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Résumé de l'article

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Abstract

This paper deals with the general problem whether and, if so, how far the impact of the digitised learning environment on our traditional distance education will change the way in which teachers teach and learners learn. Are the dramatic innovations a menace to established ways of learning and teaching or are they the panacea to overcome some of the difficulties of our system of higher learning and to solve some of our educational problems caused by the big and far-reaching educational paradigm shift? This paper will not deal with technical or technological achievements in the field of information and communication which are, of course, revolutionary and to be acknowledged and admired. Rather, the digital learning environment will be analysed from a pedagogical point of view in order to find out what exactly are the didactic possibilities and opportunities and what are its foreseeable disadvantages.

Introduction

Let me start with a preliminary observation which will explain the way in which I intend to deal with this subject. In my country as well as 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 one 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 memory and recall them when being asked for in examinations. In fact, this mode of teaching and learning has a long tradition from antiquity to the present day. Lectures in study centres, printed teaching material as well as educational radio and TV presentations provide ample proof of this. The teacher or the programme developer determines, dominates and is responsible for the teaching-learning process in many ways. Therefore this particular kind of learning is called *heteronomous* learning. All of us have learned in this way at school and at university. We are used to it. And it is easy to continue in this way.

Then there are the *progressives* (e.g., Arnold, 1993; Boud, 1988; Dohmen, 1997; Friedrich & Mandl, 1997; Knowles, 1975; Zimmerman & Schunk, 1989) who

are opposed to this kind of learning on the ground that it is basically only *cognitive*, that the students remain relatively *inactive* or even *passive*, that the idea that large groups of students could be offered the same content and would then learn the same is an illusion. They maintain that the competitive industrialised information 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 is factual knowledge important, but also *competence in using the methods of obtaining it* as well as *the competence of co-operating with others*. Here the learners dominate the teaching and learning process whereas the role of the teacher is reduced to that of a facilitator and advisor or counsellor. The learners have to take over responsibilities for their own learning. And they must be active in order to be able to learn. As no external person or institution interferes, this learning could be called *autonomous*.We are not used to it. And it is a very demanding and ambitious way of learning.

I hold the view that *both* approaches are and will remain important, especially in distance and open education.

Heteronomous learning

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

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

- several presentation methods can be combined and integrated
- multi-sensory instruction can be considerably strengthened

- interactivity can be extended quantitatively and qualitatively
- the support system can be extended and improved

The combination and integration of several presentation methods

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

But there is even more. Also the *image of the teacher* can have an effect on students. This does not have to make 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 and the students sitting at their desks. The image of the teacher can now be made more *dynamic* by means of different camera angles and settings, and can lead to an impact and intensity of the images never before experienced. There are possibilities here for pedagogic film direction and dramaturgy in distance education whose criteria are unknown to us.

These two innovations of the spoken word and the image of the teacher alone would be an achievement which could considerably alter the methods and efficacy of distance education, because it would then become more stimulating, because 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 can become more variable, more interesting, more diversified, more intensive, more concise and more colourful, both literally and figuratively.

The problem of how these new possibilities and chances for digital learning can be used in distance education is now of considerable *pedagogical* importance, and the following questions should be asked:

- When and why should work on the screen be done with written texts?
- When and why should teachers themselves "say something" and "put in an appearance"?
- When and why is it right 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 that demand decisions from them, may not be made schematically nor at their discretion. We are confronted here with fundamental questions of *digital teaching and learning* which we probably will not be able to answer by means of experience gained with analogue teaching films.

Multi-sensory presentations

The exactly calculated combination of the spoken and the printed word, and still and moving pictures of the lecturing professor 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 digital *technology*, which can change contents disseminated in various modes of presentation into flows of bits (Kaderali, Müller & Rieke, 1994), 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 *multisensory* impression can be used for presenting, recognising, understanding, processing, testing and experimenting, or simply for repeating. Not only the spoken and the written word are combined and integrated with a pedagogical intention, but also, where this is required, image, 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 a *cumulation, compression and intensification of presentation* that has never been seen before, because it was never before 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.

Heteronomous presentation can be taken to excess in certain phases here, e.g., where the student's attention is to be 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 interplay between the individual presentation sequences is planned, designed and then realised technically in 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, and this is certainly a great relief. The pedagogical benefit can be very great, as can be seen from the following example of a multimedia course at the FernUniversitaet.

This is an animated graphical presentation which is built up in steps in front of the students and is explained and commented on by the professor who is doing the talking. The *colour* makes the stages more clear, *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. Multisensory presentation is used here for repeating and practising. The multimedia presentation on the screen can be seen in high resolution and brilliant colours. Sections of the graphics can be magnified by up to 800 percent and made much clearer in this way.

By the 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 can have. According to Michael (1983, p. 77), it not only supports impressive presentations and, as in this case, *recognition of a regularity and concept formation*, but 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 to 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.

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 teaching in schools. 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" (Wolf, 1970, p. 50).

Higher levels of activity and interactivity

Jerome Bruner (1974) 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 was decisive, and this also conforms to the 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 the *alphabetically transformed* and *printed* language. The dominant foundation of teaching and learning behaviour in first-generation distance education is writing and reading teaching texts. In the previous section we saw how the digital learning environment can considerably intensify the *iconic* method of dealing with reality through 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 controlling teaching, which was received "passively" by students, led to the demand that mature students should participate *actively* and *acting* in their own learning process and in doing this achieve a higher level of interactivity. The break with behaviourist learning models and the turn to structuralist models encouraged this paradigm change still further, because learning was now seen in many cases as the activity of individuals in the construction and 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. *Interactivity with the teaching material and with other persons* in the pedagogical field has been discussed and regarded as important since then – particularly in academic teaching.

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

Second- and third-generation distance education intensify this interactivity even more. Because of the presence of a digital learning environment students find themselves in a much more favourable *starting situation*. This situation differs markedly from that of students reading and working through printed distance education course material with a pencil in their hand. It is as if students had an opposite number, not just the screen of the monitor but also the teaching software, which can react in different ways to their activities. And behind all this is the network with a tremendous depth of penetration because it links the digital learning environment with many virtual databases, institutions, libraries and individuals. Continuous contact can be made with this opposite number, and maintained, by using the keyboard, and this contact is integrated in the learning behaviour and with time becomes a force of habit. Depending on the feedback, i.e., the computer's "replies," feelings of satisfaction, relaxation, self-confidence, but also of disappointment, amazement, surprise or annoyance are triggered – and determine the situation. Bernhard Koring (1997) 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 more rich 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. Maybe this is the reason why students like to learn in such a digital environment and many are even fascinated by it. Another factor is possibly the integration of the three methods of confrontation with reality which makes this type of learning so attractive.

Teaching programmed courses in digital learning environments aims among other things, at the following student interactions:

- answering questions and reacting to feedback as in programmed teaching
- selecting and working through prescribed links
- participating in a simulated tutorial dialogue
- opening a notes window for writing margin notes
- opening a comments window
- placing "bookmarks" to mark defined pages
- working with a search menu which can be opened by means of central terms in the text
- working with several indices, each of which enables access to different abstraction levels of theoretical dimensions

- amending teaching texts in accordance with own points of view: placing sections or chapters under different points of view, storing important sections, editing ones "own" teaching text
- searching for sections of text containing the same term
- completing recommended "drill and practice" programmes
- replacing a standard teaching text by a longer or shorter teaching text
- explorations 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

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

For teachers, all this means the demanding task of mastering these and other activities and interactivities not merely from the technical aspect, but also of deliberately pursuing pedagogical aims when doing so. Teaching software can diagnose what previous knowledge is already present, students can be motivated and counselled, and different learning paths can be provided, offered and used. Finally, and Anthony Bates (1995, p. 191) points this out, a skilful combination of tests, feedback, repeats 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 takes normally four to six weeks at the FernUniversitaet, can be reduced to a couple of days. This is certainly a most important didactic 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 more often, 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). The students and the 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. A very intensive cooperation evolved and really cooperative learning took place. This is a very convincing example of the interactivity 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 heternomous learning. Much greater activity and interactivity are required in the case of autonomous and self-directed learning, and we will now take a look at these forms.

Autonomous learning

The use of the digital learning environment to present computer-based learning programmes, integrate audiovisual sequences or even digitised printed teaching texts is really *misuse* because its specific potential is not even seen, let alone actually used. These examples simply 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 behaviour are being extended into the digital age and this causes us to misunderstand the special opportunities provided by "digital learning."

This has to happen, because what is being developed at present in the sector of digital learning is more than we can imagine. Is it not so that these explosive technological developments have long since surpassed human comprehension? Our thoughts and actions like to remain on the ground, with familiar things. The first cars and railway compartments 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 digital learning as well, new and it seems completely unknown opportunities are being opened up that are based on *computer, media, network and hypertext/hypermedia technologies*. One of these is the intensified development of *autonomous learning* as *self-planned, self-organised and self-assessed learning*. The digital learning environment provides even now unusually

favourable preconditions that *enable* and *simplify* this special type of learning in a variety of ways. We will now examine these ways.

Different starting situation

The new and completely different learning situation – already referred to – is advantageous for this. An interrelationship, an interplay, even a *quasi-symbiotic relationship* is created in the digital learning environment between the individual and the software. According to Nickerson (1987), the strange dyad individual/digitised learning environment displays criteria of interpersonal communication: "bidirectionality, mixed [reciprocal] initiative ... shared situational context, peer [equal] status of participants" (p. 681). It does not matter how critically we regard these comparisons; in practice people experience the particular attractions of this learning environment everyday. It fascinates 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.

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

Let us take a closer look at this cosmos. It seems that there are above all the three following disjunctive activity fields in the digital learning environment:

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

Learning in hypertext

With hypertext, students are confronted with *text blocks* representing "cognitive units" and which may be located on various cognitive levels. Thus 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 pedagogics. 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, and this is also a completely new term for an unusual pedagogical activity. What they are looking for here are those cognitive units of information that supplement and expand the information they have already acquired – and here again they are guided by their own interests, needs and objectives. And in doing this they activate and coordinate 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 autonomous learning: the break with linear presentation in set sequences and the establishment of non-linear and non-sequential learning. "Digitisation 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 fundamental 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 above bindings leads to a *flexibility* and *variability* of learning which was never before possible. There is now a free space which can be used for autonomous learning.

This approach is so interesting because it lets new elements of learning behaviour become visible which can become fundamental for the autonomous learner of the future. In the way *searching* is actually carried out in practice four types can be seen, which Kuhlen (1991, p. 128) names 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 use 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 found. No matter how we look at these differentiations, it is abundantly clear that when the 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 can arrive at different learning results. 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, autonomous learning comprises searching, finding, selecting, evaluating and applying information.

Network-based learning

Networks offer even greater opportunities and chances for 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 digitised archives. "Digital libraries," some of which do not have a single book of their own, help searchers to examine and find the required literature by means of *digital catalogues* and *abstracts*. Already digitised texts and illustrations are being offered more and more. The American Gutenberg Project (http://promo.net/pg/history.html) is planning to be able to provide about 10,000 electronic books (classics which are no longer protected by copyright) on the Internet by the year 2001 (Collis, 1995, p. 166). Increasingly, digitised academic journals are becoming available.

In network-based learning the implicit and often subtle heteronomous steering of the learning process which is still found in hypertexts is missing, in spite of the curricular freedom. This is 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 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. Interestingly enough, it is claimed that all these questions are answered within eight hours. Students can also discuss their learning problems with fellow students, tutors or course counsellors on their own initiative and for their own purposes by exchanging *e-mail*. In addition, they can also use their own initiative to work with the *bulletin board*, which is set up for certain courses or departments and constantly updated. Here they can read messages from other students and can also pass comments on the subjects the boards contain. Interactivity here develops outside official teaching and learning programmes. It challenges students and makes them more independent.

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

directed learning.

Computer conferencing has been developed the furthest under present conditions for this purpose. Examination of contextual problems on a discussion basis, something which tended to come off second best in first-generation distance education, can now take place *virtually*. If students initiate computer-supported discussions 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 cooperation of the distance students themselves.

From the point of view of pedagogics, by making *active* participants in discussions out of receptive students while at the same time granting them autonomy, these virtual seminars play such an important role because they *individualise* the heavily structured course based on the industrialised mass-production model, which calls for the same instruction for all distance students. Worthy of note is an IT course at the Open University in Great Britain in which 1,364 students took part. They each received a book consisting of newspaper articles and watched 16 teaching films on television. But instead of counselling in study centres they took part in *computer conferencing*. A total of 65 virtual seminars were set up, each led by a tutor. The pedagogical advantage: contributions from participants were recorded by the computer, and this can be a great advantage for assessments and research purposes. For example, it can be verified 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* can be established 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 express criticism or praise for 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).

Computer conferencing is a form of autonomous learning that leaves expository teaching and receptive learning far behind because they are replaced by independent achievements. The new learning behaviour manifests itself in the search for, assessment and application of suitable information and in careful (written!) communication and cooperation. The proximity to learning by doing research and to academic work in general can be quite astounding.

Commentary

The teaching behaviour that is created in these three basic forms of digital learning has different approximations and pedagogical potentials with regard to autonomous learning. Their advantages and disadvantages would have to be described in terms of pedagogics 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 distinction has to be made as to whether this autonomous learning is inserted like islands in conventional distance education, or whether whole programmes of study should be created by 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, 1996, p. 286).

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 Paulsen (1995, p. 120), four different models have emerged in current practice: the *one-alone method* (the WWW paradigm) is probably the most marked. The *one-to-one method* (the e-mail paradigm) can be used for tutoring and counselling autonomous learners as well as for communicating with other students. The *one-to-many method* (bulletin-board paradigm) can be used on the one hand for teaching events, such as lectures and symposia, and on the other hand students can act in accordance with the one-alone method and send messages to all and wait for 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 *pedagogics of digital learning* are being introduced here which will have to be developed still further. Often, a paradigm shift is 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 a fundamental problem which will have to be clarified theoretically.

Summary

Digital learning environments open up new opportunities and chances not only for heteronomous but also for autonomous learning. One could conclude that they make heteronomous learning even more heteronomous – and autonomous

learning even a great deal more autonomous.

With *heteronomous* learning, the pedagogically substantiated combination and integration of two or more modes of presentation means that multimedia teaching of content can be offered on a multisensory basis, thus enabling precise close overlapping of stimuli whereby better learning can be prepared, effected and strengthened. In addition, much higher levels of activity and interactivity can be achieved.

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

If what is in fact important today is that we get away from the *pedagogics of instruction* and create and implement a *pedagogics of enablement* in its place, as Rolf Arnold (1993, p. 53) demands, the digital 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 fundamental 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) demand even 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.

The new opportunities and chances of *digital learning* in distance education have great significance for the future of our information and learning society. Helmut Hoya, the present Rector of the FernUniversitaet, underscores this statement by telling visitors that the university of the future will look much more like a distance teaching university than a traditional one.

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