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E-learning and its application within the Czech tertiary education system

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Introduction

Information and communication technologies provide many opportunities with respect to the implementation of effective learning. Some forms of study, at Czech, as well as foreign universities, are even directly based on them. It is mainly the education through e-learning, with the whole education process being mediated, managed and evaluated via computer technology, high quality hypermedia educational materials and sophisticated software solutions. One of the major benefits is the fact everybody can participate, regardless any possible handicap, the only precondition being the ability to study independently and the responsibility for one's own learning process and the goals to be achieved.

E-learning has become a phenomenon approached continuously and intensively recently. There exist many studies dealing with the problem, for example by: [Zounek 2009a; 2009b; Clark, Mayer 2008; Paulsen 2003; Barešová 2003; Nocar et al. 2004; Eger et al. 2002; Zlámalová 2002; Bednaříková 2008; Kopecký 2006; Květoň 2004; Prucha, Mika 2000].

1. Current social context of the introduction of e-learning to Czech universities and colleges

From a retrospective point of view, it is possible to observe the existence of two phenomena, which the Czech tertiary education has constantly had to deal with since 2005. The first phenomenon has been a constant effort to „unify" higher education within the European Union. The second phenomenon is a frequently discussed issue of financing of Czech tertiary education, including science and research. Both these phenomena have been significantly influencing the tertiary education development trends. Universities were thus obliged to adopt relevant optimization measures in order not to impair the quality of tertiary education at all levels. At the same time, they had to continue on developing and cultivating particular scientific disciplines. The measures were often purely pragmatic, and the inadequate application of them had a negative impact on the quality of the whole education system. However, thanks to the efforts and the pursuit of Czech universities' academic staff, that has happened only rarely. To keep the positive trend, it is nevertheless necessary to modify some tradition-

al and modern methods so that they meet the demands of the students on the one hand, but also guarantee the necessary level and quality of education on the other one.

The first phenomenon affecting the lives of Czech universities in the last 5 years stemmed from the fact that the Czech Republic, as one of the signatories to the Bologna Declaration, made a commitment to meet the obligations set by the Bologna process, the outcome of which should be a creation of a unified European Higher Education Area. Within the framework of this process and based on the Berlin Communiqué, the Czech Republic acceded to restructuring study modes implemented at universities. This restructuring, consisting in establishing two cycles of tertiary education, was to be started no later than 2005, which in the case of the Czech Republic actually happened.

From the overall point of view, one can see that the restructuring of some study modes has not always brought the desired effects and in some cases was rather counterproductive, since it was not enough economically or legally substantiated. Examples of this are most teacher training programs and courses. According to the Education Act, the graduates of their bachelor's study modes are not entitled to hold the position of an education worker (teacher), but only the one of an assistant teacher [Vašutová 2004], which does not entirely meet the demands of teaching practice and does not reflect the applicability of the graduates. The effect of the restructuring in this very area should therefore be reconsidered, as well as the importance of the reasons for it. However, it should be noted that in other fields the restructuring did well and filled with some sectors at the labour market (knowledge management, nursing etc.).

The second phenomenon, which greatly influenced the development of Czech universities, especially from the years 2008 to 2011, was the policy of financing, evaluating and stratification of Czech public universities, defined in the „White Paper on Tertiary Education" [Matějů 2009]. The economic growth of the Czech Republic paradoxically brought along a substantial decline in the volume of the funds given to public universities in the nature of a contribution to a particular student. Some sources even state that during the years 2006–2011 the amount designated for the educational activities at Czech universities decreased by one fifth even. Universities were thus obliged to respond to this fact and begin to offer not only attractive and more applicable study programs and courses, but also adapt themselves to the labour market needs.

At this point, e-learning became one of the essential activities at Czech universities, as it was vital for their further operation. It should be noted that the tendencies to maintain the necessary quality of education have not always become evident. In particular, some important facts concerning the means of assessing the teaching load and study texts' quality have been ignored and receded into the background. It was necessary to have „the LMS system and educational content in it" and the qualitative character was disregarded, mainly due to missing or poorly developed evaluation tools.

2. Case study reflecting the development of e-learning in the university setting

The above stated facts will be illustrated hereinafter by giving the example of the Pedagogical Faculty of Palacký University in Olomouc, where training through e-learning was to witness a rapid development throughout the period of 2005 to 2010. The indicated results can also be supported by the findings coming of research investigations carried out in this field at other Czech universities, which also confirmed an extensive increase in the proportion of training through e-learning [Hampl, Česal, Vaškovic 2008]. It can thus be said that this is not an isolated phenomenon. From 2005, Palacký University Faculty of Education has aimed at supporting activities resulting in the increase in the number of accredited study programs in combined mode. It was therefore necessary to continuously strengthen the distance component of the combined form of study, in order to comply it with the requirements of the Accreditation Commission of the Ministry of Education of the Czech Republic. As an essential software tool for the implementation of the distance forms of education across the UP, the LMS Unifor system [Klement, Štencl 2008a] was chosen, to be implemented through e-learning [Klement, Štencl 2008b].

The faculty management thus reflected the fact that while the model of financing of tertiary education had always been closely connected with the number of students, the economic situation of CR resulted in a lack of funds to finance the still increasing number of the latter. The Ministry of Education thus proceeded to modifying the method of financing schools by gradually decreasing the subventions on students and their linking more to the scientific output of the particular universities. As a result of this strategy, the nominal value of the subventions designated for students did not increase since 2004 (actually decreased in relation to inflation); many universities started to turn their study programs into combined forms and strived to increase the effectiveness of the learning process in general. Many a school, including PdF UP Olomouc, thus sought to maximize the effectiveness of teaching, with the volume of instruction significantly increasing on the one hand, but the volume of work load stagnating or even declining one the other one. PdF UP Olomouc, like many other Czech universities and their faculties, took the opportunity to solve the problematic discrepancy between the required increase in the number of students on the one hand, and the decreasing the volume of funds on the other one, by the inclusion of distance learning modes of study implemented through e-learning, not only to the combined but also to full time study programs.

As Chart 1 clearly shows, the total number of disciplines was increasing annually, due to an increasing teaching load and the opening of new study programs. This increase could also be noticed in the field of disciplines taught in combined modes and of subjects implemented through distance learning via e-learning. This principle of implementation of distance forms of study exclu-

sively through e-learning at PdF UP Olomouc was used in practice, and since 2006, it has been applied on almost all parts of distance education in combined, but also in full time mode. A necessary precondition for the adoption of this concept was the accessibility of a wide range of study materials, referred to as e-learning supports or multimedia learning supports, to the students. Another specific feature of this concept was that students were able to access materials via the LMS system, which enabled the use of all the presentation, management, evaluation, and communication components of it. The adoption of all these systematic measures facilitated the maintenance of the quality of education in the ever-deteriorating conditions of the financing of Czech universities. However, it was necessary to significantly increase the number of available learning materials, and to ensure their maximum quality, too.
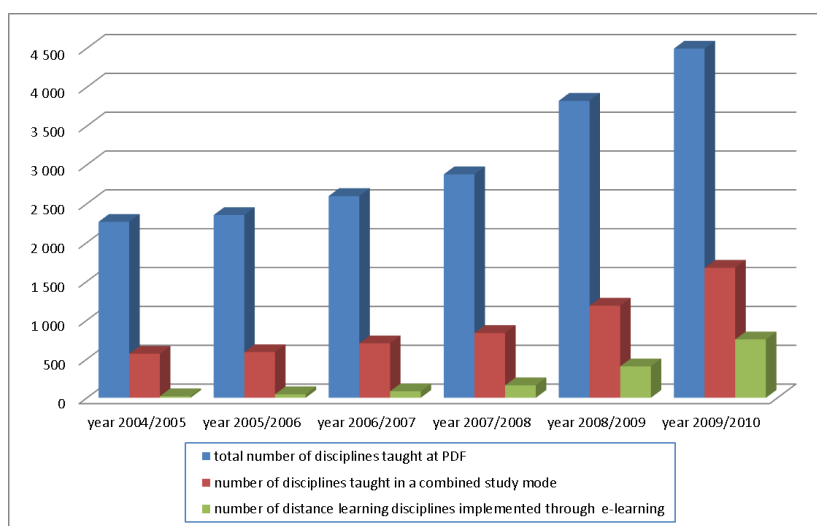
Chart 1. Number and structure of disciplines taught at PdF UP Olomouc

Graph 2 shows the pace and the extent to which the number of educational materials was increasing within the period of interest at PdF UP Olomouc. In a similarly extensive way, distance education was being developed at other universities or their faculties and departments. The phenomenon is not a unique one, which was documented by investigation researches carried out [Hampl, Česal, Vaškovic 2008].

Even though, retrospectively, one can say that the education development supported by the LMS and e-learning has proved successful, it should be noted that to maintain the necessary quality in the required extent is only possible provided that there are appropriate assessment and evaluation tools. A widely applicable tool must result from modernization trends that can be identified in the field of distant study programs. The latter will be indicated hereinafter.
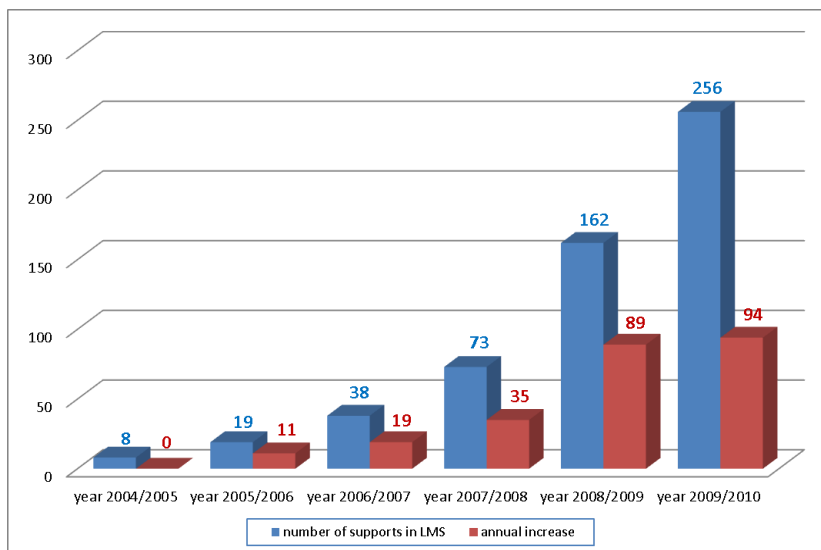
Chart 2. Increase in the number of e-learning study supports at PdF UP Olomouc

3. Current trends in the development of education implemented via e-learning

As stated above, one method of the implementation of education is e-learning, which is specific mainly by the use of electronic distance learning texts, also known as e-learning supports [Kopecký 2010]. In order to use the latter effectively, it is necessary to use not only sophisticated LMS systems, but also appropriate learning texts, containing a wide range of elements that contribute to the effectiveness. That is why the question of defining the content, as well as the structure and application of modern ways of presenting the curriculum, such as multimedia and virtual reality, have come the forefront of Czech and foreign teachers. Furthermore, issues concerning possible ways of implementing e-learning into the educational process carried out in firms or schools are becoming more and more topical.

From this perspective, it is possible to identify several development trends, based primarily on the technical possibilities of today's information and communication technologies. Those have witnessed such a rapid development, both qualitative and quantitative, that it is now possible to implement technologies that, only a few years ago, were either financially or personally so challenging that it was very difficult to use them in everyday practice. These technically oriented trends in distance education can be observed in three particular areas.

– A full computerization of distance education. Distance learning in „traditional form", based on technically obsolete transfer or presentation media, is now fully replaced by LMS systems and the Internet, and distance learning can thus be implemented mainly through e-learning.

– The use of interactive teaching elements in the form of simulations of real processes and procedures. The multimedia nature of these elements prede-

termines them for being used instead of static visual information (pictures, graphs etc.). Interactive elements are one of the most effective e-learning tools as regards motivation and illustration and they enable a continuous or final verification and interpretation of the lectures and lessons, using simulators in many fields of human activity.

– The use of virtual reality as a „learning" environment capable of inducing the atmosphere and climate of an educational institution even in home environment. Virtual reality, or virtual environment, is a technology allowing the users to interact with a simulated environment. The technology of virtual reality creates an illusion of real or imaginary world. Presently there are dozens of „virtual worlds", inhabited by tens of millions people, and there even exist virtual universities as institutions providing education in distance forms.

The above mentioned technology trends, resulting from a massive explosion of information and communication technologies, are a logical result of the gradual convergence of these technologies and the widest possible group of users. Another group of current development trends is characterized by a purposeful application of some elements of constructivist theories in the form of the enrichment of learning strategies or more effective achievement of the set up learning objectives, not only in cognitive but also affective and psychomotor areas. Hereinafter the most important trends will be specified:

– The use of a wider range of learning strategies. The „classical" concept of distance education is closely connected to the theory of programmed learning. Programmed learning is a teaching method based on the management of students' learning activities, based on behaviourism and neobehaviourism, and its basic formula being the one of S-R (stimulus-response), in the form of U-Z (learning-reinforcement) [Crowder 1966]. However, learning strategies reflect the ideas of constructivism, with the purpose of education defined not only as a transfer of a single truth, as is the case in transmissive pedagogy, but as a much more significant challenge, i.e. to equip the recipient of such education with the capability of getting through an enormous amount of knowledge to be able to use it properly. These learning strategies are currently gaining importance and computers already have the tools to support these activities.

– An effective achievement of educational objectives is based on the fact that the implementation of the „classical" distance learning was based on the transmission media, which did not allow the use of certain elements providing with an effective application of the principle of clarity, and made it very difficult to allow the achievement of affective and psychomotor learning objectives, too.

To differentiate these two groups was only possible via a detailed analysis of the theoretical background and grounds of distance education and programmed learning, and their comparison with the up-to-date theories of learning. As indi-

cated above, distance education is based on some rules that reflect the times when the level of science and technology did not provide for the future existence of technologies that would allow these boundaries to move to entirely different dimensions. It is therefore desirable to analyze whether the 'classical' concept of distance education and modern educational concepts implemented via e-learning have the same theoretical foundations, and what other new influences and ideas enter this type of education.

The so called „moral obsolescence" of classical distance education is thus not only the result of a massive explosion of information and communication technologies, but also a logical result of the gradual convergence of these technologies to the needs of educational theory and practice. This approximation can be identified especially in the area of the development of „learning environments" or software products that now facilitate the application of some methods of constructivist pedagogy and cognitive psychology [Grecmanová, Urbanovská 1997].

4. Technically oriented development trends and their application within the framework of Czech university system

Hereinabove, some of the trends in the development of distance education within the framework of Czech universities were mentioned. Based on the analysis carried out earlier, these trends can be specified in terms of nature and a synthesis can be performed. See the recapitulation of the above mentioned technically oriented trends below.

5. The trend toward the computerization of education

It is conditioned by the use of effective „learning" environments, often in the form of LMS systems [Dlouhý, Jančařík 2010], which make for the implementation of the education process through e-learning. However, these environments require the use of hypermedia study supports that contain not only hypertext, but also multimedia features facilitating a simultaneous stimulation of multiple components of perception. These materials can be created and presented only electronically. Of course, it would be far from reasonable not to use the potential of already existing study materials, and therefore many authors accede to the reshapement of the latter into the form of hypertext, enriched with multimedia features. Once thus adjusted study supports become incorporated into the fully computerized „learning" environment, they contribute to a much higher efficiency and better management of studies. Hereinafter, a few other notes, explaining the above-defined trend, are stated.
– The learning environment in the form of LMS systems allows for better organization and management of student's learning and reduces the delays to a minimum. The student is permanently informed of updates, deadlines or other important facts relevant with respect to the distance education.

– The learning environment in the form of a fully computerized system allows the LMS to develop a variety of communication face-to-face techniques, which are important for the development of social skills. Of course, a personal contact between the student and his tutor is highly desirable, too, but the above mentioned allows for its minimization, enabling the learner to increase the efficiency of the time spent studying.

– These systems also provide immediate feedback as, supposing they make use of suitable study supports, they are able to automatically evaluate the results of student's activities. They are also capable of delivering those results immediately to the tutor, who can assess them and immediately respond.

– Multimedia make for the achievement of a higher degree of interactivity while working with the study material, given that interactivity is one of the most important prerequisites for a continuous motivation. However, interactivity cannot be achieved without the use of electronic hypermedia learning supports.

– Electronic hypermedia learning supports facilitate quick editing, without spending large sums of money on the production or distribution of thus modified or updated study materials. Moreover, their production (meaning in the form of physical media) is not as expensive as in the case of printed study materials.

– Electronic hypermedia learning supports, also known as e-learning or electronic learning supports permit for achieving a high degree of modularity and mobility of the studies. Modularity stems from an appropriate structuring of LMS systems; mobility comes in useful on travels, where a properly modularized learning support can be stored in an on-line or off-line form to mobile phones or handheld computers [Dostál, Klement 2008].

6. The trend toward using interactive teaching elements in the form of simulations of real processes or procedures

As stated above, learning simulations contribute to an increase in the effectiveness of education through e-learning, because of their being highly effective in the area of specific skills' training and development of psychomotor skills of students. The fact stems mainly from the hypermedia character of the simulations, since it is possible to make use of the interactivity of these elements as an important means for activating students. There is indeed a wide range of situations, skills and methods, where activity seems of much more effectiveness as a method of learning. Hereinafter, a few further notes, explaining the above-defined trend, will be presented.

– There are many types of simulations that cover a wide range of activities, not only of technical or scientific nature. These simulations can therefore be used in human science or arts disciplines.

– The development of training simulations is no more as demanding as it used to be several years ago. There exist numerous development environments

susceptible even to less skilled computer users, e.g. software simulations, Adobe Captivate, word games – Hot Potatoes etc.), also thanks to the relatively low price.
– LMS systems are capable of operating these educational objects and often comprise specialized modules for their use.

7. The trend toward the use of virtual reality as a form of learning environment

Though being quite obvious, this trend has not made its way through yet on a large scale. It is therefore a highly promising area of computer technology, which, after overcoming a few technical difficulties, can provide the education process with almost unlimited possibilities, independent of space and time. For the time being, it is possible to make use of certain activities that can be incorporated into the education implemented through e-learning, such as replacing virtual classrooms with virtual simulations. Several Czech universities have already become aware of the above mentioned fact and have consequently set up so called virtual booths, within the framework of the Second Life project [Marešová 2010]. They thus significantly extended the range of training activities falling into distance education realized through e-learning. Below there is a brief summary of further arguments supporting the importance of those technologies' potential for the education process.
– It is already possible to integrate some elements of the LMS systems and virtual reality systems, and to transfer some of the activities carried on within the LMS to such environments.
– The number of users of simulated virtual worlds amounted to several million in 2010 and has seen a steady annual growth since.
– Performance and availability of computer technology and fast data connections have been increasing annually.
– The potential use of virtual reality in education is almost unlimited and can bring a solution to many problems related to the social dimension or humanization of studies.

To conclude, the above stated trends assume the existence of technical or methodological means allowing for the application of these elements within the education process, and of the tools for assessing the quality and effectiveness of the learning process thus enriched.

8. Pedagogy directed development trends and their application within the framework of Czech universities

Another group of development trends that can currently be observed is characterized by the purposeful application of some elements of constructivist theories, such as an expansion of learning strategies or a more effective achievement of the stated learning objectives, in cognitive as well as psychomotor and effec-

tive areas. Hereinafter, the above mentioned pedagogy directed trends will be recapped and the reasons for their being justified, desirable in some cases even, will be reexplained.

9. Application of a wider range of learning styles

The traditional concept of distance education is based on the behavioural theory of programmed learning, which was gradually being replaced by cognitive theories of learning, which, on its turn, have recently been progressively replaced by the constructivist theory. The main presentation element of the curriculum within distance education, a learning support, originally printed, today in the form of hypertext and multimedia, has however never been possible to overcome a certain level of learning. The fact leads to a conclusion that advanced technologies enable the use of procedures and ways of learning that better fit the personality characteristics of students and thus make the study process more efficient and rewarding for the latter. Find below the propositions confirming the above stated conclusions.

– Correspondence learning, based on the theory of programmed learning, which itself consists in the presentation of the content using printed materials and the communication via postal service solely, better corresponds with a lower involvement intellectual processes, as it presumes the employment of only a limited range of learning strategies.
– Cognitive processes applied in multimedia distance education, which is based on the use of several carriers of the educational content presentation and distribution via communication technology (television, radio, DVD and CD-ROM); allow a lower as well as higher involvement of intellectual processes, but even so the applicability of learning strategies is limited.
– Hypermedia distance learning based on the constructivist learning approach, consisting in using hypertext and multimedia elements as well as advanced electronic „learning" environments in the form of the LMS system, allows the involvement of the highest possible levels of learning and intellectual processes. The student can thus apply a wide range of learning strategies and thereby increase the efficiency and the output level of the whole process of education.

10. Trend toward a more efficient achievement of learning objectives

It is a mere fact that the implementation of traditional distance education relied upon the transmission media, which themselves did not allow to use some of the efficient elements in compliance with the principle of clarity. It neither made the achievement of affective and psychomotor learning objectives easy. At present, the possibility of using simulation and virtualization can be a very effective way towards achieving educational goals, cognitive as well as affective, and psychomotor ones. However, the use of these modern technologies assumes the

existence of a fully computerized system of study, where education is carried out through e-learning, with the hypermedia content incorporated in the LMS system. Once again, a few arguments that make us believe that the above outlined trend stems not only from the demands of the educational process, but is also a reflection of contemporary psychological and psychological theories dealing with the process of learning.

– The use of printed study materials within the framework of the correspondence or multimedia forms of distance education allows the achievement of predominantly cognitive educational goals, as stated hereinabove. This is mainly due to the fact that it is very difficult to develop psychomotor and affective skills at the students with just text instructions and guidelines.

– The use of hypermedia study supports ensures a high degree of interactivity between students and the content submitted. These materials and multimedia elements facilitate a manipulation with computer reality or simulation of certain processes which may be affected by the students themselves. Consequently, it is possible to reach a much wider range of learning objectives, which in turn can develop at least as wide a range of students' competencies. All the above stated can be achieved through e-learning.

– To be objective, it is necessary to ask ourselves which of the above stated trends are merely a reflection of time, and thus respond to some external influences that do not influence the very course and outcomes of the learning process, and which ones, on the other hand, are really based on the deep necessity of the development of education both in terms of quality and efficiency.

Conclusions

In accordance with the assumptions stated at the beginning of the study, an insight into the conditions under which the education via e-learning takes place was submitted, and the methods of its implementation were discussed, too. This view facilitated a comparison regarding the development of particular learning theories and the application of the latter in terms of both distance and computer-aided teaching.

At various stages of its development, distance education has reflected the contemporary learning theories, e.g. programmed learning was a reflection of behaviourism, and technological theories reflected cognitivism. The constructivist theory's impact on education via e-learning shows itself especially in the contemporary „hypermediality" and „interactivity". These theories were compared not only with the general principles of distance education, but also with the real possibilities of using information and communication technologies.

Based on the analysis and comparison of the outcomes, it is possible to proceed to the elaboration of the basic principles of distance education, which, if implemented by means of e-learning, should be enriched with a new principle of

interactivity, as a prerequisite for the effective learning of students, and as a means of achieving wider range of learning objectives. The latter can nowadays be provided through the use of educational simulations and virtual reality. This principle allows a long-term development of education via e-learning, based on the consistent application of new knowledge in the fields of pedagogy and psychology. Interactivity is an important factor in the efficiency and the level of the outcomes of education realized in the form of e-learning, too, not only in terms of theoretical development, but also in terms of experience and needs of the recipients of this type of education. The principle of interactivity in thus „upgraded" concept includes not only the communication component, but emphasizes the component of students' manipulation of the curriculum, presented by modern learning simulations or virtual reality, too. The application of this principle, important for education via e-learning, enables the achievement of a wider range of learning objectives, not only in the cognitive, but especially in the affective and psychomotor areas.

It proved to be desirable to revise the current interpretation of one of the fundamental principles of the traditional concept of distance education, i. e. the principle of multimediality. This principle was once seen as suitable for the application of a wide range of transmission media intended for the presentation of the distance education curriculum. It stemmed from the assumed necessity to ensure the transfer of the curriculum to the student via as many channels as possible, but did not accept the fact that these channels should transmit the same information content, and thus stimulate more elements of the student's perception. This way of presenting the subject matter is mainly reflected in the fact that it was only possible to achieve cognitive educational objectives, thus substantially limiting the range of usable learning strategies. Based on the analyses carried out, both theoretical and empirical, it is possible to argue that this perception of the multimediality principle no longer corresponds to current level of knowledge and its contents should be reconsidered. However, in terms of the education implemented through e-learning, only one transmission medium – the Internet – is effective and capable of stimulating more elements of students' perceptions at a time. It enables the teacher to present one piece of information simultaneously in the form of a text, a static image element, a dynamic visual element, an audiovisual recording, or even as any combination whatsoever of these. This approach to the concept of multimediality, in terms of training implemented through e-learning, is a necessary precondition for an effective implementation of the latter. Multimediality can thus be understood as a means to stimulate multiple components of the student's perception, not only as the transmission of information via multiple media. This application is of high importance for education through e-learning, and facilitates the development of a wider range of learning strategies.

The necessity of lifelong learning has been declared and considered as substantial for further development of every society. Information and communication technologies can be of great help, as the formerly used means of the presentation of the curriculum would make it difficult to ensure effective learning in contemporary conditions, even in full-time study modes. There are a number of important questions and issues subject to further study and discussion. The present study put forward and analyzed selected contemporary problems regarding the use of information and communication technologies, in terms of education implemented through e-learning.

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Abstract

During the last few years, e-learning has become an integral part of the system of tertiary education, not only within the framework of combined, but, to an increasingly larger extent, also of full time study modes, accredited and implemented at Czech universities. However, along with its large-scale deployment, a number of problems have emerged, which resulted in the formulation of new research hypotheses. Among the most important ones are those regarding the influence of e-learning on the quality of education, the efficient ways of motivating and mobilizing students, the creation and development of particular competences. There are many external, as well as internal influencing factors, acting more or less covertly, to a greater or lesser intensity. It is highly desirable to identify, describe, analyze, and minimize or maximize their influence in order to prevent them from having a massive negative impact, conditioned by fashion trends, on the quality of tertiary education.

Key words: the Bologna declaration, tertiary education, e-learning, e-learning development, learning theories, information and communication technologies.

Wykorzystanie e-learningu w czeskim systemie szkolnictwa wyższego

Streszczenie

W ciągu ostatnich lat zdalne nauczanie stało się integralnym komponentem systemu nauczania w czeskim systemie szkolnictwa wyższego. Wprowadzenie tego trybu nauczania-uczenia się spowodowało pojawienie się wielu problemów, które doprowadziły do sformułowania nowych hipotez badawczych. Do najważniejszych należą te, które dotyczą wpływu e-learningu na jakość kształcenia, poszukiwania efektywnych sposobów motywowania studentów do rozwoju konkretnych kompetencji. Istnieje wiele czynników zewnętrznych, jak i wewnętrznych, które potencjalnie mogą mieć mniejszy lub większy wpływ na proces nauczania-uczenia się. Wysoce pożądane jest, aby je zidentyfikować, poddać gruntownej analizie i opisać. Pozwoli to na określenie, czy e-learning ma pozytywny wpływ na rozwój wiadomości i umiejętności, czy może to jedynie modowy trend.

Słowa kluczowe: Deklaracja Bolońska, szkolnictwo wyższe, zdalne nauczanie, teoria kształcenia, technologia informacyjna, technologia komunikacyjna.