FROM THE BOARD TO E-LEARNING

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Abstract: The use of information and communication technologies in education at all types of schools is becoming commonplace today. Some modern forms of study in the Czech and foreign schools are even based on using information and communication technologies. One of the most important of these technologies is e-learning, which has penetrated into the life of almost every high school and not just in our country. However, the way to this form of education was neither simple nor easy. From the historical point of view, it has been implemented in several stages, which above all responded to the technology options available in a given period, often in relation to the philosophical and pedagogical approaches to teaching and learning. The present essay thus describes some of the most important stages in the development of distance learning in the form of e-learning, not only within the context of the Czech Republic.

Keywords: Theory of learning, individualized learning, distance learning, computer technology, information and communication technologies, e-learning.

1 Introduction

The terms of distance learning or distance learning implemented through the electronically supported learning (often referred to in the abbreviated term of e-learning) are frequently used at present. Although in our country, they are primarily associated with the implementation of education and training within the tertiary education system, with an overlap into lifelong learning, there have recently been efforts to extend this method of education, especially in relation to the use of e-learning, at lower educational stages. These efforts stem from the constructivist paradigm of education, based on the assumption of every learning process being highly individual and all knowledge being made up of one's own experience and interpretation of the world. Consequently, the role of the teacher and the pupil have been changing in a radical way which should result in a change of conditions under which and means through which education is implemented.

As one of possible means to meet the goals of the constructivist theory of learning, e-learning, as a relatively new and progressive form of education, has recently come to the fore in philosophy, education and didactics circles. In terms of the application of the pedagogical-psychological approaches to learning, using computers and computer networks, e-learning has gradually reflected three learning theories, all of them having had and still having a major impact on the design of educational content implemented through distance learning: The theories are as follows:

- Behaviorism (neobehaviorism). Study materials stemming from this psychological theory always await the student's reaction. They are based on pre-specified structures and incentives or tasks, submitted to the learning subject and followed by the diagnosis of the quality of the student's response or behavior, the consolidation of convenient responses and the reduction of the inaccurate ones (1).

- Cognitive psychology. This theory, based on the premise of human behavior modification being determined by internal factors, above all by ´knowledge`, puts emphasis on knowledge of both declarative (i. e. sets of particular knowledge) and process (procedures used when acquiring and processing knowledge) character (2). In terms of distance learning, materials containing a wide range of incentives, aimed at achieving cognitive educational goals, using a wide range of information sources, are accented.

- Constructivism. Learning is regarded as a process of students' constructing knowledge individually, i. e. without any pre-set regulations, on the grounds of their previous experience and through a highly active search for the information and ideas needed in a ´wide open information space` (using so called open technologies), with no restrictions as regards original solutions (3). In terms of distance learning, the application of this theory is conditioned by the creation of learning environments rich in incentives and of activating character, which would meet the demands of both individual and group form of study and are often referred to as "hypermedia learning environments" (4).

All the above mentioned learning theories have influenced the development of distance learning from the individualized to distance form and up to e-learning and its current form of m-learning, e-twinning, etc. Apart from the hereinabove learning theories, the distant forms of education have been considerably influenced by the constantly developing technologies, which, being a major stimulus, provided the process of development of the distant forms of education with a powerful impulse. The most important technologies, with a truly revolutionary impact on the development of education, have been information and communication technologies, represented in this area especially by computer technology, computers, the internet, and mobile communication technologies. That is why we will try, in the course of the following text, to define particular stages of the development of distance learning from not only pedagogical, but also technological point of view.

2 Distance learning and its development

The history of the individualized teaching dates back to a very distant past. As early as in 1728 Caleb Phillips, a teacher, published an advertisement in the Boston Gazette which searched for students willing to become subject to the experimental trying of the new method of teaching of the latter, with the educational content being delivered to them once a week (5).

2.1 Development of distance learning abroad

Initially, modern distance education relied on the rapidly developing postal services, which took place in the 19th century. They were first made use of in 1840 by Isaac Pitman, who began to offer shorthand writing courses in the correspondence form (6). The reaction did not wait long and in 1858 the University of London became the very first university type institution to implement distance learning at all educational levels and in the form of an external training program (7). Short after, the United States of America followed. William Rainey Harper, the first president of the University of Chicago, developed the concept of expanding education. When trying to put this idea to practice, he collaborated with other universities, which resulted in the creation of the concept of school correspondence courses in 1982 and was then put into practice at Columbia University (8). As for Australia, the University of Queensland established the Department of Correspondence Studies in the year 1911(9, p. 256).

It was Charles Wedemeyer, based at the University of Wisconsin-Madison, who first began to neglect postal services in favor of other methods as regards the delivery of the educational content. He thus laid the foundations of the distance learning in America. During the years 1964 to 1968, the Carnegie Foundation funded Wedemeyer's project of AIM (Articulated Instructional Media), which made use of the wide possibilities of communication technologies in order to transmit not only the educational content itself, but also mutual communication. As stated by Moore, AIM became popular especially in Great Britain, where the ideas and methods connected to it were applied in 1969, at the establishment of The Open University. Radio and television emissions started to be widely used instead of the post (10). In 1974, these efforts were followed up not only by the Germany FernUniversität in Hagen (11), but truly all over the world, as in that time, several institutions, based on the same

principles, emerged. These institutions often operated under the Open University title (in English or local language), and all these ´open universities` were using distance education methodology as the primary technology for the delivery of the educational content. Some of these institutions have gradually become so-called ´mega-universities`, i. e. institutions with more than 100 thousand students (12).

The development of computers and the Internet made the distribution of distance learning even easier and faster, which ultimately led to the creation of so called ´virtual universities` with the whole process of education being implemented on-line (13). In 1996, Jones International University began to operate. It is considered the first accredited university department offering education fully on-line, not just on the United States territory, but also worldwide (14).

2.2 Development of distance learning in our country

As regards our country, there was no progress in developing distance education until the year 1989, above all due to the fact that prior to this year, there had been a long tradition of so-called ´distance courses`, a specific form of studies which allowed employed people to study along their jobs and was thus widely spread in high schools and colleges (15). Distance learning, as a form of study, had been neglected, its ultimate development being related to the activities of the Czech Association of Distance Education at Universities (ČADUV), founded in 1993. This organization, as well as the National Centre for Distance Education, established in 1995, has always put maximum emphasis on the development of one particular form of distance learning, i. e. e-learning, which is characteristic not only in the Czech Republic but also abroad (16).

3 Distance learning development resulting from the computer technologies and ICT development

From its very beginnings, distance learning has emphasized the promotion of the principles of clarity and demonstration (17). It has thus followed the well-known rule saying that ´the more senses I use to perceive, the easier it becomes to learn, to remember, and to understand` (18). According to K. Kohout, it is the multimedia character of distance learning which invites us to look back as far as to Comenius' principle of demonstration teaching and, moreover, to use its updated form. Nevertheless, demonstration should never be confused with attractiveness, its use being determined by its functionality. An excessive and non-functional use of colors and sounds for example may ultimately provoke rather distraction or neglect from and of the educational content itself.

Some elements of demonstration teaching, such as images, diagrams, graphs, or symbols, widely used in everyday life, too, were already made use of by traditional learning supports. However, they being distributed predominantly in printed form, it was only possible to provide the image information in a static way. Thanks to the development of computer technologies and the hypermedia theory, a growing number of multimedia study supports, being characterized by the extension of the structure with various multimedia and interactive elements (e. g. animation, multimedia records, dynamic simulations, sound recordings, etc.) that can only be presented and distributed in the electronic form, have been used. It is this expansion of interactivity and multimedia components which make the real difference and which distinguish electronic study supports designed for e-learning from the study supports intended for the other, earlier forms of distance education.

The whole process of distance education being influenced by the development of technical means can be traced to the above mentioned principle of demonstration, where the real difference can be noticed. With the developing technique, it was actually possible to apply the principle of demonstration in always better forms and events or happenings not visible to the eye could be displayed through enlargements. It was even possible then to display dynamic images, via which not only particular images, but the whole sequences of consecutive images, i. e. a cine film, a video, etc., could be displayed. Last but not least, auditory devices, being introduced into the education process after the year 1940, were upgraded, especially in terms of the recording as well as the reproduction equipment

At the same time, a purposeful examination of the impact of audiovisual resources, having stemmed from a joint application of both visual and sound information on the educational process (19), began. The communication theory incorporation into the educational process made it possible to create a comprehensive system of didactic technology, through which learning could finally be implemented as a process of communication. Its basic constituents were as follow, i. e. the source of information containing the curriculum itself (i. e. teaching aids), the transmitter of information (teacher and teaching techniques), information channels (sight, hearing, touch, smell, taste) and the receiver of information being equipped with the just acquired knowledge (pupils, students) (20, p. 26).

As shown in Figure 1, computer technology made its way to the field of audiovisual communication only after the year 1960, when the principles of cybernetics started to be implemented. Until then, computers, had not allowed for extensive use of any kind in the educational process, them being rather ponderous, single purpose devices, highly demanding in terms of operation and maintenance. A major breakthrough came in 1983 when IBM introduced the first personal computer, which enabled a massive use of computers not only by households or businesses, but also at schools. Computer technology thus became affordable and easy to use, a number of software companies, involved in developing application software for professional, as well as user applications, arose. Moreover, in 1984, first computer-aided educational programs, as well as didactic games were launched, which led to the ultimate decrease in interest in the one-purpose teaching machines in favor of computers.

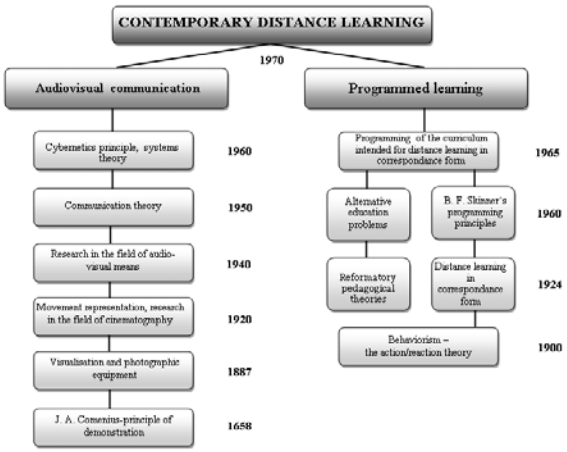

Figure 1 – Relation between audiovisual devices and distance learning in a historical context.

With the further development of computer technology, computer devices became cheaper, which resulted in a rather massive involvement of the latter in practice. Over the last 20 years, computers have become tools enabling the application of the distance learning theory in educational practice. The computer, as a new information transfer medium, facilitates innovation of the ´classical` theory not only of programmed learning but also of distance education and of their application in practice. It makes it possible to use multimedia elements such as animations, sounds and movies, even individually, as stated by John Nightingale (21, p. 45). This means that each student can actually work on his or her own and choose their own pace of work. It also enables providing feedback and consistent control of students' independent work (22, p. 76).

4 E-learning and its development

Though relatively new, having first been used in 1993 (23, p. 25), the history of the concept of e-learning has always been connected with the history of information and communication technologies. The latter do not now influence the very

philosophy and principles of the education process, however, it is due to them that e-learning, as an up-to-date and currently favored method of distance education, made its way through. Its use is nevertheless preconditioned by the meeting of certain technical requirements, which can be divided into two groups. First, it is necessary to create and distribute appropriate educational materials, i.e. electronic study supports, which vitally depend on a mass expansion of the appropriate information technology. It is also essential to provide potential learners with fully electronic ´learning` environments in the form of LMS systems, and supporting tools relating hereinto. It is from this purely technical point of view, that we can briefly describe the history of technical and computer equipment, which now allows to implement e-learning.

The history of distance education through e-learning dates back to the late sixties. In that time, new learning machines (24) were experimentally introduced within the framework of the program learning methods development. Even in the former Czechoslovakia we had one of these, then called automatic teaching machines, Unitutor (25), said by some to have been one of the best of its kind in the world in that period. Unitutor not only segmented curricula into individual pages, but also provided the learners with control, multi-choice tasks at the end of every page. Following the answer, the program could be further branched, and the information concerning the correct or incorrect solution presented an immediate feedback. This period is linked with the name of Prof. Milos Lánský in our country. Nevertheless, as a whole, teaching machines were too complicated and not very effective and that is why they did not make their way through.

In the early eighties, eight- bit and sixteen- bit microcomputers emerged, resulting from the so called ´computerization` of education. This massive trend, aimed at providing children with computer literacy, came to our country at the beginning of the year 1985. Specific school microcomputers IQ 151 were launched and teachers were quite interested in them, despite several deficiencies. In the second half of the eighties, first thirty-two-bit computers appeared, the market being then dominated by personal computers PC, built on the IBM platform (26, p. 54). Along with this happening, software industry was developing, too, especially in terms of a massive boom in office applications. Computers finally made their way to households. As regards the education sphere, the global development of cybernetics and artificial intelligence reflected itself in the improvement of the teaching machines, the computer having been introduced to the teaching process in the nature of a teaching as well as examining machine (27, p. 9). Due to this, theories, according to which the computer should have been partially replaced the teacher one day, were starting to be taken into consideration.

In that time, several, mainly university research teams all over the world, began to develop intelligent learning systems, i. e. ITS or Intelligent Tutoring Systems (28), aimed at a creation of applications capable of providing a long-term control over the learning process. The latter combined the ability of interpreting, practicing as well as testing the subject matter, used graphics, animations, sound, and were even able to integrate fully independent programs.

The predominantly testing-aimed use of computers being often subject to criticism, the programmed learning through teaching applications was enriched with elements of artificial intelligence. The tests were enhanced by explanation and practice of the subject matter, subsequently forming a platform for drawing particular lessons and whole courses, too. The advancement of every single student was taken into account, which, nevertheless brought about the responsibility of the computer for predicting students' possible reactions and situations that students might have got involved in. In the early nineties, e-mail appeared as a very fast and promising means of distance communication. This meant a radical shift, because from then on, it has suddenly been possible to carry out a written communication, even a large-scale one, at almost any time.

Along with the development of e-mail, a rapid growth of the worldwide information network, i. e. the Internet, took place. (26, p. 9). Another important step forward as regards technologies was the launch of digital off-line carriers, such as CD and DVD-ROM, which made it possible to store large volumes of data on relatively small and at the same time portable media. Call conferencing, voice mail and intercontinental connections via satellite changed the traditional ways of communication once and forever.

Tertiary education was among the first to begin discovering the benefits of these newly emerged media and technologies. By the mid-nineties, the university type e-mail communication systems were already established as a norm, especially in traditionally technologically advanced countries like Japan or the USA. Both faculties as well as individual students began using the Internet and the World Wide Web (WWW or Web) services as a source of information, communication and entertainment. Mostly younger students created discussion groups and online chat rooms, which provided them with a possibility to communicate in real time about everything from fashion through politics to finding new friends. The development at universities did not fall behind either. Syllabi, library resources, the contents of lectures started being moved from conventional classrooms to multimedia resources and to the local network. Private companies started looking for possibilities of commercial use of e-learning (29). On the Web itself, virtual universities were created, which offered all of their courses and a possibility of obtaining certificates via the Internet.

The mutual development of facilities, communication technologies, and pedagogical theories applied in practice allowed the establishment of a qualitatively far more efficient, fully electronic ´learning environment`, in compliance with the theoretical vision of ´a computerized environment for learning and gathering knowledge` (30), defined by C. Beyou as early as 1982. Since then, the vision has been specified and put in concrete terms in the nature of e-learning and LMS systems allowing for its implementation.

Over the particular stages of the development of e-learning methods the latter have always significantly reflected the technical level of information and communication technologies (them being first off-line, later on-line), and also the level of knowledge in the field of human learning (programs first, then hypertexts and compact multimedia).

5 Conclusion

In the original and what is now seen as outmoded concept of programmed learning theory, which laid foundations to some of the principles of distance learning, computers and information and communication technologies were seen as means stemming from the tradition of teaching machines, which themselves presented the essential means for the implementation of programmed learning. However, the single-purpose teaching machines were soon outmatched by the computer and the information and communication technologies in terms of technique, organization, as well as didactics. Previously, students first had had to learn how to operate the teaching machine itself, learning itself came only afterwards and within each training method, several teaching machines had to be made use of simultaneously. Computers do not work this way. With computers, work with individual teaching materials (or, as regards programmed learning – programs, for distance learning - electronic learning supports), is rather analogous. It is mainly due to the fact that modern programming languages and environments, which are made use of when designing teaching materials, allow for creating user-friendly environments. Those resemble each other (31, s.114) and make it possible for the students to operate them in a rather intuitive way.

Therefore, the computer is to be approached as an element of audiovisual teaching techniques, but providing the user with more options than it is the case with classical, modern as they can be, didactic means, used within the framework of the distance education, implemented through e-learning (32). It makes it possible for the classes to take place at any place and any time, exactly according to the principles of distance learning. The function of the teacher is thus taken over by the computer, i. e. the educational materials or control and communication components of the LMS system, although it is clear that functions and activities associated with the development of social and communication skills of students cannot be carried

out without sophisticated and targeted support of communication by the computer solely.

The use of computers in distance education, implemented through e-learning, must also correspond with the structure of the curriculum, which is thus presented. This means that in particular subjects the computer, via particular study support or general computer program, provides the students with teaching particular content structures. The focus is thus put on the learning process, supported by the computer equipped with communications abilities, as a teaching tool or as a means of communication. Learning is a mental activity, however, and there are many theories that describe and explain it, them being based on psychological principles and phenomena. The combination of all these trends within the framework of information and communication technologies is now called ALE - Adaptive Learning Environments (33). It is a learning environment susceptible to adaptation by the student and interconnecting the research in the field of computers with the research aimed at the teaching process. It also includes humanizing tendencies towards the education as it makes use of the technical system as well as social group activities of particular students.

As it follows from the above said, distance learning, as well as other forms and methods of education, has undergone significant development. As regards distance learning, both classical and e-learning type, development, it has been stimulated by two factors. In Table 1, these two are presented simultaneously, which may help the reader of the paper presented better distinguish between particular learning theories on the one hand and distance education implemented through e-learning on the other hand.

Psychology trend	**Behaviorism**	**Cognitive psychology**	**Constructivism**
Learning theory	**Programmed learning**	**Cognitive theory**	**Constructive learning**
Learning process principle	Stimulus (S-stimulus) – Reaction (R-reaction) – Reinforcement (Rf-reinforcement).	Structuring and classing information. Cognitive, psychomotor, and attitude domain.	Learning via setting up and updating formulae (through assimilation and accomoddation).
Methods	Setting goals, question, problem, active response, gradual progression, iteration aimed at receiving the correct answer, drilling, practising, associations, chaining, generalising,	Setting goals, explanation, demonstration, illustration, classification, structurizing, organizing, examples, algorithm problem solution, analogy, analysis, synthesis, application,	Modelling, simulations, heuristic solutions, object learning, situation learning, authentic learning, contextualizatio n, hypertexts, branching, social approaches, exploration, research,
Distance learning	**Correspondenc e form**	**Multimedia**	**Hypermedia**
Presentation, communication and management styles	Distance learning implemented in the correspondence form, by sending letters, making phone calls or using fax.	Distance learning based on the use of several different types of transfer media (mass media), radio, TV, computer programs, multimedia audio and visual recordings, CD, and DVD.	Distance learning implemented through e-learning, fully computerized. Computer or computing system projected into every single activity of the tutor as well as the student.
Predominant study materials	Printed, based on the linear character of the text, only still image information used.	Printed, based on the principle of branching, enriched with various media carrying the education content which itself is based on the use of electronic media and computer technologies.	Electronic, based on the principle of hypertext, integrated into a fully digitalized learning environment, in the form of a sophisticated LMS system.

Table 1– Comparison of particular theories in respect of distance learning through its development.

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