogical dangers.

Part I: Predictions and Prophesies

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 favorite 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.[1] In his book "The Future Shock", Alvin Toffler diagnosed the bankruptcy of the contemporary educational system (1970, p. 319) and criticized above all the widespread lecture system, in which he recognized the hierarchical structure of industry. He wanted to replace this by seminars and simulation 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 digitalization would structurally alter teaching and learning at university level with regard to increased individualization. "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

[1] 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).

underestimated the resistance immunity 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.

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 on the subject which tend to run from the skeptical 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. 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 generalized. 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:

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.

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.

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 programs,
- hybrid models: links between PC, CD-ROM, CDI + the network,
- synchronous services: video conferences, chat rooms,
- asynchronous 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 pluralization 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. Dialog 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 realization. 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, counselors, 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-institutionalization*. 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 privatization and commercialization of education.

Finally, reference is frequently made to the *individualization* 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:

- 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.
- 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.
- The confidence in the impact of computers and computer networks "appears to be practically unbroken".

Prognoses Made From 1998 to 2004

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

According to the Delphi-II Study (Bundesministerium, 1998), which was organized 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 realized, the globalization 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 skeptically. 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 digitalization 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 counseling 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 individualization 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 realization 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 realization 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 programs 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 that 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 (1998, p. 21) 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.

New Universities?

In their book “Szenario: Universität 2005”, Jose L. Encarnaçao, Wolfgang Leidhold and Andreas Reuter (1999) prophesied the creation of new types of university. Their theory is that because of the digitalization 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. This shows that we can in fact observe how different institutions of online learning emerge, and this is verified by means of examples. 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 socialization and educational processes that are brought about through campus based universities.

Trends That Affect distance Learning

A precise description of the factors which will determine the future of distance education was presented by Scott L. Howell, Peter B. Williams and Nathan K. Lindsay of the University of West Georgia. They published their report "Thirty-two Trends Affecting Distance Education: An Informed Foundation for Strategic Planning" in Online Journal of Distance Education Administration in 2003. These are some of their findings:

> "In summary, many trends in higher education will influence the future of distance learning. Student enrolments are growing to surpass the capacity of traditional infrastructures, learner profiles are changing, and students are shopping for education that meets their needs. Traditional faculty roles, motivation, and training needs are shifting while workload, compensation, and instructional issues continue to deter them from distance learning participation. The institutional and organizational structure of higher education is changing to emphasize academic accountability, competency outcomes, outsourcing, content standardizing, and adaptation to learner-consumer demands. The Internet and other information technology devices are becoming more ubiquitous while technological fluency is becoming a common expectation. Funding challenges are increasing with fewer resources to meet expanding lifelong-learning demands. Distance education is becoming more abundant, especially online, and location independent, increasing the need for effective course-management systems and teaching strategies that utilize technology." (Howell, Williams & Lindsay, 2003).

The Computer of the Future

Hermann Maurer, a computer scientist at the Technical University of Graz, has described the new technical facilities that computers could have in the year 2014. According to him, a computer would then only be as big as a credit card and would be equipped with a virtual monitor, a virtual keypad and a wireless telephone with stereophonic sound. In addition, it would have a micro-camera and wireless access to broadband networks. It is worthwhile considering the consequences that this computer could have for the design of future learning environments and for the structure of the learning and teaching enabled in them. Networked computers have already changed the dissemination of knowledge so profoundly that we must adapt to a new pedagogical paradigm shift (Maurer, 2004).

Predictions Made in 2006

The 2006 Horizon Report

Here developments of technologies are reported which are expected „to have a large impact on teaching, learning or creative expression in higher education. This annual report has been published by the "New Media Consortium" and the "Educause Learning Initiative". It is research oriented and based on an ongoing discussion of experts "in business, industry and education, published resources and current research and practice". Four distinct trends are presented (Johnson, Levine & Smith , 2006):

- "Dynamic knowledge creation and social computing tools are becoming more wide-spread and accepted."
- "Mobile and personal technology is increasingly being viewed as a platform for services of all kind".

- "Consumers are increasingly expecting individualized services, tools and experiences, and open access to media, knowledge, information, and learning."
- "Collaboration is increasingly seen as critical across the range of educational activities of any size or scope."

Predictions Made in 2008 and 2009

The Horizon Report 2008

This report refers to and describes the following new trends (Johnson, Levine & Smith, 2008):

- Grassroots Video. "Virtually everyone can capture, edit, and share short video clips using inexpensive equipment (such as a cell phone) and free or nearly free software."
- Collaboration Webs. The newest tools for collaborative work are "small, flexible and free, and require no installation.
- Mobil Broadband. "Mobiles "are quickly becoming the most affordable platform for staying networked on the go".
- Data Mashups. Data and data sets "from different sources can be "mashed up into a single tool.
- Collective Intelligence. "In the coming years we will see educational applications for … collective intelligence."
- Social Operating Systems. They base the operation of networks around people, rather than around contents. The authors believe that "this simple conceptual shift promises profound implications for the academy and for the way in which we think of knowledge and learning."

The Horizon Report 2009

This forecast deals with six new technologies which should be watched in the field of higher education. They include (Johnson, Levine & Smith, 2009):

- *Mobiles* "with new interfaces, third party applications and location awareness".
- *Cloud computing* with "data farms" that is "large clusters of networked servers".
- *Geo-Everything* – "geocoded data determine the physical coordinates of a place or object".
- *Personal Web* – Tools "to aggregate the flow of content" in order "to create a customized personal web-based environment".
- *Semantic*-Aware Application – "Tools can simply gather the context in which information is couched" Will be providing rich new ways of finding and aggregating content.
- *Smart Objects* – They "recognize their physical location" and "connect with other objects or information".

Further more the researchers identified the following five key trends:

- "Increasing globalization continues to affect the way we work, collaborate, and communicate".
- "The notion of collective intelligence is redefining how we think about ambiguity and imprecision".

- "Experience with and affinity for games as learning tools is an increasingly universal characteristic among those entering higher education and the workforce".
- "Visualization tools are making information more meaningful and insights more intuitive."
- "As more than a billion phones are produced each year" these media "will continue to impact the ways we communicate and view computing and networked resources".

Internet as Information Source, Social Effects

The "Center for the Digital Future" of the Annenberg School of the University of South California explores trends in annual Internet surveys. The reports deal with many aspects of digitization. Some of them may be important for the future of online learning.

- The Internet is increasingly considered "foremost as an information source". Whereas 66 percent of the users above the age of 17 considered it "an important source of information" in 2006, the percentage rose to 80 percent in 2008.
- The social effects of the Internet are growing. Membership in online communities has more than doubled in three years. Fifty-five percent "feel as strongly" about their online communities as "they do in real world communities".

Cell Phones, Oral and Haptic Technologies, Augmented Reality, Mental Commands

The Pew Internet & American Life Projects at Elon University summarized a great number of surveys on December 14, 2008 as follows:

- The cell phone will be "the primary connection tool to the Internet in the world in 2020".
- "Talk and touch user-interfaces will be more prevalent and accepted by 2020." The prediction was that *"haptic technologies based on touch feedback have been fully developed in 2020, so, for instance, a small handheld Internet appliance allows you to display and use a full-sized virtual keyboard on any flat surface when you would prefer not to talk aloud to your networked computer. It will be common to see people "air-typing" as they interface with a projection of a networked keyboard visible only to them"*. Sixty-four percent of 578 expert respondents "mostly agreed and only 21 disagreed".
- "The divisions between "personal" time and work time as well as between physical and virtual reality will be further erased for everyone who's connected…" But the predictions that interaction in artificial spaces will increase are not unambiguously clear. The statement: "*In 2020, virtual worlds, mirror worlds, and augmented reality are popular network formats, thanks to the rapid evolution of natural, intuitive technology interfaces and personalized information overlays"* was agreed upon by 55 percent of 578 expert respondents only, whereas 31 percent of them disagreed.
- Tan Le, co-founder of Emotiv in San Francisco, predicted: "We have an opportunity to revolutionize the way people interact with technology. In ten years or so we will all go around in the world that will respond to our mental commands." – It picks up electrical activity from the brain and sends wireless signals to a computer (Tan Le, 2008).
- Selected predictions and comments on the future of online learning. "Online education today is considered as an alternative, but a promising alternative

> nonetheless. During the next few decades it will become a mainstream approach in the lifelong learning process." (Anonym, 2009)

Pedagogical comments: Readers cannot but being overwhelmed by the multiplicity of different directions in which learning in digitized learning environments proceeds. They will also be impressed again by the pace in which new trends become visible. Each of the registered trends may influence and change the way in which we teach and learn online in the years to come. Autonomous learners will find it easier to create their own learning content and build their own curriculum. Learners will deal not only with their personal computers, but also with multi-functional mobile phones. Learners will generally expect more support or "service" from their educational institutions which will bring about necessary structural changes. Collaboration with learners also from other universities will become quite normal. Most persons will have acquired competence in creating, editing, and sharing their own videos clips. This competence could be used for teaching and learning purposes. The new tools for cooperative work might help to realize the requirement of cooperative learning – so often praised and so often not realized. Mobile learning will be facilitated by using the new cell phones. Teachers and learners who search for information will be supported by new tools which not only find and collect, but also arrange and collate information. Several procedures will be available for using collective intelligence. And the new networks around people will increasingly complement networks around contents and become an instrument for successful information strategies.

Fundamental Questions

Seemingly, some of these questions can be answered already – although tentatively only – if we consider new contributions. They bring the discussion round to more general questions: what will be the future of the computer in higher education? Will the present technological configuration of devices disappear altogether? Will the idea prevail that the "most profound technologies are those that disappear" as "they weave themselves into the fabric of everyday life until they are indistinguishable from it" (Weiser 1991, 1998). Will we see the rise of "pervasive computing"? Will we experience the advent of a third generation of computers with one person being served by many computers as a successor to the first generation, in which *one* computer served *many* persons and the second generation, in which *one* (personal) computer serves *one* person? (Dupin-Bryant, 2006). Alois Ferscha (2008), of the "Institute of Pervasive Computing" at the University of Linz (Austria), suggests that pervasive learning will enable us not only to use additional new technologies, but also to reach new pedagogical goals:

New Learning Paradigms	**New technologies**
Individual/learner-centered	Personalized services
Collaborative, social learning	Networked/ wireless
Situated learning	Mobile, wearable
Contextual learning	Context awareness
Ubiquitous learning	Ubiquitous
Lifelong learning	Durable

Table 2: Source: Alois Ferscha, 2008.

The possible emergence of entirely new ways of teaching and learning is based on these new technological advances. They may have promising potential for pedagogical reform in higher education.

A General Look Into the Near Future

Nicholas H. Allen, the Provost Emeritus of the University of Maryland University College, presents a penetrating analysis of the U.S. learning community (Allen, 2009). Most of his predictions are significant also for the further development of distance education in other countries. According to him the most important change will be a definite shift to non-traditional students. "Future growth will continue to be driven by post secondary students". This is in line with 'rising social expectations' according to which "tertiary education will be a universal requirement". This goes so far that higher education is even considered a 'human right'. The Spellings Commission, for instance, postulates: "Every citizen shall have the opportunity to earn a degree". The capacity of our universities can no longer be expanded "through bricks and mortar expansion". The advent of the 'Third Age' and mid-career learners and the rising life expectancy will aggravate the capacity problem. As future students will be 'highly divers', no one size format of courses will be possible any longer. Pedagogy and support services will have to adapt to this situation. The educational community will see "the pervasive growth of online education" and a breakthrough of educational applications, especially of "mobile education" and Web 2.0 technologies. A Web 2.0 culture will develop by applying a great number of technological innovations. "By 2020, half of all learning may be online" (Draves & Coates, 2004). There will be an "unparalleled access to micro and meta content". "Within the next five years the typical mobile will have the computing power of today's PC". The Internet will evolve "from two dimensional theatres to multi dimensional cyber sphere". Mass "access to quality education at affordable costs" will be possible.

Allen concludes his presentation by stating "what we must invent for tomorrow". Some of these necessary inventions are:

- "The creation and production of distance education programs, which are able to dramatically expand capacity, increase access and reduce per student costs. "Now it is time for Open and Distance Learning to fulfil its potential and its promise in the U.S."
- The provision of technology-driven support systems "wrapped around academic programs and mass-customized to" make "students part of the learning community", "address individual student needs" and enable them to succeed.
- The design of "intentional persistence programs" to "address the needs of risk students". These should identify risk students "early in their academic experience", warn them before it is too late and design clear "paths through the curriculum".
- The development of efficient tracking systems that help to become aware of high quality resources with regard to subjects, pedagogical contexts, and learning needs.
- The professional development of faculty with regard to Web 2.0+ technologies and the ability to transfer knowledge into wisdom.
- The implementation of technology driven processes for reengineering institutional and administrative systems in order to make them more effectively with regard to lower cost per student and raising institutional productivity.

- The imparting of "baseline knowledge and skills necessary for employment and responsible citizenship in the 21rst century".
- Data-driven research should "assess the impact of Web 2.0+ tools, OER and delivery formats on costs, student learning outcomes, faculty productivity and institutional effectiveness."

These demands are significant as they are pedagogically founded and practice oriented. They show the authors' pervasive concern about the success of educational practice in higher education in a highly technological future.

Evaluation

The prediction that the Internet is considered "foremost as an information source" is certainly not new to anyone practicing online learning. However, the interesting aspect of this prediction is that the number of persons who thought so, rose considerably within just two years. What is really surprising is the opinion that 55 percent "felt as strongly about their online communities" as they did about their real communities. Can this finding be explained by the strange phenomenon that regular online learners quite often think that real and virtual seminars do not really differ? (cf. Peters, 2003c, p. 56).

The predictions of the Pew Internet and American Life Project make us ponder about the technological configuration used for learning in about ten years. Will the keyboard then be abolished? Will the cell phone play a major or a supporting role? Will touch and voice and even "mental commands" change the traditional online learning behaviors decisively – as Maurer and Tan Le suggest? The development of Maurer's futuristic computer, which, however, is already now technologically feasible, could intensify changes considerably, perhaps even radically. With it, forms of learning and teaching could be developed that we can only imagine with great difficulty today.

When present changes of the conditions for learning and teaching in digitized learning environments are being planned, futurological aspects should be kept in mind in order to react flexibly to pending changes, whether in a supportive, warning or rejecting manner.

Obstacles, Protests, Resistance

Critics of the digitalization 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), skeptical and critical opinions do not appear to find any resonance and then are often not voiced at all.

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

Rolf Schulmeister (2001, p. 34) reports on actions to prevent digitalization of university teaching. 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 organized Digital Education Initiative. David Noble is carrying on a real crusade in the Internet against the commercialization 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 (Noble, 2002). The following abstract mirrors ignorance and an attitude which is probably typical of many professors who, however, prefer to remain silent.

> "In recent years changes in universities, especially in North America, show that we have entered a new era in higher education, one which is rapidly drawing the halls of academe into the age of automation. Automation – the distribution of digitized course material online, without the participation of professors who develop such material – is often justified as an inevitable part of the new "knowledge-based" society. It is assumed to improve learning and increase wider access. In practice, however, such automation is often coercive in nature – being forced upon professors as well as students – with commercial interests in mind. This paper argues that the trend towards automation of higher education as implemented in North American universities today is a battle between students and professors on one side, and university administrations and companies with "educational products" to sell on the other. It is not a progressive trend towards a new era at all, but a regressive trend, towards the rather old era of mass-production, standardization and purely commercial interests" (Noble, 1998).

Commentary

The prophecies which were shown and studied here make clear just how important the authors think that computer networks will be for the future of teaching and learning. It is obvious that they recognize 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 our 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 fulfill an important function: they draw attention forcefully to possible, 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) have mushroomed, not to mention the many *corporate universities*. The overview from Helm and Helm (2000) already listed 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 (Sloan Consortium, 2002). These figures have probably increased considerably since publication. 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 have already been fulfilled at these institutions of higher education, and from this aspect we can understand the boldness displayed by some experts in their 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!”

Part II: Limitations

Can We Still Curb Unwanted Developments?

The significance of online learning is growing all over the world. This is indicated among other things by the new learning behavior of members of the "net generation" (Tapscott, 1997), the persons who were “born digital” (Palfrey & Gasser, 2008), the success of fully online Master's degree courses (Bernath. Brahm, Euler & Seufert, 2008) and the development and trial of virtual and corporative universities (Ryan, 2001; Schulmeister, 2001; Hazemi & Hailes, 2002). The proportion of teaching events that take place in virtual teaching spaces is growing. The paradigm change that this necessitates is bringing about a change in consciousness that has never before been experienced. Students, university teachers and experts are frequently encountered who are so convinced of the specific pedagogic possibilities of online learning and its innovative powers, and expect so much of them, that they regard traditional situations of learning and teaching, for example, talking together in a classroom or seminar, as outdated or even obsolete. This situation calls for examining whether such attitudes and opinions are correct. Can a trend be seen here that should lead to concern for pedagogical reasons?

Shortcomings of the Dialog in Online Learning

Many new techniques have been developed for communication in the virtual learning space: *email*, *mailing lists*, *news-groups*, *talks*, *MUDs*, *gophers*, *World Wide Web*, *weblogs*, *wikis*, *podcasts*, *chats*, *bulletin board* and *web conferencing*. This means that the facilities for virtual communication are extraordinarily varied, and this includes cooperation and collaboration over distances. We might think that understanding and mutual comprehension have been optimized in a way never before seen. On the contrary: My own experiences in more than 30 virtual seminars based on asynchronous communication tools in higher education cannot confirm this assumption. Respective impressions of students, empirical surveys and fundamental considerations provide evidence of considerable shortcomings of virtual dialogs.

Before these shortcomings are referred to and discussed, two points should be emphasized. First: 'Shortness' of individual postings and of threads of virtual discussions have been defined on the ground of a comparison to real discussions in face-to-face situation. This is problematic and should not be done. The pedagogical structure of the two forms of seminar differs too sharply. The students were asked to compare these two forms of education in order to sharpen their pedagogical awareness and promote their theoretical understanding. Second: Describing those shortcomings of virtual dialogs is in no way intended to cast doubt on the significant innovatory pedagogic potential of online learning. Quite the contrary. The skilful use of networked computers affords promising innovative forms of teaching and learning that have no equivalents in real learning spaces: new ways of distributing, presenting, communicating, exploring, navigating, cooperating, collaborating, simulating, searching, storing, learning with multimedia, hypertexts and hypermedia. All these extraordinary pedagogical activities are and remain extremely valuable. The only problem to be addressed here is whether systems of online learning could or should be even enhanced by the inclusion of oral face-to-face dialogs every now and then when they can be provided and are pedagogically required. Could virtual dialogs be complemented and balanced by additional oral dialogs in real learning spaces?

Impressions of Students

In the last ten years students taking an online master's degree course at the University of Maryland University College in 30 virtual seminars were requested to explore the advantages and disadvantages of the dialog in the virtual seminar. Two things became clear here: Many students had become so used to the new form of the dialog that they no longer perceived any differences to the dialog in the real learning space. Others, however, noticed and described them (see Peters, 2003, pp. 56-66). They listed seven advantages and eighteen disadvantages of virtual dialogs.

The most striking disadvantage reported was that those students who "prefer to talk their ideas out" are prevented from doing so by the necessity to exchange written statements only. The postings are usually short and deal with different topics. The students are confronted with a kaleidoscope if bits of information. A thesis cannot be dealt with at length and depth. Usually the discussion consists of a series of rather isolated questions and answers. One student deplored that it was difficult to follow the course of the dialog through threading.

Also the following aspects were presented: Teachers and students appear rather detached and isolated; seminar participants have only slight socio-emotional orientation; information is communicated without emotion, or with reduced emotion; and the essence of the

participants cannot be perceived. Social interactivity is reduced, students are unable to cope with the immense volume of information that accrues and are often unable to select from it on the basis of an evaluation. Several participants will often speak at the same time on different aspects of the subject, or, which is even worse, on different subjects. Some students find the step from oral to written communication difficult.

The students have confronted us with a great number of amazingly detailed statements. They were written by adult persons many of whom are holding responsible professional positions. Some of them have earned already several degrees and acquired many years' experience in virtual seminars. The reported impressions are fresh and personal, but cannot be generalized as they are too individual, casual and not reflected systematically. Greater general significance can be attached to the following statements.

Empirical Findings

Some researchers come to the following results on virtual seminars that were ascertained in experiments:

- Active participation is low and unbalanced (Friedrich, 2001, p. 270).
- The talks are not orderly. The "conversational coherence" is reduced. The "conversational chaos" can only be partly compensated through *multi-threading* (Boos & Cornelius, 2001, p. 76).
- The teaching and learning processes are "*far from straightforward*" (Chambers, 2000, p. 156).
- There are increasing problems with purely passive participants and *drop outs* (Buder & Creß, 2001, p. 49).
- The mutual familiarity of participants with other is slight (Buder & Creß, 2001, p. 51).
- Status information on participants is often not available (Buder & Creß, 2001, p. 51).
- "The lack of many person-related social stimuli … leads to greater task-relatedness and less socio-emotional orientation" (Diehl, 2001, p. 24).
- The following are referred to as problems of computer-based cooperative learning: the lack of social presence, the lack of group coordination, the lack of harmonization on the joint knowledge background, the glut of information and the lack of correlation between contributions (Hesse, Garsoffky & Hron, 1997, pp. 255-261).
- “Communication and cooperation (were) very low.” (Nistor & Mandl, 1997, p. 19).
- Reduced communication channels make it difficult to develop feelings of being involved in cooperative learning processes, the assessment of the knowledge of the other students as a basis for communication is restricted (Wessner & Pfister, 2001, p. 170).

After an analysis of theories on computer-mediated communication (CMC) N. Döring (2000, p. 371) made the following core statements, among others: "Because of the lack of sensory channels, CMC is deficient and impersonal in comparison with face-to-face communication"; "CMC is suitable for defined communication occasions, not for others"; the “use of CMC is influenced by social norms in the environment and is therefore often irrational and dysfunctional"; "CMC represents a mixture of orality and written form and alters communications styles, rhythms and networks ".

On the basis of an analysis of 160 definitions, Merten (1977) distinguished the following criteria for communication: reciprocity, intention, presence, orality, effect, reflexivity (cf. Städtler, 1998, p. 571). If "presence" and "speech" are among the core features of communication, it can be seen from this that it does not take place virtually.

In view of such shortcomings some researchers recommend that virtual seminars are supplemented by *presence phases* to mitigate the disadvantages shown here (Buder & Creß, 2001; Hesse, Ostermeier & Buder, 2000; Jechle, 1999).

Scholarly Reservations

There are university teachers who are opposed wholesale to the virtualization of academic studies. Rolf Schulmeister (2001, p. 34) in particular has pointed this out. Others complain of specific disadvantages of online learning. For example, in his taxonomy of learning Hubert Dreyfus (2001, p. 35, quoted in Ess, 2003, p. 129) distinguishes seven stages and gives reasons why, at least in the humanities, only the lower simple forms of learning can be successful in online learning. However, this was not the case with the higher forms of learning – *competence, proficiency, mastery, practical wisdom*. The more demanding the type of learning, he argues, the more necessary *"the guidance and example of their teachers as embodied beings in real-world contexts"* was for students. The importance of physical presence in real spaces is emphasized here. In this spirit Charles Ess (2003, p. 117) claims that in the study of philosophy, e.g., the term "aretē" (virtue, skill, excellence, wisdom, justice), simply cannot be imparted online.

Objections such as these can sharpen our awareness of those pedagogical targets that are easily achieved, those that are achieved with difficulty, and those that cannot be achieved at all with online learning. They are worth considering, because they affect central questions of the specific possibilities of online learning.

The deficiencies of the virtual dialog shown in this chapter are in my opinion so serious that it is advisable to examine in detail the pedagogical possibilities of dialog in a *real* space. In this way we can see what is missing in virtual learning space. Specific potentials of the oral dialog in real learning spaces [2].

The Room

We will take a look at pedagogically relevant qualities of real learning spaces in which oral dialogs take place. The "physical presence" in the room is a determining factor that is often overlooked. It causes "sensitivity" and “atmosphere”. Teachers and learners are not only in the room, they “feel themselves in it some way or another”. “They perceive the atmosphere of a room that can evoke specific moods. According to Gernot Böhme (2003) the “space of bodily presence is something deeply subjective, although common to all subjects. The space of bodily presence is the space within which we experience our bodily

[2] The differentiation between ‘real’ and ‘virtual’ learning spaces is in so far questionable as both, seen from an epistemological aspect, cannot be convincingly separated from one another. In the end, all reality is virtual. In spite of this, we go along with the use of virtual that is now standard in everyday speech and is also firmly established as part of technical language, but understand it only as “the extension of didactic-methodical possibilities with the means of electronic-didactic information and communication technology” (Beyer & Dichanz, 2004). ‘Real’ is used in the sense in which it is used in everyday language.

experience…". The mood and atmosphere qualities generated in a real room are naturally not possible in a virtual learning space. A student who was asked how she had experienced discussions in a virtual seminar said: "I missed the "sensualness", the mood, the atmosphere that only appears in *face-to-face* seminars." (quoted by Schulmeister, 2001, p. 303).

The effect of the room on learning has not yet been examined, because up to now it has been experienced unconsciously as something entirely natural. We only pay attention to this variable because it is missing in the virtual learning space. Here there is no distinction between, for example, near and far, and traditional cultural boundaries between different bodies (gender, age, social status) are dissolved (Großklaus 1995, 8). This means that a structurally altered situation with the deficiencies shown above is created for the dialog.

The Time

Just like a room, time is also a "fundamental structure of human perception" (Sandbothe & Zimmerli 1994, VII). Both are "basic coordinates of human existence" (Marotzki 2003, 318). By taking part in a *face-to-face* dialog, students perceive time in the same way as in many tasks in their everyday life. The time experienced every day influences their behavior in the dialog as well. They learn to order intended activities in a time frame. They hardly notice this, because experiencing time is a normal unconscious process that does not have to be specially practiced.

However, four phenomena become significant for participants in a dialog: concurrence, non-concurrence, order and duration (Städtler, 1998, p. 1247). They are under the impression of time slipping away and of the end of the set time. They trace the order of events and not only store them, but also their sequence. Several participants may want to speak at the same time or successively. They may speak quickly or slowly, they may pause for thought or achieve specific effects by inserting artificial pauses. The perception of the duration is influenced by tests and examinations. Motivational and emotional factors play a part: where dramatic peaks are involved time is experienced differently than with leaden boredom.

In the oral dialog, experiencing time by itself trains behavioral modes that are important for the development of professionalism. Experiencing time establishes in its own way connections to everyday acting in the environment and therefore contributes to behavioral certainty.

This is worth emphasizing, because in the virtual dialog the structures of time are radically dissolved and destroyed (cf. Virilio, 1991, p. 334). It is standardized, universalized. Whereas space "is everywhere occupied through the principle of 'ubiquity', the principle of 'always' applies for time though ceaselessness" (Geißler, 2006, p. 26). A structurally changed situation results for the dialog here as well, which naturally has an effect on the pedagogical structure.

Corporeal Presence

In real spaces, dialog takes place between people of flesh and blood, *face-to-face* or, as Charles A. Wedemeyer put it, *"eyeball-to-eyeball"* (1971a, p. 135). It takes place, i.e. it is "presented". It is an oral and not a written happening, direct and not mediated.

Students perceive those speaking and listening, and above all themselves, in relationship to others with all senses, in other words, corporeally. They experience how the physical

appearance and "body language" can by themselves lend weight to an argument. In the course of time they recognize the character of the other persons in the dialog, the "essence of the persons", as an American student expressed this.

While those taking part in a dialog speak with each other face to face, they acquire something that is important for studying, namely the capacity to deepen their own ideas when listening and talking and to articulate them *verbally* in the language of their discipline, whereby body language has an effect as well. The pedagogical dialog, which has more than just an explanatory function, can in this way achieve coherence, intensity, color, characteristics which are not possible in virtual learning spaces.

The Dialog

In the real room the dialog takes the following shape: The participants speak with one another in real time, the dialog can start and be continued spontaneously. Here the dialog becomes a unique, unrepeatable happening, an event that actually takes place.

Its special characteristic is multidimensionality. The participants receive non-verbal signals as well from their dialog partner, unconsciously display a specific discussion behavior towards them and feel the respective characteristic effect of the person, in certain circumstances their personality or aura. What happens here is authentic for them. With all their senses they become part of a complex event. All this is not possible in a virtual seminar, which is why Horst Heidbrink (2001, pp. 1/18) described it appositely as "silent seminar".

The Group

When several people meet physically in close proximity for a dialog, they experience themselves as a group. They sit close together in a room, take part in a dialog, discuss a subject, learn how to get on with each other and develop modes of social behavior. In each case, a specific community is created, characterized by their individualities and strengthened through the achievement of solutions to problems in collaboration. A feeling of "us" arises. The group's "energy" can be felt.

In addition, the physical presence of other people can bring about the rise of feelings such as belonging, security, community, protection, solicitude, but also of neutrality, disregard and rejection. Because of this, the dialog in a group has special peculiarities that can only be indicated here: because the students see each other in the dialog in relation to other members, they are noticeably and imperceptibly caught up by the dynamism of the group. Different individual roles are formed, social responsibility is expected and relationships with others are created. Where necessary, rational independence can be asserted with regard to physically present opponents and group pressure can be conformed to or resisted. The oral dialog can contribute here to self-knowledge and the formation of identity. All this is very difficult to simulate electronically.

An objection from protagonists of online learning can be expected here, namely that the verbal interactivity of the learning and teaching process can be strengthened as well with the help of contemporaneous *video conferencing* and that an intensive, personal, individual and dynamic dialog is certainly possible for specific phases of online learning. However, they are the victims of a serious delusion with far-reaching consequences. They regard the *images* of persons as real persons, the *appearance* as reality.

"Fellowship"

The group that gathers in a location forms a counterweight to the tendency to separation, isolation and sporadity that dominates in online learning and that can only be partly alleviated through electronic forms of communication and collaboration. A person who sits at a computer, searches the Internet for information, works through digitalized course materials and takes part voluntarily in the sessions of a virtual seminar is as isolated, as separated from the environment, as the reader of a book has always been. In 1791, Johann Wolfgang von Goethe described the situation of the reader paradigmatically and pinpointed the unraveling force of discussions with like-minded persons, when he said:

> "*The friends of the sciences are ... often isolated and alone, although the spread of printing and the rapid circulation of all knowledge make the lack of fellowship imperceptible to them... We therefore owe printing and the freedom this brings inconceivable goodness and an incalculable benefit, but we can thank active intercourse with educated persons and the frankness of this intercourse for an even greater benefit that is at the same time linked with the greatest satisfaction. Often an intimation, a word, a warning, applause or contradiction at the right time is capable of making epochs in us." (Goethe, 1994, p. 405)*

For many online learners the "lack of fellowship" also appears to be "imperceptible", even though the "active intercourse with informed persons" would certainly represent the "greater benefit". And above all: an intimation, word, applause or contradiction *at the right time* and in the corporeal presence of *educated persons* is not possible in the time-delayed virtual seminar.

Pedagogical Assumptions, Insights and Experiences

We must note that in the daily practice of online learning, above all in the virtual seminar, the dialog is usually in short steps only and is not very coherent. The relationship level and its emotional content display only rudimentary development. Seen pedagogically it usually exercises instrumental functions only, for example by being used merely to provide additional information, to clarify comprehension difficulties, to recommend solution paths, or to prepare for forthcoming examinations. In contrast, in the real seminar the dialog can be more detailed, continuous, coherent and personal. In this way it can develop into an *independent teaching and learning form* with a special educational and pedagogic pretension that is based on traditional, philosophical, and pedagogic concepts. These can only be touched on here.

For example, there is the close connection between knowledge and language, between speech, thought and action. From this, Ludwig Huber derives the demand to "bind teaching and learning to the process of cognizing during speech". He states that this can only happen through "the unforced participation in the process of scientific research and productive new inventing or re-inventing thought" (Huber, 1995, p. 497).

In addition, traditional techniques of the Socratic dialog, the academic teaching forms of the disputation, the colloquium and the seminar, continue imperceptibly to have an effect. The representation of scientific problems is experienced and made visual in a special way through the dialog of actual persons. Martin Buber (1954) indicates deeper effects.

According to him, in the dialog the I-it relationship (i.e. the subject-object relationship) changes into an I-you relationship (i.e. into a subject-subject relationship).

In online learning, because of the extensive anonymity of the teachers, the objectivization of the teaching functions and their technical realization, there are normally merely I-it relationships between teachers and students. Only the additionally enabled oral dialog *face-to-face* would offer in online learning as well the chance to create I-you relationships, at least in the form of islands or in part, in which the individuality and personality of the teachers and students play a part and through this actually become formative in the first place. This can lead to what humanistic pedagogy has referred to as the *pedagogical reference* (Nohl, 1963, p. 132) or the *pedagogical relationship* (Klafki et al., 1970, p. 53) and that can be transferred analogously as well to the relationship of teachers to "their" students – but only in their actual presence and in an oral dialog.

Franz Pöggeler (1974, p. 203), the adult educationalist, goes even further in the interpretation of the dialog. He sees in it a *"form of existence of modern mankind"*, a *"definiens and constituens* of humanity*"*. For him, the dialog becomes in this way the *"principle of ethical action"*.

Sociological Interpretations

Some may regard several of the latter characterizations of the oral dialog as far-fetched, exaggerated, and perhaps even as eccentric. Those to whom historical consciousness and interpretation with the assistance of humanistic categories have become alien ideas and who tend towards the abstract "the end justifies the means" way of thinking of technologization that is increasingly dominating more and more areas of everyday life, are quickly ready to judge in this way. This is why some sociological, i.e. empirically determined and verifiable, findings on the oral dialog deserve special attention for further substantiation. They show as well how significant the oral dialog is from the aspect of university education.

In the descriptive conceptuality of sociologists, the term "dialog", which is laden with philosophical and pedagogical meanings, is called social "interaction" and "communication". Social interaction means, e.g., in the sociological understanding of the term, "the exchange of mutually related actions" (Hillmann, 1994, p. 381) in a social situation. These actions are influenced by the judgments and attitudes of the respective other orientation and action partner (the significant others), that are themselves derived from appropriate social judgments.

The socialization of individuals takes place in the framework of interactions of this nature. They develop their identity as persons, they become interactively competent, i.e. socially capable. To achieve this they have to acquire two skills above all: they must acquire role distance (Goffman, 1959) and be able to take over roles (*role taking*) (Mead, 1973). Role distance empowers the individual to have an "ambivalent, critical, doubting, relationship" (Hillmann, 1994, p. 744) to himself, to the role that he plays. This enables him to take over roles (*role taking*), which means "to put himself into others in order to anticipate their behavior and to take it into account in their own plans for action" (Schäfers, 2000, p. 293), as well as to react to the dominating standards in a group reflectively and interpretatively, which is necessary and important for the stabilization of the individual's own identity. The significance of verbal communication in interaction is referred to expressly here, because it is regarded as the "central means of social interaction" (Miller, 1978, p. 60).

In socio-psychological terms communication is above all verbal interaction, in which the *meaning* and the *significance* of what is communicated are important. Its target is mutual comprehension and enables *meaningful action*. Great value is placed here on the relationship level, which is distinguished from the content level, and on the meta-communication and the symmetry of communication, which presupposes the equality in status and equal footing of the communication partners.

According to Mead (1973, p. 205) *speech* forms the basis on which a person organizes his identity: *"Speech is based mainly on vocal gestures with the help of which cooperative activities are to be carried out in a society. Logical speech consists of those vocal gestures that tend to cause in the individual the attitudes that are also triggered in the others. This perfection of identity through the gestures that transmit social activity triggers the process in the role of the other is taken over."*

Conclusion

Dialogic teaching and learning in face-to-face group situations are occurrences with a unique, and therefore incomparable, nature. Its particular effects cannot be produced electronically. Anyone who takes online learning seriously, and does not merely mean reading distributed study materials with additional virtual communication, should provide opportunities for oral dialogs in real rooms as well – if this is logistically possible as well as pedagogically advisable and rewarding. This conception is intensified if we consider further just how much the development of scientific thought depends on its genesis and development in dialogs with teachers and other students, and just how much speaking, thinking and acting involve each other here. If learning in the oral dialog is neglected or even done without altogether, the studies do not only lack an important dimension for proof of qualification in scientific professions, but also depth and, if we follow Pöggeler's argument, humanity.

The considerations put forward here may appear to some to be conventional, even conservative. This is correct in the sense that this is a plea that in the further development of online learning a conventional prototype of acquiring knowledge is not abandoned, but continued in an innovative form. But it is incorrect, because in the final analysis it is important to make online learning pedagogically more effective and, *nota bene*, to oppose the *total fusion* of people and computers foreseen by futurologists (Kurzweil, 1999; Moravec, 1999) because this would decisively alter our "human identity" (Marotzki, 2003, p. 322).

11 “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". (N. Bolz, 1997, p. 677).

Digitalization and computerization are changing teaching and learning in multiple ways, if we just call to mind the progress of online learning in schools, institutes of higher education and continuing education. In online learning, we might be tempted to think the change is taking place with regard to new pedagogical scenarios, organizational 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 chapter will deal with the consequences that this change has for teaching and learning in 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 behaviorist 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 (1977) 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 digitalizing 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 skeptical 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

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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).

both the process and the object components. In the analysis of this term we must keep 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 (OED) (1989) the word was first seen in English in mediaeval scholasticism and meant "the action of informing matter" (OED, 1989, 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, 1989 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, 1989, 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.

Mention should be made here of Manfred Faßler, a cultural anthropologist at the University of Frankfurt am Main, who presented a concept of information according to which information is *organically* connected to man as it not only accompanies him throughout his life, but makes human life possible in the first place. Man depends on streams of information. This kind of information differs from an-organically composed information, which however, cannot be interpreted scientifically without this organic concept. The reality of an-organic-organic information is the precondition of the emergence of the "infogenetic man" (Faßler, 2008, p. 9). This approach is important for the development of a new anthropology.

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 civilization.

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 signaled 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

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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.

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 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. "Slowly we learn to grasp that information is not what man obtains, but what he does with it" (Faßler, 2008, p. 32). 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 socialization, 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, computerized 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' German dictionary for the 17th century. According to this, "knowledge" is connotated *"subjectively as personal mental possessions"* (Grimm, 1838-1969).

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) characterizing 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:

- *Demarcation:* Knowledge must be differentiated from mere perception, susceptivity, opinion, belief and conviction.
- *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, recognizing, 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
- *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).
- *Content dimension:* The contents of knowledge can be categorized 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).

- *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*."
- *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."
- *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 socialized and its dissemination accelerated.
- *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."
- *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.

- *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 analyzed 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 (1997), 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 recognized 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 categorization 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 (artificial intelligence), 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 recognize 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 judgments 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. Digitalization 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 industrialized 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 characterized 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 specialized companies, consulting firms and think tanks. The organization of knowledge production is not hierarchical.

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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, 1982, 1987; Damerow & Lefevre, 1998).

Work is trans-disciplinary and not mono- or multi-disciplinary in the traditional sense. 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:

- 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.
- 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).
- Informed knowledge is in principle fractioned, in pieces[6], fabricated and often modularized 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

6 We obtain an idea of the degree of fractionation and breakdown of knowledge by using Beats 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

contrast, with traditional knowledge an appropriate context is usually present from the start through the circumstances of its creation, the situation and the personality of the respective authors or teachers.

- 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.
- 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.
- 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).
- 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 generalizing is greatly restricted.
- 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."
- 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).
- 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 organization 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.
- 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.

- 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.
- 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.
- 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.
- 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.
- Informed knowledge "ages faster, is renewed faster, is under pressure to keep up" (Degele, 2000, p. 43).
- 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 digitalization because he characterizes 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 characterizes an epochal change.

Correspondences and Differences

Common Features

Certain *formal* correspondences between *information* and *knowledge* can be seen immediately: both appear as systematized, 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) characterizes 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 characterization 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 individualization 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 characterization 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 "McDonaldization" 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 computerized 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 localization 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 between information and knowledge

Information	**Knowledge**
Tends to be economically-industrially marked	Tends to be institutionalized
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 skillfully 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 characterization

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 computerization 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 individualization 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) summarized 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

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7 For example: Ministery of Education and Research. "Information Society Germany 2006". Retrieved on February 20th, 2010. http://www.bmbf.de/pub/aktiosprogramm_2006_gb.pdf

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) criticizes 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".

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 globalization 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 industrialization 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 favor 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 program coordinator of the Heinrich-Böll-Stiftung, Andreas Poltermann (2001) conceptualizes 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 characterizing 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

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

- 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.
- 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 computerized information systems.
- 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.
- 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.
- 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:

Wisdom

↑

Knowledge

↑

Informed knowledge

↑

Information

↑

Data

↑

Signal, signs

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

1. 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.
2. As a consequence of this development the production of knowledge breaks down in a manner never before seen into the distribution, organization and management of knowledge. Knowledge is applied to knowledge.
3. The classical forms of the production, transmission and application of knowledge will change through the development of informed knowledge.

Commentary

The diagram above 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 digitalized 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 computerization 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 tranquility. 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 criticized 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 digitalizing 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 realize that they are taking place. The technological protagonists who have already recognized 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 rationalization, mediation through media, automation, industrialization, commercialization on the area of knowledge in particular. Processes of depersonalization, of "desubjectivisation" through the increasing objectivization 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 commercialization 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.

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 skepticism, apprehension and even with rejection:

- The pedagogue Hartmut von Hentig (1993) criticizes: "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 criticizes 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 criticize 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 computerization on our society not only with regard to information but also to knowledge. The direction and the unprecedented dynamism of the current actual change become manifest and clear, and put 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, favoring 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 recognized.
- 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, internalized conceptions and habitualized behavior. 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 realize 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 behavior 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. 11) 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 behavior. 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 characterized 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 legitimize 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 characterize 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 civilization 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 Michael Gibbons et al. (1994) 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 recognize 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.

PART III:
AUTONOMOUS LEARNING

12 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 realization in the future and that models of independent online learning are already available. A cultural history interpretation of autonomous learning is made.

Introduction

Negative Opinions: Stiff Resistance

Whenever I tried to convince audiences of the importance of learner autonomy I was sure to be confronted with reservedness, skepticism, 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 organized 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.

Positive Opinions: Hopes and Expectations

On the other hand there are many educationists who consider networked computers and digitized 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.

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.

Objectives

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.

Exploring the Meaning of "Autonomous Learning"

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**.**

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-organizational* 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.

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 B. Zimmerman and D. Schunk:

Psychological: Learners are autonomous when they are "*meta-cognitively, motivationally and behaviourally* active participants in their own learning processes" (Zimmerman & Schunk, 1989, 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 judgments 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.

Renewed and Increasing Interest

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 favorable. It is fair to note that the renewed and increasing interest in autonomous learning could not have aroused without the powerful impact of digitization.

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 digitized 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 (also Bernath & Szücz, 2004).

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.

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, 1784, 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).

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 individualized 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 criticized above all the widespread lecture system, in which he recognized 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.

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 organized 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 specialized 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 individualization 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 realization 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?

Origins in Educational Theory and Practice

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-realization 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 emphasized 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.

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". (Knowles, 1988)
- 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 behavior not of adults, but of school children. This is an important aspect.

Helmut Felix Friedrich, the educational psychologist, characterized the general situation in this way: "Whereas the debates 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).

Characterizing 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).

Visions of Pedagogical Innovation

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) analyzed 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-organized 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 digitized 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 marvelous 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 digitized 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 behavior.

Currently theorists and practitioners are in the process of developing a *"second generation"* (Reimann & Zumbach, 2001, p. 35) of online learning. 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 endeavors 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.

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 internalizing 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 (Rogers & Freiberg, 1969). 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.

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 digitization of learning environments, which disembodies learning, it is necessary to emphasize 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" (see chapt. XX) are filled with many new pedagogical approaches. Students have developed and trained an entirely new learning behavior. Faculty have recognized and internalized 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 recognized 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, 2000) 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) Theorizing and research no longer emphasize strategies of *teaching* but strategies of *learning*; no longer emphasize expository teaching and receptive learning, but individualized, self-regulated learning.

It is needless to say that today we are still far from this imagined situation.

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* behavior 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.

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
- Individualized 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. Digitized 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.

Specific Pedagogical Models

In order to demonstrate that autonomous learning in digitized 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.

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 digitized learning environment that deserve the special attention of instructional designers? I can see and distinguish ten of them. It is important to recognize 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 characterized 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 emphasize 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.

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 recognized 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, visualizing 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.

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 organize 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.

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 criticize 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 behavior 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.

Distributed Problem-based Learning

Problem solving is an acknowledged traditional goal of instructional design. It is a process of recognizing 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), analyzed 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.

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). Zumbach and Reimann (1999) tested the method of learning by design by developing a project of "information design" and compared this method with a Hypertext program 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.

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 (see also Bernath & Rubin, 1999).

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, 2000). 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 socialize 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.

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 realize that the advent of digital learning has not only changed the learning environment and the learning behavior. 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 internalized 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 individualization, de-institutionalization, 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 information to 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 center of this radical change we are challenged to reinterpret two fundamental categories of the civilizing process of our bourgeois society: working and learning. The emergence of autonomous learning is an important feature of this reinterpretation.

13 The Transformation of the University Into an Institution of Independent Learning

> *"All we can predict at this point is that the old 'knowledge factories' embodied in the 'comprehensive university' of the twentieth century are on the verge of obsolescence. The question is not whether the university is going to have to change dramatically in the next five years. The question is simply whether it can change."*
>
> *Carl A. Raschke (2003, p. 20)*

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 digitization of learning and teaching, chronic financial difficulties, the quest for quality and steadily increasing industrialization, commercialization and globalization. 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 digitalization 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 organized. 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 favor of a gradual adaptation of traditional forms of studying to new situations. Futurologists who have analyzed 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 'modernization crisis'. In fact, the only treatment available is a bold wave of modernization 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 recognize 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 analyzed 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.

Recent 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, organizations, 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 programs 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 Learning in Higher 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:

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 programs,
- 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 counselors that students initiate themselves, the course of which is also determined by the students,
- optional participation in tutorials in small groups in study centers,
- self-initiated and organized 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.

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 counselors, 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".

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, 1997, p. 26). The following experiences from this field might be absorbed and developed further:

- Advisory talks with a teacher (at set times),
- counseling 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 organization 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 programs, 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 localization 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 realize 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 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 realized 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, organizational, 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 programs, 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 characterized by their individuality which can only be reproduced in part, and indeed in a reduced form, by mediated means. A dialog in the same room has more elements than in an abstracting teleconference, even where this is not merely the asynchronous exchange of messages, but is in fact a video conference. Those taking part experience an original and authentic dialog. They absorb non-verbal signals and unconscious behavioral reactions. With all their senses they become part of a multi-dimensional encounter that can be analyzed with psychological and sociological criteria. For example, Geselligkeit' (social intercourse), which Johann Wolfgang von Goethe 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 socialization 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 practized 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.

Organizational 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 reorganized, restructured and rebuilt. The following matters will need to be addressed in this regard.

Instead of having lots of lecture halls and organizing 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 multimedia teaching and study programs (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 catalogs have been digitalized 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 ritualized, 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 individualized and student-centered, 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 organized. This system will no longer be on the periphery, but will be of central importance. Great emphasis will be placed on personal counseling from tutors, which will advance to become an important component of academic teaching.

Skeptics 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 centers, 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 decentralized and individualized in real rooms, and in some cases takes place everywhere in virtual rooms.
- As a result of the upgrading of guidance and counseling 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 digitized 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 modernization.

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 asynchronicity 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 organize 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 counseling 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 favored or rejected; how this completely different system of teaching and learning can be financed; how those university teachers who are still skeptical 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 organizational 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 realized. What it will look like cannot be prophesied in detail today. However, the general goal has been already described by a group of notable international educational experts in a report to UNESCO. They recommend that *"each university should become an open university offering possibilities for distance learning and learning at various points of time". (Delors, 1998)*

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