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PROBLEMS OF ICT-BASED TOOLS ESTIMATION IN THE CONTEXT OF INFORMATION SOCIETY FORMATION

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The article describes the problems of improvement of quality of implementation and use of e-learning tools which arise in terms of increasing quality and accessibility of education. It is determined that those issues are closely linked to specific scientific and methodological approaches to evaluation of quality, selection and use of ICT-based tools in view of emergence of promising information technological platforms of these resources implementation and delivery.

Keywords: *information society, competence, ICT learning tools, evaluation, demands*

Introduction

In the context of information society formation there is a problem of training of highly qualified scientific and production personnel, being the main driving force of economic development, a catalyst of social processes in scientific, educational and industrial fields. Particularly difficult and important task is forming of a person, being capable of productive activity and having professional and educational competencies that would ensure him to solve personal and professional problems in a society characterized by intensive development of high technologies.

In this context, the role of information technological support is crucial for all spheres of education, being a strategic resource for social and economic development, providing the educational system with electronic tools and resources, hardware and software for training purposes, contributing to general improvement of e-learning.

Modern electronic tools, multimedia resources, mobile and distance learning technologies being an important part of a learning process mostly are taken in the context of open education contributing to the concept of open learning technologies [4]. Just such kind of learning technologies suit best of all for the needs of solving of urgent social, economic, educational and cultural problems of modern society, including such an important one as improving accessibility and quality of educational services.

However, the rapid growth of new technological infrastructure, software, information and communication networks cause the need to analyze trends and future prospects of educational context of ICT application in the aspect of improving the quality of e-learning systems.

There is an important trend of open learning technologies development connected to cloud computing (CC). This technology gives new possibilities for e-learning organization while changing the entire notion of e-learning platform [5]. This technology implementation supposes flexible and adaptive use of resources and services while the platform itself may be dynamically formed and accessed by the user [1, 5]. This creates potential for individualization of process of education, formation of personal learning trajectories of a students, selection and use of appropriate technological tools [5].

There is a need to explore educational benefits of emerging e-learning technologies and to investigate how it can impact and improve pedagogical effect of e-learning.

The *purpose of the article* is to identify trends of e-learning systems development and estimation in the context of new demands and requirements posed by information society.

Development of information society and quality of e-learning

In general, the defining feature of e-learning is use of information and communication resources and technologies as tools of learning [4, 6, 9]. This requires an environment for creating and distributing of high-quality software - e-books, libraries, and portals, resources of information and communication networks, distance education services [5]. The current state of ICT-based learning environment formation is characterized by increased quality of information resources for educational and academic purposes, the introduction of integrated platforms of access these resources for educational institutions and individual users [1, 5].

The emergence of new technological platforms and tools provides qualitatively new opportunities for delivery and application of educational resources, changes the idea of infrastructure of the learning process and its information content. We are talking about such advanced technologies as cloud computing, adaptive information and communications networks, virtual and mobile learning, etc [1, 3, 7, 8, 11].

Modern ICT tools are appearing to be an instrument of open education and learning [4]. In this respect there are new challenges and goals posed due to the current stage of information society development. Innovative educational technologies and tools should fit some system pedagogical and information technological requirements in concern to the current level of scientific technological progress and main principles of open education such as mobility of learners and teachers, equal access to educational systems, forming of structure and realization of educational services [4]. Problems of informatization of education require complex fundamental research of the processes of creating and application of ICT tools with respect to e-learning systems quality increase.

Among the main aims which arise in the context of information society development there are forming of XXI century learners competences. Among them different authors pose such as technological skills: informational literacy, media literacy, ICT literacy; social skills: overall cultural literacy, flexibility and adaptability, high level knowledge and mental skills, communication and collaboration [2]. These competencies are so important due to the tendencies of high connectivity and speed of social processes, rapid increase of amount of available information [2].

The competencies of a learner are the point of the main concern due to the statements of competence approach [3, 4] being methodological basis of the learning systems development in the framework of the modern educational paradigm of equal access to qualitative education. Due to this approach quality of education may be assessed in the terms of competencies which are taken as a result of learning. If to take forming of main learner competencies as a purpose aspect of the pedagogical systems organization, it appears that just the appropriate tools of learning should be projected and delivered so as to achieve a better effect of learning. In the context of information society development ICT based tools may be the most efficient and powerful instrument of educational systems structure. So the ICT tools may be the most appropriate component so as to tackle main trends of e-learning systems development which influence quality of education most closely. These trends concern to increase of the quality of e-learning systems and accessibility of e-learning [4]. These too aspects should be the basis of current demands for educational systems development due to their realization in the age of information society.

Quality of e-learning, and the quality of educational services provided through e-learning systems covers a lot of indicators to be evaluated: the content of education and training materials; the level of related hardware and software; adequate means and mechanisms for evaluation of knowledge, processes and results of educational activities; the state of logistics; the level of the

educational process management; level of ICT competencies of students and teachers, their readiness to use technology.

The subject of much research is an issue of computer evaluation of its learning results. Assessment technology concerns many aspects of electronic learning environment. Among the difficulties that arise while e-assessment implementing, there are the problems of the risk of hardware failure, the high cost of powerful servers with a significant number of customers, need for students and teachers to master the assessment technology and others [9]. Theses factors are also depended on the technological platform choice.

The quality of training materials is a separate problem. It supposes various kinds of requirements for maintenance, management, interface engineering, ergonomics and others. These questions are important due to permanent improvement of computer technology. Development and implementation of learning materials and resources require experimental studies, development of methodology and methods of assessment.

In particular, the problem of defining psycho-pedagogical, didactic parameters evaluating the quality of educational resources continues to be relevant. Many authors (S. Sanz-Santamaría, J. Á. Vadillo Zorita, J. Gutiérrez Serrano, N. Friesen, M. AL-Smadi, Ch. Guetl, D. Helic [10]) agree that although the standards in the sphere of e-learning have been developed to identify ways of teaching with learning objects, it rather facilitate the search in this direction, than facing solution. Existing educational facilities specifications aimed at the ability to share various pieces of content by different management systems training. Search for a pedagogical approach being behind the learning objects is to be continued.

Accessibility, access of e-learning, widening participation is now considered in two aspects. The notion of access to education is interpreted, first, as "the nature and extent of the provision available at a particular time". Another notion comprises such factors as wealth, social class, sex, age, ethnicity, and physical and mental ability which influence access [9, c.132].

Among the important factors that hinder e-learning use, are such as having the appropriate hardware, software and necessary services, the Internet, including broadband access, with sufficient speed connection and others. Just the platform is relevant while planning and projecting realization of e-learning process. It gives the opportunity for dynamic access to hardware and software resources, their systematization and optimization of their use.

We must also consider the availability of relevant information and learning resources, whether it is possible and convenient to find and select the material to use [12].

There is also another dimension of access to education, concerning restrictions in time and space. This contradiction is solved in some way by the use of mobile technologies and distributed learning which is now in progress [12].

All these questions are valuable while considering a choice of e-learning platform.

Current demands for ICT learning tools development and organization

The current trend is in wide diversity and complexity of modern e-learning systems. This gives the opportunity for more integration, concentration and choice.

Among the reasons that prevent more intensive information technologies penetration is not only lack the required number of computers, hardware, software. Among the main problems is how to use these hardware and software and how to improve the learning process under computer support. This requires determination of the trends of ICT learning tools development, analysis of advanced domestic and foreign experience, identification of the best examples of software, investigation of ways of selection of certain resources and e-learning systems.

There is a need to explore benefit of development and application of e-learning platform for increasing access to e-learning and quality of services, delivery replenishment and use of best types of resources due to the principles of flexibility and openness of education.

So in order to be able to make balanced decisions regarding selection and appropriate use of this or that information technological platform and learning resources for its content, the problem of evaluating the quality of ICT resources and tools are highlighted [10]. The quality of products is especially significant in this context, when the tools and platforms to provide educational resources are intensively elaborated, changing forms and methods of learning environment organization and management of e-learning systems.

What tools and techniques are to be applied for supporting learning activities so as to achieve the best results and to form main types of learner competencies? The answer to this question depends on the content of e-learning, on the best ways of e-learning systems estimation, choice and use and on technologies of their delivery. It supposes various kinds of requirements for maintenance, management, interface engineering, ergonomics and others which are posed for e-learning systems organization on the basis of emerging platforms and in particular on the basis of cloud computing.

There are several indicators concerning various aspects of e-learning systems application in the context of current demands of open learning, mobility, creativity, flexibility of learning aiming at professional development .of a person.

One important indicator is connected to *adaptability of e*-learning systems. This factor touches upon the development of rather specialized and differentiated teaching systems based on modelling and tracking individual trajectories of student progress, knowledge level, and further development [6]. In this regard, the adaptive technologies, taking into account peculiarities of the individual student progress are used. Adaptability presupposes adjustment, coordination of training, regarding pace of training, diagnosis of achieved level of mastery of the material, broading range of various facilities for learning, suitability for a larger contingent of users.

Building adaptive model of student for monitoring personal characteristics such as the level of knowledge, individual data, current results, and technology to track individual student's trajectory is quite complicated mathematical and methodical problem [6, 9]. Knowledge curriculum includes some form of formalized representation of a totality of knowledge in a subject area being studied. Therefore, the development of such type of systems, mainly with elements of artificial intelligence is rather laborious and presupposes processing of large amount of data. Increasing adaptability is one of the trends of e-learning system development which may be resolved with the using of appropriate tools. Various materials, resources and services may be delivered by the demand and preference of the user being dynamically adapted to the learner educational landscape and competency.

In this respect the next indicator concerns to the problem of *integrity* of e-learning which is highly connected to standardization of technologies and resources to manage e-learning. This problem arises due to formation of an open learning environment that provides flexible access to educational resources, choice and variation of pace, content, temporal and spatial boundaries of training depending on learner needs [4]. There is a tendency of coordination and unification of standards for learning materials, developed by various organizations such as IEEE, IMS, ISO/IEC JTC1 SC36 and others, as well as harmonization of national standards with international ones. In this respect, approaches to evaluation of information technology and ways of their selection and use get further development on the current stage of open e-learning systems formation.

Another indicator concerns to wide scale *interactivity* of ICT tools. Actually, modern ICT tools aimed to support teacher activity for control of a learning process in virtual computer class [7]. There are such forms of learning which suppose forming groups, communities or classes communicating in virtual on-line mode. To manage the learning activity there are functions for collaborative access to educational content for the group of learners, the teacher is able to browse all computers of a group, to concentrate attention of learners giving pauses and massages, to switch on and off some learners, to spread files and references among the target group, give messages to certain students. The students also may appeal to attention of a teacher while asking, remarking, speaking out and so on.

Next indicator applies to consideration of *safety* of educational environment and concerns to minimal risks and increasing benefits of using computer technology in education aiming at *development of intellectual activity of a learner*. In this respect, some ergonomic and design factors, psychological and educational requirements for educational software and hardware are taking into consideration due to the rapid upgrade of computer equipment.

The promising approach is to deal the problems of e-learning systems development in perspective of advanced technologies giving the appropriate basis for these systems investigation, elaboration and use.

There are several trends to use cloud computing technology as e-learning platform in which computer resources and facilities are available to the user as a Web service.

Trends of cloud computing technology application for e-learning resources management and estimation

Cloud computing (CC) is a data processing technology in which computer resources and facilities are available to the user as a Web service. As defined by the National Institute of Standards and Technology USA (NIST), cloud computing is a model of user-friendly network access to a common fund of computing resources (such as networks, servers, data files, software application and services) that can be quickly provided with minimal managerial effort or interaction with the provider.

Thus, the essence of the concept of CC is to provide end users with dynamic access to services, computing resources and applications (including operating systems and ICT infrastructure) over the Internet [1, 4].

So as to examine CC as e-learning platform, it is necessary to take into account some didactic, methodical, technological, organizational and other application aspects, presupposition of an introduction and perspective ways of use.

Thus the advantages of cloud computing in the field of e-learning systems estimation and use are characterized by the following factors [1, 3, 5, 7]:

- simplifying the installation, support and maintenance of licensed software, which could be ordered as an Internet service, possibility to use different types of software that can be compared, chosen, investigated;

- the ability to multi-channel updating of collections of educational resources and organization of multiple access due to solving security problems and authorization in the uniform way and due to simplified licensing scheme;

- support of distributed learning processes, due to virtual projects development, for example, by a team of programmers who all have access to a particular environment and program code, devices or laboratories and other facilities;

- reduction of equipment cost while dynamically increasing the hardware resources such as memory, speed, throughput, etc.;

- improving e-learning organization through support of processes cumbersome calculations and maintain large volumes of data, obtained from students, through special cloud applications;

- providing mobility of learning using cloud communication services such as email, IP-telephony, instant messaging, teleconferencing and others;

- availability of variety of e-learning systems and resources collection for many educational institution on the basis of the integrated platform

Distant learning is a current trend of e-learning systems development which now is penetrating into school education. An important set of problems concerning e-learning organization is associated with providing of course management. An essential feature of cloud technology is in possibility of creating a single infrastructure of parallel and distributed computing and development,

and integration of systems and resources of various types on this basis. This allows using cloud computing in relation to various aspects of e-learning resources management and estimation.

Aims and objectives of distance courses management have been changed with the influence of emerging technologies, in particular CC. There are new features and management capabilities which were not available previously, and new forms of estimation of e-learning resources appearing on this basis [7].

Management of access to e-learning highlights security of information and license application considerations, because in the learning process it might be helpful to use Internet resources, search services thus submission of educational materials becomes rather laborious. In addition, the problem of organizing and coordinating access to a large number of students and a large number of resources rises when it is necessary to consider their interaction with the service provider, with the teacher, and among each other [15]. These functions may be realized by means of CC integrated platform. There are new forms of resources control which suppose their classification and integration on the basis of some methodological framework which may be based on some estimation approaches.

Content management of learning courses is related to systematization of the training materials, partitioning it into portions. Various search services and diagnostic resources may be used. Application of cloud computing makes it possible to store large collections of learning resources, data and services in a structured way to enrich them on unite basis and provide a multiply access through technology "software as service" [8]. Library of educational materials may be available for a variety of e-learning systems or provided centrally to several educational institutions [11]. By means of cloud computing it is possible to simplify management of collective resources use, remote access for multiple user selection, providing the necessary tools at some point of the training process. Students may use some kind of resources assessment presupposed by the system while choosing necessary tools.

Management of learning activity covers the following functions: search for the regularities in data obtained from students; search for patterns in data on study styles and models of individual student knowledge to determine the next steps, skills and knowledge to be mastered; visualization of the analytical findings to course managers to give the opportunity to provide and improve the learning process, to adjust the results [15]. This requires processing large amounts of data coming from students, which is achieved by means of "platform as a service". This technology may be used to improve data processing on the unite basis and to deliver some resources estimation procedure being embedded into the learning process.

Here there are emerging forms of learning organization that are to provide online virtual lessons, management of joint control of equipment at a distance, joint projects, communication in virtual mode. Testing technologies based on CC also may be used in this case, being a promising way to estimate resources quality.

Management of hardware resources may require empowering of hardware capabilities such as memory, speed, etc. "Infrastructure as a service" may be used for this purpose [14].

Communication management may be based on cloud computing standardized services to be used for e-mail, chat and forums, conferences and seminars organization, conducted by the resources stored on remote media [14].

Due to development of cloud computing technologies capabilities of access and functionality of electronic resources has been increased. By this reason, creating of effective methods of educational resources quality evaluation will improve the efficiency of their use. Thus, cloud computing technology is a promising direction of development of electronic resources application giving the way to elaboration of improved methods of multiple accesses to electronic resources collections and being a uniform methodology of a single platform, the basis for development and testing, improvement and development of integrated methods for assessing the quality of these resources.

There are several indicators of e-learning systems development of information society age that seem to be considerably tackled on the basis of cloud computing contributing to such factors as increase of accessibility and quality of e-learning. Thus this is a promising direction of improvement of e-learning systems organization which waits for further exploration by means of certain precise techniques of measurement.

One of the main reasons causing the level of quality of ICT education is the need of appropriate theoretical basis of e-learning evaluating to be developed. It requires system research, optimization and parameterization of ICT tools quality evaluation criteria, elaboration of methods of complex quality assessment determining and testing of effective techniques of mapping of learning tools and technologies to some objective psychological and pedagogical requirements for their quality. Thus the platform of cloud computing appears to be a basis for e-learning quality improvement while giving new mechanisms of quality providing and control.

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