1   Introduction

Digitalization, which is penetrating many areas of our daily working and private lives with increasing speed, is also having an effect on university teaching, and this has quite obviously been intensified since the introduction of the Internet. Traditional universities and distance universities are being confronted with new tasks. Both teachers and students must acquire new attitudes to these digital media because they considerably alter the pedagogical structure of studying at university. They have to find their way in the new situation, recognize the specific teaching and learning potentials of modern information and communication media, draft and test new forms of learning and teaching and integrate them into their daily work. Here, traditional and distance universities start from different pedagogical preconditions. This paper will above all describe and discuss the changes which new information and communication media will bring about in distance education. This topic is not only current; it is also becoming more and more significant.

Before the term is dealt with, it must be made clear what "new media" means in the context of this paper.

1.1   Old and new media

From the start, media play a different role in distance education than in studying in a traditional university. They enable distance education in the first place, it cannot take place without them. They carry out a function which is missing in teaching and learning "on site". They are used in the first place as "carrier media". However, because each medium influences and changes the pedagogical structure, the question as to which carrier media enable distance education is not only a practical/technical problem but also a pedagogical question. This situation alone shows us that with distance education we have a fundamentally different starting situation. This will become clear when we envisage the corresponding teaching and learning situation in a university: in lectures, seminars or classes, university teachers themselves function as "carrier media". The pedagogically relevant difference becomes clear immediately.

The term "new media" is now on everyone's lips. In a wider sense, since the audio-visual movement this has meant above all the mass media film, radio and TV; later other media were added, such as, e.g., audio and video cassettes. This meaning will *not* be discussed here; the discussion will concentrate instead on the "newer" media. This means exclusively electronic media, in other words the digitized media and media systems, whereby the required software must not be forgotten (Baumgartner & Payr 1994), which may have its own didactic influences. The term *multimedia* has led to fundamental changes to ideas about teaching and learning media in the recent past. Today we understand them to be first of all the PC and the digital learning environment, networks, offline and online CD-ROMs and databases, hardware and software, as are necessary, for example, to arrange video conferences, virtual seminars and computer-supported co-operative learning and working.. These are the actual "new media" in the real sense of the term, and they are the subject of this paper. There has never before been a greater turning point in the development of pedagogically used media. They enable us to gain access to a new world of teaching and learning.

To measure this radical change caused by using these new media in distance education, the role of the old media in this educational system will first be sketched.

- When organized distance education began about 150 years ago, the *written* and the *printed word*, the *railway* and the *post* were constitutive for this form of learning. With the book as

the main medium, the interplay of these technical media was typical for distance education of the *first generation,* which extends into our own times. They are extremely important, because they were a typical, characteristic feature of this type of distance education. They enable us to define distance education in all cases as *»studying enabled by media«.* Since the founding years, teaching and learning behavior in distance education has been determined above all by technical media, whereas these media were hardly used at all for over one hundred years for teaching and learning at European universities. In fact, they were often rejected there, in part vehemently. Books may be regarded as the exception.

- A new era began with the use of above all the mass media radio and television together with books as carrier and presentation media. The *distance universities* and *open universities* which were founded in many parts of the world from about 1970 offered accordingly distance education with multiple media. Quite naturally, this required altered teaching and learning behaviors, through which a different pedagogical structure was created which appears to justify referring to this period as *second generation* distance education.

- At present we are experiencing the beginning of a new epoch in which a *third generation* of distance education is being formed as a result of the unheard-of advances in information and communications technologies and their increasing use. This is no longer characterized by the combination or the »inter-linking« of several media but typically through their »integration« on the basis of multimedia technology and the PC. Jürgen Wurster (1999, 53) therefore speaks of "integrating learning environments" which are now available to distance students. With regard to the pedagogical use of the integrated new media there a fundamentally altered situation arises. Once again, teaching and learning behaviors change.

1.2   Pedagogical dimensions of networked computers

The central medium is now the *PC*. However, because of the enormous advances in computer, multimedia and network technologies, in particular in the areas of display, transmission and storage, this is by no means a *single* medium in the traditional sense, but a complex, multifunctional aggregate of *several* media. In spite of its name, it is naturally no longer just a "computer", but has become an extraordinarily versatile communications medium which unites and bundles functions which were previously carried out separately by several different media or media systems. PCs serve at the same time as a carrier, distribution, display, instruction and interactive medium. In addition, they provide pedagogically useful services which traditional media are completely unable to do. For teaching and learning they also exercise specific teaching functions as a memory, transmission and distribution appliance, and not least as a word processor and as a distribution and animation appliance. Finally, they outperform all other media because of the rapid and ubiquitous data access and data exchange, and because they can generate virtual rooms and virtual realities in a unique manner. Those who plan and design teaching are now, as it were, in a media seventh heaven. At the same time, the technologies referred to can only develop their effects when they have been programmed to do so with the respective operating and application software. In a certain sense, therefore, it is the software programs which are the real new media, in particular because considerable preliminary pedagogical decisions are often taken on their development.

The PC also differs as follows from all the technical media which have ever been used in the history of teaching and learning. Teachers and students are fascinated by the power they exude. Why is it so much more attractive than classical teaching and learning media? According to Sherry Turkle (1998, 42), it is fascinating because of the possibility of "talking" with it, being led by it into virtual worlds, or using it to extend their own intellectual capabilities. If,

for example, our memories, in other words, our internal data storage units, fuse practically symbiotically with the computer's external memory, we experience a growth in strength and an extension of the self. This is experienced as something pleasant, and even enjoyed unconsciously or in a restrained manner. Here we find the important question for distance students of whether this particular effect of PCs also has an effect on *learning motivation*. There are indications of this in teaching practice.

The PC with its hardware and software is then in the center of the integrated digital learning environment. *Standard technical equipment* has to be available. The PC is then supplemented by loudspeakers, a modem, a printer and fax machine. However, this media unit does not attain its full importance until the networks are added, with all their servers, search engines and expert systems. This configuration unites and integrates the "new media", which are designated in this way to demarcate them from the "old media" because of their structural distinctiveness, different nature and incomparable efficacy. From now on, this digital learning environment will not only determine and change the structure of the learning process in a sensational manner, but will reconstitute it.

1.2.1 Pedagogical variety

Even uninitiated observers are able to see the pedagogical multi-functionality of the digital learning environment after their first experiences with it. It is very difficult for them to comprehend fully, in fact experts find this difficult as well, and it often causes amazement. Not only can learning texts be presented with its help to students, but also two- or three-dimensional graphics, color illustrations, audio and video sequences and even two.- or three-dimensional animation and simulations. Their integration alone would be an invaluable pedagogical advance. But this is not enough. There are additional and much deeper pedagogical possibilities, namely those of facilitated and increased *interactivity, individualization* and the opportunity for *independent learning*.

1.2.2 Virtual learning spaces

PCs can generate virtual learning spaces. This results in pedagogical design dimensions which no one has yet thought of in real learning spaces. Ten of these new learning spaces (Peters 2000) are pedagogically interesting and useable in an innovative manner, namely:

> the spaces for instruction, information, communication, collaboration, exploration, documentation, multimedia, text processing, illustration and simulation and the spaces in virtual reality.

We are dealing here with distinct virtual spaces, which are independent of each other, in which specific pedagogical actions can be carried out. The majority of them are not derived from traditional forms of teaching and learning but from the specific technological situation of the PC. Naturally, not one of these spaces actually exists. For students, what is "real" is only the digital learning environment with the monitor's screen as the interface. In contrast, virtual spaces are only created if the imagined empty space behind the screen is made into the "stage" for actions, in our case for pedagogical actions.

1.2.3 Favoring autonomous learning

If we examine these virtual learning spaces, we are faced with the conception that learning in distance education certainly does not have to consist merely of the reception of intensified presentations of course contents made clear by multimedia in the sense of instruction design. It can in fact be brought about easily, and perhaps above all, by means of independent, active

pedagogical actions *of the students themselves*. Typical examples of this are interaction with adaptive teaching programs, searching for information in databases all over the world, communication and collaborating with other participants in the teaching and learning process, exploring areas of knowledge (e.g. in hypertexts), immersion in virtual worlds, storing and requesting material which has been learnt and judicious handling of knowledge which has already been acquired and documented *(knowledge management),* the creative representation of problems which have been worked out using word processing and multimedia, and publishing this on the Web. This is an absolutely amazing potential for innovation! We cannot fail to be impressed from the start by the enormous opportunities for the pedagogical reform of distance education that result with the help of the new media.

It is a fact that actions in these virtual learning spaces do encourage far-reaching, even radical changes. Higher levels of *activation* and of *interactivity* are reached relatively easily. And there are many other obvious and promising possibilities for developing an autonomous and self-regulating learning behavior. Even more: the digital learning environment actually promotes the development of an autonomous learning. Self-direction, which always has to be pre-supposed for learning by distance students, can be raised with the help of a PC to a qualitatively higher level. For important pedagogical reasons it would be irresponsible not to make use of these new chances for pedagogical optimization.

2 Favorable preconditions in distance teaching universities

If a traditional university and a distance teaching university decide to increase the amount of teaching using PCs and the Internet, this is not the same thing. In contrast to traditional universities, distance universities are already prepared in many ways for the tasks this would involve, which is usually overlooked, above all by those who see the difference between the two types of university disappearing with the introduction of Internet-based learning, and speak of their "convergence" (Tait & Mills 1999). Teachers and students at distance universities already have the attitudes, strategies and experience which from the start support and facilitate the processes of change which become necessary. Advantageous institutional circumstances are added here, because at distance 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. On the whole, learning in distance education is structurally strikingly close to learning in virtual spaces. This is obvious in the following:

1. Distance universities have long experience in looking after students who live away from the university location. *Distributed learning*, which is now being propagated, is nothing new for them. They have already developed techniques for bridging the distance between teachers and students, whereby this is not always a matter of geographical distances but also of mental, social an cultural "distances".

2. Teachers and students have a basically different attitude to *technical media* because, as we have already seen, they enable teaching and learning over a distance in the first place. The importance of technical media can be seen in the use of language as well: distance universities are often referred to as "media universities".

3. Teachers are used to using teaching texts which have been compiled carefully with the help of *instructional design* experts and tested and evaluated empirically. Their teaching is therefore on a professional level *pedagogically*.

4. "Asynchronous learning" has been practiced at distance universities from the very start. It is structurally necessary and not at all an innovation which was first achieved through digitization.

5. Teachers have developed techniques for *supporting* students working in isolation to make studying easier for them and to motivate them continuously to study. They make efforts to keep up the links with the students. These efforts find an expression in the study centers, in which tutors, mentors and counselors are integrated in the provision of support.

6. Students have already gained experience in *autonomous, self-directed learning*, at least in so far as they themselves plan and fix the location, time and circumstances for learning.

7. Teaching is therefore particularly close to the *world of employment* as students are usually employed themselves, and the tutors and mentors often have current employment experience themselves.

8. Distance universities have already opened up to *new, unconventional groups of students.* Teachers are already used to working together with older students who are usually employed as well. They have established *adult university education* as a regular and freely accessible offer.

9. Since their foundations distance universities have practiced *lifetime learning* intensively, which international educational organizations have continuously demanded for decades.

10. Distance universities have already made a noteworthy contribution to the establishment of *mass higher education*, which has become necessary globally. They have developed suitable strategies and techniques for teaching and learning for large, and in fact very large, groups of students.

11. Distance universities contributed at an early stage to reducing the costs of studying, as John Daniel (1998a, 1) has pointed out. In his judgement, a place in the Open University in the UK is only half as expensive as in comparable traditional British universities.

12. Distance universities have always been extraordinarily flexible institutions. For example, they adapted to advances in media technologies, which led to the development of the three "generations" of distance education which we referred to above. In addition, distance education is able to react quickly to new learning requirements as they arise and to adjust to groups of people who are neglected by traditional universities or in fact by the educational system as a whole.

If we remember what is to be achieved with learning in the Internet and in virtual universities, we come quickly to the following conclusion: distance universities have already taken up many of the things which the concept of online learning and the virtual university wanted to achieve with regard to university reform. We can point to pedagogical approaches which have already been consolidated and which are constitutive and typical for distance universities but are usually totally lacking in traditional universities. They are the reason why a virtual *distance* teaching university will have a different pedagogical profile as virtual universities which spring from traditional universities.

3   Stages on the road to the "learning space virtual university« of the Fernuniversität in Hagen

What is the role played by the new media in distance universities in view of the favorable conditions referred to above? To what extent and in what way are they used and what are the

effects on learning behavior? We can see that all distance universities are experimenting with the new media, often with the declared aim of establishing a "virtual university" in which the complete process of teaching and learning will be determined by an integrated system of new media. Distance teaching universities in which whole degree courses can already be taken online are already approaching this goal.

The transition from the media of the first and second generation of distance education to the new media and the development of virtual universities is a complicated and complex process. We will examine a practical example to impart an overview of the various initiatives and experiments which are necessary for using the new media for students in distance education and in the end can lead to the establishment of a virtual university. We will show the steps which led to the establishment of the »learning space virtual university« of the Fernuniversität in Hagen. It can be shown how this institution faced up the challenges of the new media step-by-step and how this forced students to alter their learning behavior. This recourse to the practice of learning in a distance teaching university should be seen as a supplement to a theoretical discussion of the possibilities with the possibilities and advantages of the virtual learning environment in distance education (Peters 2000**a**, 1). It offers itself above all because in this way the use of the new media in distance education can be demonstrated and commented on.

The twelve pedagogically relevant features of distance teaching universities which structurally favor their transformation to virtual universities, are supplemented in the FernUniversität Hagen by a much more important finding. This university has for decades realized certain elements of the teaching and learning process with the help of electronic media. This was originally done in the form of smaller experiments, then in the form of individual learning modules and training sequences. All this was at first part of the normal operating system. From today's point of view, however, they were modules for the establishment of a virtual university. Only in the last few years have efforts been concentrated on online learning. First of all there were experiments with digitized courses, which were offered parallel to traditional printed distance education courses. The development culminated in the provision of two fully digitized *degree courses*. Of course, these digitized elements are only found on islands in the great sea of teaching courses provided by the FernUniversität. On the whole, however, the experience gained with these courses means that the FernUniversität has gained a head start in this field (cf. Kaderali 1999).

A total of 34 approaches for digitizing learning can be diagnosed which up to now have been developed and tested in stages and which have since proved their worth in everyday work (cf. annex). Twelve of these will be sketched here with regard to changes to teaching and learning in distance education.

3.1 Electronic administration of distance students' files

This part of the process of teaching and studying is important not only for organization-technical reasons, because of the large number of students, but also because of its pedagogical importance. Because teachers do not normally meet their students, or only for short periods in study centers, they have to gain a general picture of them through the available data. Only with the help of the computer are they able to gain an overview of the age, sex, occupation, address, etc., of large populations of students. This is without doubt important for all teaching activities. The files also contain students' achievements. They can be requested by both teachers and students to enable them to discuss the course of their studying career. Often, earlier written examinations are opened to inform themselves or others of earlier learning steps and

learning results. This helps orientation, in favorable cases can strengthen motivation and provides data for pedagogical research.

3.2 Electronic evaluation of course development

With the help of computers the effect of the carefully developed teaching texts were already being examined in the founding years of the FernUniversität. Course units were processed by external experts who had stated that they would do this as representatives of the students. Their opinions and impressions were polled using a standardized questionnaire with a marking record. In this way, the computer was able to provide initial results (formative evaluation). Finished courses were also checked in this way. Some students were given a questionnaire with their course units, which they marked and returned. The findings were then interpreted by experts from the center for the development of distance education and passed to the teachers. In this way error rates and degrees of difficulty were ascertained. Because of the usually large number of students at a distance university (sometimes thousands of students enroll for individual courses), it was only possible with the help of electronic data processing to gain a reliable overview of the effect of course syllabuses on students. The findings were able to have an effect on the optimization of the prepared courses. And this then changed the teaching behavior.

3.3 Electronic advisory service for potential students

From 1979 to 1983, those who were interested in studying at the FernUniversität and who wanted to know whether they were suited for it, were offered detailed computer-supported advice (Fritsch 1982). What was important here was to supply them with information which would facilitate their decision. This was done through the preliminary course "Studying at the FernUniversität", which caused potential applicants to think about their study wishes in combination with their learning and life situations. Following this, they were given a questionnaire to work through which was to help the process of self-enlightenment still further. The questionnaire was evaluated by the central computer. Advice was then provided, not by means of a standard letter, but by a detailed computer letter, which responded to the individual situations of each applicant differently. This electronic advice for potential, students was not intended in any way to replace a personal discussion with a student counselor, but only to take the strain off it. This was necessary, because about 5,000 of these advice letters were sent each semester. In this way, potential, students were provided with much more information, tailored to their needs and therefore relevant to them, than they could possibly obtain in an interview with a personal counselor.

3.4 Electronic correction of written assignments

To activate students and to accustom them to interactive learning behavior with the printed distance teaching course, the teaching texts contain numerous practical and self-test assignments. With the help of machine-readable marking sheets they can find out through the computer whether they have solved the problem and how their work is to be graded. They receive a computer letter with this information (Raiser 1991). This system contains approaches to promoting self-directed learning.

Written assignments are either corrected by the FernUniversität's correctors or also with the help of computers, in particular in the subjects accounting, cost accounting and commercial balance sheets. The computer center uses the support of the mechanical correction systems

LOTSE and operational accounting (bRw), both of which were developed by the FernUniversität and have been in use since 1977.

The electronic correction system has an effect on learning processes in that each notification of the grade includes information on the overall grades and achievements. This provides students with orientation.

3.5   Electronic drill exercises

Since 1984, in addition to the printed teaching materials, some departments have offered computer-supported practical exercises and training on disk. These are "assignment and examination trainers", first of all for extending and strengthening the specialist vocabulary for *English for mathematicians* and *English for economists* and for solving the problems in the course *Mathematics for economists.* Depending on the object and the learning situation, these drill and practice exercises are oriented towards the respective current behaviorist instruction models and were therefore interactive throughout. At the same time, however, self-controlled branches could also be integrated. For example, in the program *Macro-Tool-Box* economics students can experiment independently with models so that they can learn to handle larger econometric simulation models in their working lives.

3.6   Electronic teaching in continuing education

Since 1990, computer-supported teaching programs have also been developed on central topics of printed distance education courses whose pedagogical function is seen in strengthening, extending, supplementing and simplifying understanding. These teaching programs can also be worked through independently of the available distance education courses. At present, for example, these teaching disks are offered in the Department of Computer Science on the following subjects: *knowledge-based systems – neural networks – introduction to the programming language C – introduction to UNIX-SOL – relational database language – object-oriented database systems – introduction to fuzzy logic.*

These continuing education programs are oriented towards models which understand learning as active information processing. They deal with the "active construction of individual knowledge, experience and behavior potentials" (Heuel & Postel 1993, 267). "Self-direction" and "interaction are the most important pedagogical goals here.

3.7   Online seminars

In 1995 the university started experimenting with virtual seminars (Wiendieck & Üstünsöz 1995), particularly in social sciences and the humanities, namely in Labor and Information Psychology, Methods of Psychology, Political Science, Therapeutic Pedagogy, Special Pedagogy and Economic Informatics. Fourteen virtual seminars have since been held at the Institute for Psychology alone. There is no doubt that in the corresponding departments there is a greater demand for discussion than in scientific-technical departments, at least in distance education. Computer-supported seminars enable a group of students to communicate and collaborate with or without the direction and guidance of teachers. Both forms are based on a usually lively exchange of e-mails and attached text, which are read and answered with a time lag, and also on the free exchange of knowledge and opinions via newsgroups. The experiments show that there is no way in which the teaching and learning behavior of traditional seminars can be imitated. Online seminars have rather proved to be teaching of a special kind, which can be located roughly *between* instruction with printed material and oral seminars.

In certain situations experiments were also carried out with video conferencing (e.g. Ewert et al. 1998)). This is a new medium for teaching and learning in distance education with definite advantages and disadvantages, whose beneficial use for distance education still has to be developed. It will certainly improve the communicative structure of distance education, but it cannot serve as a substitute for personal, face-to-face communication in distance education.

3.8   Online drill

Since the beginning of the 1990s, a general software infrastructure for Internet-supported exercises has been developed and tested in four departments. The research relevant to this is carried out by the Chair of Practical Informatics III and the Chair of Ecological Psychology in the framework of the *WebAssign project* (Voss et al. 2000; Six et al. 2001). It supports all activities involved with drill, in particular solving problems, and correcting and evaluating solutions. Work is done with preliminary tests which enable students to work several times through a problem which they have solved incorrectly. Only the final correction, which is either manual or mechanical, is evaluated. The system regulates the co-ordination of the activities of students, correctors and counselors. It is so advanced that it can be integrated into the coming »learning space virtual university«.

3.9   Online practical training

The opportunities which are opened up here can be seen in a perfect pedagogical example which is practiced in the robot laboratory of the Department of Electrical Engineering. Students can carry out real control engineering experiments with a robot without being physically present themselves. Students control the robot through the Internet, follow its movements per video and then evaluate the measured values (Hoyer 1998) This is an example which can be transferred to other laboratory situations.

3.10   Online tutorials

In traditional distance education, support for distance students is provided above all by the mentors in the study centers. Since the introduction of the Internet, advice and help are no longer requested by telephone alone but also by e-mail (Kleinschmidt 1999). An example of this is the support provided for students of the course "Introduction to the Methodology of Political Science". Mentors provide students with their e-mail addresses and answer their questions. They also give students minor problems to solve or solve them together with the students. Support can then take on the character of preparation for the next written examination

3.11   Using the university library online

The current situation has been documented by Dirk Pieper and Dieter Schmauss (1999, 71), and by Dieter Schmauss (2000). The online services of the university library were provided in the 1980s via Datex-P, and since the early 1990s they have been provided via the Internet. In addition, since 1995 the university library has had its own home page on the Web. The whole stock of 660,000 books and 3,100 journals is documented in an online catalogue (OPAC) which can be researched via the Internet. The Internet can also be used by students to access national and international library catalogues, specialized electronic information, specialized databases and full texts and the document delivery system JASON-WWW for North Rhine Westphalia. A journal contents service is being developed. Students can also reserve books via the Internet or extend loan periods. A virtual semester apparatus is planned.

3.12 Learning space virtual university

If we take all the activities referred to in this section together, we see a mosaic of experience with digital teaching and learning which can be integrated into the development of an overall system for a virtual university. However, they are not yet related to each other and harmonized. This will require a differentiated process of development, testing and evaluating. This has been developed in the FernUniversität since 1995. At the Chairs of Practical Informatics (Prof. Dr. Schlageter) and Communications Systems (Prof. Dr. Kaderali), work has been carried out intensively and at great expense on developing, testing and optimizing a model for operating virtual universities, whereby in particular the findings and experiences gained by multimedia and communications technology are used as a basis. The ambition of the project groups set up is to optimize the technical installations for operating an virtual university with the required hardware and software, but at the same time to develop an *overall concept* for the virtual university. They want to take up the previous isolated experience with data courses, interactive multimedia modules and *tele-conferencing* and use it productively, but also to bundle these services with other services in the university, so that in the end they will be in a position to exercise *all* the functions of a university. Not only are teaching and research optimized, but also access to the administration and the library, to current information and to opportunities for informal discussions, counseling and learning support.

An example can illustrate these efforts. The learning portal on the PC screen which shows students how to use these services at present comprises, in accordance with the designated goals, the following elements: ***teaching*** (where access to virtual teaching is shown); ***research*** (where teachers and students can obtain information on the status of research in individual teaching fields); ***"News"*** (where current information on the system, the department or the course can be obtained, as on a blackboard); ***Shop*** (where above all additional teaching and learning programs can be bought); ***Cafeteria*** (for informal contacts with other students, including private contacts); ***Office*** (where all administrative processes are carried out); ***Library*** (where books can be reserved, digital books or journals read or bibliographic research carried out); and ***Information*** (where all questions on the FernUniversität are answered, potential students, i.e. "virtual visitors", are shown the FernUniversität and talks with mentors take place). (See Schlageter 2000, 135).

This means that students no longer need to leave their digital learning environment because all the university's services, and those of the study centers, are available there. They can make use of them without any problems. An initial result of these findings is the fully digitized ***degree course ET Online***, which is provided in *German* and *English* and for which the degree of Bachelor of Science can be awarded (Kaderali 1999). Development started in 1995 and since then it has been tested by 5,000 students. Students can check their registered particulars here, access electronic teaching materials and communicate with mentors and other students. Secondly, the virtual ***Bachelor's Degree Course in Computer Science*** has just been completed. Thirdly, a virtual mathematics degree course is being prepared. These are the first steps in the transformation process from a distance teaching university towards a virtual university (Hoyer 2000).

3.3   Change of Learning Behavior

These degree courses presuppose new *learning behaviors*. It is not just a matter of students' finding their way around in the abstract world of a virtual university and accustoming themselves to the completely different way of working in the digital learning environment and in the Internet. Experience alone will probably be sufficient for this. What is more important is to acquire the skill not to be dependent on the judgement of others, to be clear about their own learning requirements, to take the initiative, to develop the skill to recognize quality differences quickly, to evaluate the advantages and disadvantages of defined learning paths, to make a well-founded choice between several course syllabuses, to reflect on their own learning and to contribute to the creation of a culture of digital communication. In other words: predominantly externally directed students have to change into predominantly internally directed students. The pedagogical goal here is the development of autonomously acting students who initiate, control and evaluate their work themselves

3.2   Consequences

The transformation from learning in real rooms in the university to learning in virtual rooms, and this can be seen in the 12 stages and even more the 34 development steps in the enclosed table, was not a sudden and rapid process at the FernUniversität but a general preparatory process over many years. It will probably continue for some time to come and may even remain open-ended, because of the rapid technical and social changes. Many people took part in the process in many functions, including professors for practical Informatics and for communications systems. The entrenchment of the transformation process in research which is achieved here has an extremely beneficial effect as it contributes concepts and processes for this innovation project. At the same time, research makes the FernUniversität relatively independent of commercial ties, dependencies and restrictions, which is even more significant because, in some countries, more and more universities which want to teach online are moving into outsourcing important academic functions. Frequently, not only software and technical monitoring but also even the digitized teaching programs and the pedagogical support for students is bought in from outside companies. This is only mentioned to show the problems with which distance education institutions can be faced, if they use the new media without being adequately prepared and equipped for this.

4   Summary and evaluation

Now that the structural affinity of distance education to Web-supported learning has been shown, preliminary approaches to learning with the new media have been sketched and the pedagogical structure of the »learning space virtual university« has been described, two concluding questions will be dealt with. (1) What are the pedagogical gains which make the described use of the new media appear advisable if not even absolutely essential? (2) How is the prescribed use of the new media to be evaluated from the aspect of cultural history?

4.1 Pedagogical gains

If we look at the large number of new media in the form of hardware and software as they are now used in the layout and in the operation of the digital learning environment, and if we consider their special possibilities in the framework of virtual universities, we come to the conclusion that the importance of the previous development work can be assessed very highly, because the following positive effects on learning behavior can be detected.

4.1.1 Improving external working conditions

At first, two qualities are seen which, by the way, have never played any role in traditional pedagogy: the considerable *time savings* and the *comfort*. Both of these are considerably important for distance students who are in employment because they suffer from a chronic lack of time and because it is difficult for them to attend regular teaching events, counseling, tutorial in study centers or other institutional centers. The sequence of learning and teaching acts is rapid and the return times for corrections are short. As far as "comfort" is concerned, this appears at first glance to be an external characteristic. However, its special importance becomes clear on a second glance. If such rapid access to the desired information, instruction, course syllabuses of various origins is available, as well as much easier access to joint discussions, group discussions and collaborative activities, this is not only the result of the *"user-friendliness"* of technical media which Anthony Bates (1995, 9) continually stresses. What is in fact being created here is a radically new and never before experienced situation, in which everything is *available* at the click of a mouse which is required for reading, looking up, studying, training, repeating, constructing, organizing, informing, storing, remembering, *browsing* and *navigating*, and which also saves students many trips and considerable effort. The word "comfortable" in the sense of "imparting comfort" may be used here as a working term, though "convenience" might be a more fitting term.

4.1.2 Special distance education pedagogical benefits

Our attention is then directed towards those benefits which the new media offer distance education with regard to the improvement of its pedagogical structure. They can provide partial and some times surprisingly effective compensation for the *pedagogical deficiencies* of correspondence distance education and of distance education with joint media. The most significant of these deficiencies are

- the widespread reduction of the representation modes to the medium of the printed material
- dependence on one-way communication when using mass media (print, TV, radio),
- the drastic reduction of formal and informal social contacts to other students and teachers,
- the considerable spatial and social isolation of students,
- the inadequate participation in the scientific process.

With the help of the new media it is namely possible to use and combine several modes of representation, to facilitate and strengthen two-way communications, to initiate social contacts virtually, to reduce the isolation of students and to enable participation in virtual collaborative research projects. Above all, physical distance can be changed into *virtual proximity* for distance students, which enables "tele-presence", in other words "mental presence with physical absence" (Kleinschroth 1996, 237). These advantages are constitutive for third-generation distance education. Each distance education theoretician and practitioner should value these possibilities for optimizing the teaching and learning process in distance education as being

extremely attractive and desirable. They should see the virtual university as the culmination of all efforts to improve learning conditions in particular for distance students.

4.1.3 Inherent advantages of the digital learning environment

The distance education pedagogical advantages referred to above are joined by those characteristic features which distinguish the different digital working methods. These are just the six most important of these:

- strengthening and bundling several *presentation modes* through multimedia
- *access to* a broad, differentiated and apparently inexhaustible range of *information*
- the capability to *communicate* and *co-operate* independently of the location, at the same time and with a time lag
- increases in *activity* and *interactivity* with the help of adaptive learning programs
- the technical measures for *storing* and *presenting* knowledge
- the way in which the digital learning environment encourages, tempts and forces students into *autonomous learning*.

These possibilities make learning by distance students flexible and extend it structurally to a serious extent. They change the learning process, its organization, contents, methods and social forms. The pedagogical consequences of such changes are still by no means fully conceivable and foreseeable. It is important, first of all, to *recognize* the specific learning potentials of the digital learning environment and then *to use them in a new way* on the basis of *pedagogical* reflections. Not what is technically feasible, not hardware advertised and sold commercially, but what is pedagogically desirable and necessary should be in the foreground here. The basic principle is: "The use of new media (...) may not be linked with an additive approach but must be linked with a systematic approach". Only in this way can the new media become an "impulse for a change of forms of teaching and learning which have become ineffective" (Reinmann-Rothmeier & Mandl 1999, 6). This change has to be comprehensive, because "transformation is paramount for success" (Eisenstadt & Vincent 1998, 13).

4.1.4 Misgivings

The pleasure and enthusiasm for the wonderful instruments of the new media, especially in a virtual university, are not unmixed. Educationists are bothered by the question of *how* they will be used in practice. Will many be tempted to use this expensive an extraordinarily versatile technological system, so to speak in a one-dimensional manner, to imitate, perpetuate and aggravate the *traditional* teaching and learning situation, unfortunately down to the very last detail? Will many teachers simple record their lectures on video, transfer them to CD-ROM and then feed them into the virtual university? Will other teachers simply have their teaching texts digitized and placed on the Internet? Will they therefore misunderstand the Internet mainly as an instrument for distribution? Will universities simply use the new media for a technically enabled extension of conventional instruction through satellite and *videoconferencing* to other learning groups? This is the system of teacher-centered *remote group learning* which was so fiercely attacked by John Daniel (1998b, 25). Great chances would then be lost of working with a highly flexible, variable and adaptive teaching and learning situation, which can be quickly adapted to changing individual, occupational and societal requirements. We could then no longer expect a reform of the curricula or a working out of methods of teaching and learning which are in compliance with, and peculiar to, a virtual uni-

versity. The virtual university must develop its own pedagogical profile and must not simply want to imitate the methods of campus or distance teaching universities.

A second problem is caused by the cheerful confidence of those protagonists of the virtual university who believe that the interactivity and communication which is lacking in distance education will be provided by the new media. They hold out a hope for themselves which will prove to be seriously self-deceiving. Communication mediated through technical media remains *mediated* communication and *cannot* replace an actual discussion, an actual argument, a discourse among people gathered at a single location. Mediated communication and real communication are in relation to each other in the same way as a pencil sketch to an oil painting of the same subject. What happens in a discussion between two or more people is only partly mediated electronically. What is missing is the consciously perceived presence of the others, their aura, the feeling of being together, which arises in a different manner on every meeting. All this makes communication genuine and lively. A virtual university which does without *face-to-face* events by pointing to the possibilities of *video-conferencing* will always remain a surrogate of a university.

In the face of these problems, is it advisable to imagine a virtual university as an independent and enclosed institution? Should we not rather go on to consider how it might be integrated into a *university of the future* (Peters 1998, 219; 2000b, 10)? Because of the two critical points referred to above, it should not provide the prevailing pattern, but bring its extraordinary efficacy, flexibility, adaptability and variability into the university of the future, in which, however, the academic discourse face-to-face and "academic social life" (Casper 1997, 25) are found just as naturally as the proven forms of teaching and learning in traditional distance education. The pedagogical contribution described here of the virtual university enabled by new media should be extremely welcome in a *mixed mode university* of this nature.

4.1.5   Evaluation

The use of new media in distance education cannot be compared with the use of early technical media We are not dealing here with pedagogical progress in traditional paths and under a traditional general setting, but are entering new territory and experience, and suffer an unequalled *breach of tradition* while breaking with this tradition. Learning and teaching in the digital age have to be redefined. We only have to think about the fundamentally new requirements which autonomous learning places on the evaluation of the "learning success" (Baumgartner 2000). The pedagogical paradigm change puts students and teachers in distance education in a difficult situation, which remains inevitable however. It will take some time until they have really accustomed themselves to the new situation. But in face of the rapid change, the question must be asked whether this goal can ever be achieved. We will probably have to regard the new media and their continuing change as constant determinants of our future learning. We should see this as both a challenge and a chance.

If we sum up from the described virtualization on a higher reflection level, above all the radical »*mediatising*« (Haefner 1987, 33) of teaching and learning is seen as a serious consequence of the use of PCs and computer networks. This is a procedure which is unparalleled in human history because of its massive effects. This mediatising has taken place in moderate and radical forms. In moderate mediatising, computer networks serve only to supplement and enrich conventional forms of teaching and learning. Here they are an additive, which can be left out where required. Radical mediatising on the other hand is "disruptive" (in the sense of Garrison & Anderson 2000, 27) and leads to the dissolution of conventional forms of teaching and learning, which can, however, lead to its creative restructuring in the form of completely

new learning scenarios. In distance education, the link between the teachers and the students was mediatised from the start. The printed material and the written letter mainly came between the two. The new media strengthen and radicalise this process. In addition, they extend it in that they also mediatise existing islands of direct interaction, for example in study centers.

The use of new media, this can be seen at least, confronts us with problems which do not exist when dealing with old media in distance education. It changes not only the attitudes, the behavior and the learning action of students and even knowledge as well as the structure of the institution, but has a deeper effect, because it is also part of those structural changes which the post-industrial information and knowledge society imposes on us in any case.

5   New media research

5.1 Overview

In the field of learning with new media in distance education the following publications can be evaluated:

(1) **Empirical reports from practice.** As far as their numbers are concerned, these are in the foreground. However, their findings can often only be generalized conditionally, because of the special underlying situation in each case. In addition, many refer only to "*work in progress*". Even in the early 1990s reports of this nature were read at NATO Advanced Research Workshops and published in the corresponding proceedings. The volumes which are relevant for our subject are concerned with *Computer-Based Learning Environments and Problem Solving* (De Corte et al. 1992), *Collaborative Learning Through Computer Conferencing* (Kaye 1992) and *Collaborative Dialogue Technologies in Distance Learning* (Verdejo & Cerri 1994). More recent example are Nicolae Nestor's and Heinz Mandl's "Experiences with a virtual seminar" (1997), and reports on the same subject from Ulrich Bernath (2000), and Ulrich Bernath with Eugen Rubin (1999). Reports from Horst Heidbrink (1996) and Norbert Wenning (2000) are available from the practice of the FernUniversität.

(2) **Analyses grounded on learning psychology.** They are of particular importance for practice because they provide criteria with whose help the new phenomena of online learning can be interpreted correctly. In this terrain, which is strange for most university teachers, but also for educationists and pedagogical experts, many try to experiment with *traditional* forms of teaching and learning. These articles help them to reorient themselves in the *transformation* of pedagogical action which has now become necessary. Four examples: the chapter "Learning and teaching with the computer" by Heinz Mandl, Hans Gruber and Alexander Renkl (1997), the article "Problem-oriented learning with multimedia" by Gabi Reinmann-Rothmeier and Heinz Mandl (1997), the article "The virtual university from a pedagogical point of view" by Rolf Schulmeister (1999) and the work by Hermann Astleitner and Detlev Leutner (1998) because of their pedagogical-psychological approaches.

(3) **Research reports from institutional research.** Because most distance universities have been dealing for years with the new opportunities provided by online learning, for obvious reasons, have already gathered their own experiences and at the same time are forced to carry out *»institutional research«* (Woodley 1999, 52), online problems concerning the institute can be dealt with by professional instruction designers and instruction technicians in the appropriate research agencies or institutes. In the Open University in the UK, along with the *Institute*

of Educational Technology there is an institute which was established expressly for the purpose of researching into online learning in distance education. This »*Knowledge Media Institute*« has published a well-founded report on its work (Eisenstadt & Vincent 1998). The chapters "Knowledge Media", "Collaboration and Presence" and "Knowledge Systems on the Net" provide information on research into important aspects of learning with new media in distance education. Examples from the institutional research at the FernUniversität are listed in the annual reports of the Zentrum für Fernstudienentwicklung ("Centre for the Development of Distance Education") (ZFE 1999, ZFE 2000). One working area of this center is concerned in particular with interactive media, develops Web-based teaching methods and new integrating software and looks after the mechanical correction systems. Relevant articles have been submitted by Jürgen Wurster (1999, 1997), Christine von Prümmer (2000, 1999, 1998), Fritz Peter Helms (1999), Jürgen Ewert et al. (1998), Jörn Bartels (1997), Friedrich-Wilhelm Geiersbach et al. (1997) and Wolfram Laaser (1990).

(4) **Research reports of applied cognition research**. Aspects of online learning have been researched for some years by the Department of Applied Cognition Research of the German Institute for Distance Education Research at the university of Tübingen. Its main areas of work in the field of virtual learning environments are, among others, "visualizing", "navigation", "co-operation", "participation and communication" and "structuring the supply of information in virtual seminars". Two examples: "Vergleichende Bewertung von Methoden zur Beurteilung von Lern- und Informationssystemen. Fazit eines Methodenvergleichs" by Sigmar-Olaf Tergan (2000) and "Partizipation im virtuellen Seminar in Abhängigkeit von der Moderationsmethode – eine empirische Untersuchung" by Helmut Felix Friedrich, Friedrich W. Hesse, S. Ferber und J. Heinz (2000a).

In the face of the rapid technological development of learning with new media in distance education, there are considerable problems for empirical projects. These naturally require a great deal of time. When their findings are presented they are often outdated in part, above all, namely, if overriding pedagogical and pedagogical aspects are not considered or are not considered enough.

(5) **Contributions from other disciplines**. Because the digitalization of learning environments is a sub-process of a global economic, political and cultural development through to a "virtual society" it is also important to research into overriding dimensions. For this reason, we must also take into account philosophical contributions, for example on the phenomenon of virtuality (Friesen et al. 2000; Baudrillard 1989); sociological studies, for example on determining the characteristics of the information or knowledge society (Bühl 1997); cultural history findings, for example on the historical and present-day metamorphoses of perceptions of space and time (Burckhardt 1997; Virilio 1999); and communication science studies, for example on conceptions of the consequences of computer-mediated communication (Beck 1998).

5.2 Desiderata

For pedagogical reasons, it is essential that research is carried out into the following aspects of learning with the new media in distance education: learning situations in a virtual seminar; stages and forms of autonomous, self-directed learning in the virtual learning environment; new forms of evaluating with online learning, in particular with autonomous learning, in which the evaluation criteria of expository teaching and receptive learning cannot apply; web-based advice, support and counseling for self-learners, whose importance has increased and which will have to be fully reconceived; the pedagogical relevance of different forms of vir-

tual collaborative learning and opportunities for and limits of experimenting in the virtual learning space.

5.3   Selected findings

Some researches will be referred to below which can deepen an round off our understanding of learning with new media in distance education.

Adaptivity. On the basis of instruction psychology theories Detlev Leutner (1997) analyses the extent of the support which learner in a learning environments can obtain and reports on empirically tested possibilities of adaptive teaching functions. As adaptive teaching functions he names learning time, instruction sequence, task difficulty, help for learning by discovering and the link to existing knowledge.

Artificial intelligence tools. In the research project "virtual learning spaces of the National Polytechnic Institute in Mexico City, Adolfo Guzman and Gustavo Nunez-Esquer (1998, 205) develop the prototype of an M.Sc. degree syllabus in which work is carried out with the help of artificial intelligence tools. With their help. the students' prior knowledge is diagnosed, individual learning paths stipulated and suitable learning materials are put together, the Internet is searched with regard to suitable work with a tool (Claritex) which analyses articles with regard to their main topics, organizes synchronous learning activities and coordinates partnership work for students with the same or similar learning paths.

Automated tutoring. Steven Albert and Colin Thomas (2000, 141) examine the pedagogical functions of an interactive software tool which leads distance students through specific tasks and problem solutions at the Open University Business School.

Disabled learners online. Rainer Ommerborn and Rudolf Schuemer (2000) research the "opinions of disabled students on PC use in distance education". Computers prove in various and specific ways to be "aids to compensate for problems and deficits resulting from the disability".

Collaboration. Bharat Dave and John Danahy (2000, 57) work on a project to develop a *"shared virtual design studio"* in which architecture students in Switzerland, Canada and Australia work together. They do not jointly design the same building project, but in each case they design a building project in the city in which the other students work, whereby the local students help them. This approach for the collaboration pursues several educational goals, because knowledge of design for architect, landscape architects and urban planners is mediated at the same time and in a combined form.

Computer-mediated conferencing. Gilly Salmon (1999, 34-43) traces the history of computer-mediated conferencing, which started at the Open University as early as 1988, and describes the role it plays at present in the Business School of the Open University. The motivation for participation in these conferences is fed from the need for closer links to the teaching-learning system, to communicate with others, to obtain and provide information. Only a few of the students develop here into autonomous learners. The author shows how these conferences can also take place with larger numbers of participants.

Emotions. Hermann Astleitner (no year given) and Hermann Astleitner and Wolfgang Schinagl (2000, 63) research strategies with which online learning can be made more "atmospheric". Twenty prescriptive statements are made on this which are each based in research findings. Five types of emotion are differentiated: fear, envy, anger, sympathy and pleasure.

Human-computer-interface. Joan Robson (2000, 153) examines the role played in online learning by the *attitude* of the students to the computer, something which is usually ignored. However, human interface theories have to be taken into account when planning, implementing and evaluating learning because they have an effect on the cognition, behavior, interactions and individualization of learners. A suitable evaluation in particular is not possible until this has happened.

Interactivity. Johannes Haack (1997) report in detail and on the basis of research on forms of interaction in hypermedia learning environments and discusses relevant influencing factors. According to this, the appropriate intervention and control opportunities serve above all "the consideration of the individual needs of learners" (162). They prove their value "when interested and experienced learners actively work out a ranch of knowledge" (163).

Isolation. In a pilot study, David Lake (1999, 14) attempts to reduce the number of distance student drop-outs by means of an online counseling course which supports the better social and academic integration of distance students. The campus and the buildings are used here as metaphors, work with partners is arranged and the formal character of academic teaching is reduced through informal contacts and discussions (virtual cafeteria). Distance students are successfully brought out of their physical and mental isolation.

Constructivist learning. R. Schank (1997) submits a virtual learning concept which is aimed at encouraging active and self-directed learning at higher learning goal levels as well, whereby complex and knowledge-intensive tasks can also be solved. Important criteria are goal-directedness and learning from mistakes (cf. Astleitner & Schinagl 2000, 97).

Learning support. The study by Friedrich and Ballstaedt (1995), which is based on the findings of cognition psychology, should be particularly considered for researching learning processes in the digital learning environment. The authors differentiate namely between *direct*, *indirect* and *interactive* learning support and illustrate them from technological, constructivist and ecological positions. Indirect learning support through the design of the learning environments is particularly important for learning with the new media in distance education, but at the same time, interactive learning support is also important with regard to all virtual support measures. Direct learning support takes place through strategy training. This should also be researched for learning in the digital learning environment. it would be interesting to find out the relationship of the three forms in a system of "combined learning support".

Motivation. Cornell & Martin (1997) highlight the importance motivation for online learning by diagnosing seven "key principles" (Astleitner & Schinagl 2000, 58), namely, variation and curiosity, relevance, challenge, positive results, positive impression of the teaching materials, readability and generating interest.

Mummy research. At the Institute for Mathematics and Data Processing in Medicine at the university of Hamburg can be unwound virtually and given non-destructive examinations. And a virtual mummy can even be made for teaching purposes. Source: Karl Heinz Höhne: http://www.uke.uni-hamburg.de/institute/imdm/idv/forschung/mumie/

Quality criteria. On the basis of evaluation studies U. Behrens (1999) establishes that "technology centrism" dominates in online learning and that pedagogical aspects are not considered sufficiently. He offers a theoretically and empirically developed criteria grid with which online learning can be described, evaluated, designed and prospectively developed.

Ranking. In the UK, the quality of teaching in all universities is measured systematically every years by the government's *Quality Assurance Agency*. In its first report, the Open University came 10th of 98 tested universities, which makes it, with Oxford and Cambridge, one of the country's top ten universities. This finding and other research led to Desmond Keegan (2000, 78) making the following general statement: "'Both from research and practical evidence it seems clear that academic excellence can be achieved by distance systems, whether they teach the traditional distance education or on the web."

Test method. Sabina Pia Jeger (2000) classifies the online test methods developed up to now in the literature and describes a flexible application of such tests in the framework of the OLAT (Online Learning and Testing) project at the Institute for Informatics at the university of Zurich.

Drill. Josef Voss et al. (2000) report on the WebAssign project, which is being developed by Hans-Werner Six and his team to make the technical infrastructure for academic drill available as a component of a virtual university. The WebAssign system provides web-based and flexible support for all those taking part in drill and has now been tested in eight teaching areas.

Virtual blackboard. In the Fraunhofer Institut für Arbeitswirtschaft und Organisation (IAO) work has been carried out since the beginning of April, 2000, on the EU project "Virtual Blackboard". The aim is to develop a virtual lecture room in which students from all over the world can hear lectures and participate interactively. Henning Hinderer: www.virtual-blackboard.iao.fhg.de

Virtuality. The research group under the leadership of Hans Friesen (2000) attempts "to contrast constructively two pointed positions which are apparently indissolubly at variance with one another: the "phenomenology of displacement and the ontology of detachment" (5). The possibility is discussed of displacing space, time and sensory perception, whereby the detachment of the mind from the body is held to be impossible. In contrast it is claimed that in fact the mind can detach itself from the body and gain ontological independence of virtual reality.

Virtual society. Achim Bühl (1997*)* develops a theory of the virtual society, examines the technology, analyses its role in science fiction literature and its realized applications in economics, politics and culture. For the field of education and training he arrives at the following

outcome: "The profound changes to the technological basis, micro-electronics, networking, virtualising and the accompanying changes to socialization also modify the reproduction mechanisms of the knowledge and information basis of society from the ground up." (358).

Virtual seminar. Helmut F. Friedrich, Friedrich. W. Hesse, Sabine Ferber und Jochen Heins (2000, 127) check the hypothesis that a problem-oriented presentation has a more positive effect on the number of active participants than a neutral presentation without a contextual reference. This hypothesis cannot be confirmed. One presenter is in fact clearly more successful than three other moderators taking part in the experiment. It is obvious that he offers much shorter contributions with less contextual input.

Virtual seminar. Helmut F. Friedrich, Jochen Heins und Friedrich W. Hesse (1998, 95) examine the influence which institutional support has on the willingness of participants in a virtual seminar with regard to the continuation of their online interaction and cooperation. In a virtual seminar the teacher stopped his assistance after three weeks and invited the participants to continue discussing independently in the remaining week *(low institutional support)*. At the end of another virtual seminar the participants are invited to continue working in small groups for four more weeks, namely in accordance with exact job orders, schedule and with the task of recording the findings in a text which is published on the Internet *(high institutional support)*. This type of intensified institutional support motivates student to a *greater* extent to self-directed learning than if such help is not found.

Virtual seminar. Helmut Felix Friedrich & Aemilian Hron (2001) develop a framework model for designing and evaluating virtual seminars based on the input-output models of empirical teaching research. The model designates and describes critical variables and constraints of online learning.

Virtual seminar. In a field experiment, Helmut Felix Friedrich, Aemilian Hron, Sigmar-Olaf Tergan and Thomas Jechle (2001) study the effects of a weak and a strong variant of the procedural support of co-operative text production in virtual learning groups. There are no unambiguous findings. However, the *internal climate* of the respective groups plays a part. If it is regarded as positive, more people take part and the cognitive stimulus content of the written assignments is assessed more positively.

Knowledge management. Online learning is a matter of handling networked and therefore complex information and knowledge stores intelligently and responsibly. Heinz Mandl and Gabi Reinmann-Rothmeier (1998) diagnose therefore a demand for knowledge management. They regard this activity as an interdisciplinary research object, because it has to be processed not only from the aspect of the individual but also from societal areas and knowledge domains. Central criteria are self-responsibility, self-direction and co-operation.

5.4 Conclusion

If we take all the research that so far has been referred to together, all we find is a kaleidoscopic image of many selective approaches. What is missing are significant large-scale studies which identify and verify the integral pedagogical effects of the new media on a theoreti-

cal, empirical and interdisciplinary basis. So far only the outline of the area that must be examined has become clear, there are no relevant research capacities and there are no funds for this. However, in view of the great, and growing, importance which online learning has in distance education in particular, large-scale research projects of this nature have absolute priority at present. Learning with new media in distance education is still an uncharted territory.

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