CLOUD TECHNOLOGIES IN THE DEVELOPMENT OF THE E-LERNING: THEORETICAL ASPECTS

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This paper gives an overview of the current problems of the formation of cloud technologies based educational environment in the development of e-learning. The authors explore available theoretical developments in this area, consider methodological basis and technical options for the implementation of "cloud" based educational services. Nowadays it is difficult to argue that cloud-based technologies are incredibly in demand and are actively developing. A cloud computing technology refers to a technology that allows you to combine IT resources of various hardware platforms into a single whole and allows the user to access them via the Internet.

Both positive and negative aspects of introducing cloud technologies into the educational process are examined from the technical, technological, didactic and economic view. Particular attention is paid to the topics that are directly included in the educational process or supporting its tasks, whose effectiveness can be increased if cloud services are introduced. In addition, several ways to implement this approach are proposed, based on the widespread cloud service delivery models.

The paper also considers how cloud technologies provide the implementation of individual, group and collective forms of network interaction, the creation of a communication environment for the interaction of teachers and students in order to acquire new knowledge, control, evaluation and, in general, contribution to improving the level of professional training of various fields specialists.

Analytical review allows the authors to formulate conclusions about the timeliness and need for research in the field of modern educational process, to identify the main prospects for the use of cloud technologies in professional activities

The overview of the state of the problem of formation of educational environment based on cloud technologies in the development of e-learning is given in this paper. The authors explore the available theoretical developments in this area, consider methodological basis and technical options for the implementation of educational services based on the "cloud".

Keywords: e-lerning, informational and educational environment, cloud technology, virtual environment, cloud-oriented environment of the teacher, the student's individual educational environment, distance learning, information and computer technology, information space.

Сажко Г.І., Д. Піршл «Хмарні технології в розвитку e-learning: теоретичні аспекти».

У статті наведено огляд стану проблеми формування інформаційно-освітніх середовищ на базі хмарних технологій в аспекті розвитку e-learning, розглядаються методологічні основи і технічні варіанти реалізації освітніх сервісів на основі «хмари». Сьогодні важко посперечатися з тим, що технології, засновані на хмарних обчисленнях, неймовірно затребувані і активно розвиваються. Під технологією хмарних обчислень (cloud computing) розуміється технологія, яка дозволяє об'єднувати ІТресурси різних апаратних платформ в єдине ціле і надавати користувачеві доступ до них через мережу Інтернет.

Розглядаються як позитивні, так і негативні сторони впровадження хмарних технологій в освітній процес з точки зору технічної, технологічної, дидактичної і економічної. Особлива увага приділяється темам, які безпосередньо входять в навчальний процес або завданням, які його підтримують, чия ефективність може зрости за умови впровадження хмарних сервісів. Крім того, пропонується кілька шляхів реалізації подібного підходу, заснованих на широко поширених моделях надання хмарних послуг.

Розглядається, як хмарні технології забезпечують реалізацію індивідуальних, групових і колективних форм мережевої взаємодії, створення комунікаційного середовища для взаємодії педагогів і учнів з метою отримання нових знань, контролю, оцінки і в цілому сприяють підвищенню рівня професійної підготовки фахівців в різних областях.

Аналітичний огляд дозволяє сформулювати висновки про своєчасність і необхідність проведення досліджень в цій області сучасного освітнього процесу, намітити основні перспективи використання хмарних технологій в e-lerning і професійній діяльності.

Ключові слова: електронне навчання, інформаційно-освітнє середовище, хмарні технології, віртуальне середовище, хмарне середовище вчителя, індивідуальне освітнє середовище студента, дистанційне навчання, інформаційно-комп'ютерна техніка, інформаційний простір.

Сажко Г.И., Д.Пирил «Облачные технологии в развитии e-learning: теоретические аспекты».

В статье проводится обзор состояния проблемы формирования информационно-образовательных сред на базе облачных технологий в аспекте развития e-learning, рассматриваются методологические основы и технические варианты реализации образовательных сервисов на основе «облака». Сегодня трудно поспорить с тем, что технологии, основанные на облачных вычислениях, невероятно востребованы и активно развиваются. Под технологией облачных вычислений (cloud computing) понимается технология, которая позволяет объединять ИТресурсы различных аппаратных платформ в единое целое и предоставлять пользователю доступ к ним через сеть Интернет.

Рассматриваются как позитивные, так и негативные стороны внедрения облачных технологий в образовательный процесс с точки зрения технической, технологической, дидактической и экономической Особое внимание уделяется темам непосредственно входящим в учебный процесс или поддерживающим его задачам, чья эффективность может возрасти при условии внедрения облачных сервисов. Кроме того, предлагается несколько путей реализации подобного подхода, основанных на широко распространенных моделях предоставления облачных услуг.

Рассматривается, как облачные технологии обеспечивают реализацию индивидуальных, групповых и коллективных форм сетевого взаимодействия, создание коммуникационной среды для взаимодействия педагогов и обучающихся с целью получения новых знаний, контроля, оценки и в целом способствуют повышению уровня профессиональной подготовки специалистов в различных областях.

Аналитический обзор позволяет сформулировать выводы о своевременности и необходимости проведения исследований в этой области современного образовательного процесса, наметить основные перспективы использования облачных технологий в e-lerning и профессиональной деятельности.

Ключевые слова: электронное обучение, информационно-образовательная среда, облачные технологии, виртуальная среда, облачно-ориентированная среда преподавателя, индивидуальная образовательная среда студента, системы дистанционного обучения, информационно-компьютерные технологии, информационное пространство.

Formulation of the problem. Last several decades can be characterized as years of the formation of a new information culture and the increasing use of information and communication technologies in education. Special attention is paid to the introduction of modern distance technologies and e-learning technologies into education [1].

In pedagogical practice the term "e-learning" can be considered a synonym for the term "distance learning" and thus "e-learning" in methodology and didactics can be defined as a synthetic, integral, humanistic form of instruction that is based on a wide range of traditional and new information -communication technologies and their technical means, used to deliver the educational material, its independent study, the dialogue between the teacher and the student. At the same time, the learning process is generally uncritical to their location in space and time, as well as to a specific educational institution [2]. But not every educational institution can afford to modernize its computer base and software in accordance with the constantly changing trends in the development of information and communication technologies.

Radically changing the educational process, its accessibility, content and interaction of the subjects of the educational process through technologies such as the Web, virtual, cloud is enhanced. Actual and timely in the current conditions is the introduction of cloud technologies and services into the system of the educational process and the formation of an information environment.

For the development of e-learning one can highlight following advantages of using cloud technologies in the educational process:

1. Economic. Services are rendered free of charge by external providers.

2. Technical. Minimum hardware requirements. Obligatory condition - access to the Internet.

3. Technological. Most of the cloud services are easy to use and require minimal support.

4. Didactic. A wide range of online tools and services that ensure the cooperation and interaction of the teacher and student [3].

The introduction of cloud technologies improves the quality of the educational process and reduces the costs of acquiring the necessary software. Also, cloud technologies are an alternative to traditional forms of the educational process; they make it possible to build an individual trajectory of learning, conduct interactive classes and group work, which in turn has a number of positive moments:

- allows students to develop skills in the Internet;
- develops a unified information environment;
- creates conditions of the presence in the educational environment at different times and independently of each other of the participants in the educational process;
- allows creating, developing and using managing information and educational resources;
- allows changing the role status of the teacher;
- increases the flexibility of software and the environmental friendliness of computer technology.

Analysis of recent research and publications. Building an information and educational environment is the main objective of e-learning. The problems of formation of the information and educational environment are analyzed in the works of Bykov V. [4], Bogachkova U. [5], Kizim S.S., Kucak L.V., Ljuljchak S.Ju. [6], Panchenko L. [7], A.F. Manako, O.S. Voronkin [8], Ghryb'juk O.O. [9].

The new format of education is demanded, on the one hand, because it allows providing a high level of access to education, and on the other hand, to improve its quality. However, we are not talking about a complete transition to the electronic form of education. It is much more effective and productive to use mixed training. Speaking about the use of cloud technologies in education, it should be noted that the "clouds" will overcome all existing barriers to science: geographic, technological, social.

Cloud technologies in education began to develop after e-learning, the development of Internet simulators. This is one of the most promising innovations in the education system in recent times. Cloud technologies significantly reduce the cost of the information infrastructure, and to improve the quality of education, they create and distribute additional services.

Introduction of cloud technologies in the process of training is one of the most promising innovations in the education system. Due to them, the costs for the information infrastructure are significantly reduced, in the educational environment

additional services are used to improve the quality of education. In addition, cloud services in the development of individual learning methods are extremely effective tool and this allows making the learning process more productive and interesting.

The use of cloud computing technologies is an effective way to improve the information and educational environment [10]. The use of cloud technologies for the organization of the "academic cloud" provides effective access to the training resources of the "cloud", the flexible allocation of resources, the indication of consumed services, the organization of feedback. The concept of the "academic cloud" consists of creating a set of software and hardware solutions that will be in demand in the process of organizing the educational activities of a modern university (training courses, teamwork services, on-line services, training videos, videoconferencing services, learning environments, virtual laboratories). They will function as a cloud service and will not require additional hardware and licensed software, which was investigated in the works of Glazunova O. [11].

Analyzing the concept of processing electronic data on the basis of information technologies of cloud computing Bykov M. notes that their fundamental principles and program implementations should be the subject of priority study, the means of teaching, research and management of education at all organizational levels of society [4].

In a cloud-based educational environment access to quality electronic resources is expanding with innovative features such as adaptability, mobility, full-scale interactivity, free network access, a unified infrastructure, and a universal approach to work [12]. Practical experience of using cloud technologies and Web 2.0 tools in the educational process is described in the research of Balyk N. [13].

The purpose of the work. The review of the available research in the field of building and using information and learning environments based on cloud technologies contributes to the formulation of the main research hypothesis: the scientific justification of the virtual information and educational environment on the basis of cloud technologies in the future will create an information and learning environment for ensuring an effective learning process for students of any specialty. Taking into account the specifics of their training and the possibility of expanding the training base by attracting information resources of other educational institutions will help teaching students in related specialties.

According to the hypothesis of research in order to achieve the goal of research, it is necessary to solve following tasks:

1. Define the theoretical principles of building a virtual information and educational environment.

2. Identify approaches to building information and educational and methodological content of the information and educational environment.

3. Identify the necessary technical platform for building a virtual information and educational environment based on cloud technologies.

One must consider the possible options for realizing such an environment and the technical conditions necessary for this. Modernization of the educational space, conducted based on interdisciplinary and interuniversity integration, informatization of the educational process, the formation of a system of continuous education, require understanding of the possibilities of using various means of information and computer technologies for building an information educational environment.

As noted in the works of Starichenko B., any technological realization of information and computing systems is obliged to ensure the fulfillment of two main functions - resource, that is, the formation, placement and storage of electronic educational resources and tools, and communication, that is, providing on-line remote access to student and teacher resources, and communication between them [16]. Currently, at most universities these systems are based on distance learning systems - «Moodle», «Sakai», «eLearning Server», «REDCLASS Learning», «WebTutor», «eLearning 4G», «Claroline LMS», which include the management subsystem of the educational process (LMS - Learning Management System).

The main types of cloud technologies [14, 15] reflect the possible directions of using information and communication technologies to create educational services:

SaaS (Software as a Service) – "Software as a service" is used to provide users with access to electronic resources, software, information training materials. These services provide participants in the educational process with the ability to work with remote special software and perform distributed calculations in cumbersome processes for example, when processing a large amount of experimental data.

PaaS (Platform as a Service) – "platform as a service". In this case, the user is given access to use the software platform: operational systems, database management systems, application software, software development and testing facilities.

IaaS (Infrastructure as a Service) – "Infrastructure as a service". The model of providing cloud services in which the user can manage the processing and storage facilities, as well as other fundamental computing resources. For example, the developer is provided with a ready automated remote workstation. When using IaaS it

is advisable to use a fairly "weak" client hardware (laptops, netbooks, smartphones).

Presentation of the main research material. When modeling a cloud-oriented information and teaching environment, the teacher needs to take into account the specifics of the subject content and the specific features of the student's learning activities. The individual educational environment of the teacher can be made up with electronic lecture notes (created, for example, using conference systems), a lecture video library (posted on YouTube, Univer.tv), a system of tasks for independent work of students (including Documents "Google Docs", "Prezi.com"), a knowledge map (created, for example, with the help of "MindMeister"), educational monitoring tools ("QuizeMaker", "TestServer"), a professional community (created, for example, Web service «Ning»).

The individual educational environment of the student can include a video course of lectures, a workshop on problem solving, and an adaptive testing system. Combining Web 2.0 features such as using blogs to share opinions, Wiki, Google Docs for collaborative teamwork on projects, the use of bookmarking services on important resources, YouTube for viewing and discussing video tapes, podcasts for listening to lectures in audio format, "Skype" for the organization of communication, students can create personal educational environments, thus gaining access to global learning resources and the opportunity to communicate.

Given the diversity and novelty of the existing approaches, methods and technologies for designing information and educational cloud environments, their formation and use in educational institutions, we can conclude that these questions require experimental research, refinement of approaches, models, techniques, and possible ways of implementation. It should also be noted that the specificity of each separate information and educational environment affects the features of its construction and use.

Let us consider how in practice the preparation of a group project for distance learning using cloud services can be implemented. Students are divided into groups and receive topics for their projects. The teacher creates the necessary documents for each individual group and opens access to them for all group members (using e-mail). You can create any document, be it a text file, spreadsheet, presentation or booklet. Developers of Google services believe that cloud technology should provide the following scheme of action: starting work on your laptop, a person can continue to write it leaving the house on his phone while on the road and send it already from the tablet.

Approximately the same scheme students can work on their project in the house, and at the university, and elsewhere. The teacher has the opportunity to comment on the documents for correction by the students. At the same time it is possible to determine what is the contribution of each of the students.

Cloud technologies offer the ability to create learning situations, including the design and organization of research activities in such a manner that students can naturally absorb and develop the competences of the 21st century. Modern man must be able to cope with a massive body of information, use different types of media resources, plan activities, be skilled in effective cooperation.

However, the organization of work as a project, as well as research in the framework of the educational process presupposes basic steps:

1.   Preparatory and organizational:
–   the choice of the working group;
–   formulation of the problem, the definition of performance criteria, the establishment of the project concept or theme study, setting goals and objectives, a description of the relevance, the hypotheses of the study and research methods;
–   preparation of work plan and timing.

2.   Theoretical-practical:
–   collection, analysis and synthesis of information;
–   implementation of project activities or research: experiments, surveys, product development, etc.;
–   presentation of the project results and research activities.

3.   Presentation and Analysis:
–   presentation of research results and project activities;
–   analysis of the results and determination of development prospects;
–   reflection.

For such type of work Google Drive cloud service capabilities are an alternative to licensed software. It has e-mail, a wide range of applications, mobile access to resources and other useful services necessary for the organization of the students.

As a result of the project activities students cognitive activity increases, communication and information skills are formed; students take advantage of the online tools and cloud services sharing technology for networking and professional applications in the future. At the same time training is active and the activities assume project character. Students perform design tasks of varying complexity that are meaningful and professionally-directional, through different master model learning activities and functions are distributed thus

facilitating communication between the teacher, students and trainees interconnected by cloud.

The Blogger service database organizes work groups. This activity develops skills of independent communication, allows assessment and analysis of the content. An example would be a blog of the student with the government, student group blog. They can be organized to discuss actual problems of education, new projects, or to analyze events.

A special role in the development of independent activity of students is a possibility of interactive forms of interaction with the educational Web-resources. The situation of "dialogue" folds in the process of solving the problem, when applying to the student reference materials to the tip, choice of presentation of educational material (compressed view, detailed, illustrated or not), and creating the conditions for engaging in independent learning activities. Very effective for the organization of independent work, for example, can be mathematical geometry program GeoGebra, 1C Mathematical designer. They serve to create blanks with tasks which can be sent then to the email addresses of students who, by doing the job, expelled solution. The program has an opportunity to view the progress and the job done.

The same cloud-based services can be used to monitor students' knowledge. For example, at the end of the lecture it is efficient to carry out monitoring, the results of which will show how much learning material students have learnt. For the organization of such controls one should use BYOD technology ("bring your own device"). This means an opportunity for students to bring and use their devices in education. Since now almost everyone has at least one general-purpose gadget with a set of applications and uses it throughout the day to get around, BYOD trend in the modern world is practically impossible.

The use of available tools such as cloud service Google Forms and the program to create a QR-code allows the teacher to implement a BYOD technology in class.

With the help of the program QR-code, which is a reference to the test, is created and stored in Google Drive. Students using their devices with the installed program to scan the QR-code can access the test. Students have the opportunity to choose the answers to proposed questions at the end, to send the form and see the results.

Using a cloud service Google Forms, the teacher creates the test with the required number of questions. For each question, answer options are available, from which you can choose the correct answer, several correct options may be selected from a multiple selections list.

The advantages of this method of control for the teacher are: minimization of the time required to create test and inspect; automatic evaluation; analysis and visualization of results; working principle of "feedback" - according to the results of control an adjustment of educational material is made.

The advantages of this method of control for the students: getting test results immediately after on your device (not experiencing psychological discomfort with the public voicing of the results); activation of cognitive activity; the adjustment of the educational behavior; and if necessary, the adjustment of personal learning paths.

In addition to working with students, the teacher can actively use cloud technologies for himself. As an example, you can create a schedule of training sessions, consultations, the timing of the delivery of projects, abstracts, informing students about postponement or cancellation of classes.

Conclusions from this study. After examining examples of cloud computing, we can say that most often educational organizations use the cloud model as "software as a service". This is due to the fact that the educational institution in this case avoids the economic and organizational costs for creating its own server and its maintenance; it

becomes possible to install its own applications on the platform provided by the service provider.

Prospects for further exploration in this direction. The main prospect for further research is the use of the knowledge gained on the theoretical and methodological basis for the development of information and learning environments based on cloud technologies for the implementation of collaborative mediums with foreign partner institutions. In this regard, the authors outlined the prospective stages of implementing such an environment, namely: the identification of possible partner universities and related specialties for cooperation, the definition of a list of similar disciplines and topics in them for posting materials in a common virtual information and educational environment; the coordination of subjects of joint student projects of different levels of duration; organization of a technical platform for building a common virtual information and educational environment; creation of the unified complexes of information and educational materials on the subjects of similar disciplines; formation of a unified database of students and teachers for the implementation of access to the resources of the virtual information and educational environment and joint activities.

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