

# Opportunities of Digital Educational Technologies in the Practice of University Education

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## ABSTRACT

The article is devoted to the inclusion of Russian universities in the practice of digital education. This article considers specifics of various digital educational technologies in distance learning and identifies the main directions of their use in the educational process of the university. The purpose of the publication is to present and generalize the possibilities of digital educational technologies and electronic educational environment in the space of university education. The features of the electronic course in the discipline "Astronomy" in the distance learning environment Moodle for undergraduate and graduate students in the direction of preparation for Pedagogical education are revealed. From the point of the practical importance of using digital educational technologies, the presented electronic course on the discipline "Astronomy" (section "Small bodies of the Solar System") can be useful for teachers working with undergraduate and graduate students.

**Keywords:** *digital technologies in distance learning, Moodle educational environment, thematic module, web design*

## 1. INTRODUCTION

The active introduction of computer technology in all spheres of public life in the second half of the twentieth century made it possible to solve the problems of access to higher education in the world and led to the fact that most Western universities began to actively use the capabilities of information technology. Local universities have also been actively involved in the implementation of distance technologies in digital education in their practice. In 1993, the Ministry of Science, Higher School and Technical Policy announced the decision "On creating a distance education system in the Russian Federation". From this moment begins the history of distance education in Russia. Already in May 1995, the "Concept for the creation and development of a unified distance education system in Russia" was adopted, according to which it was planned to integrate the distance education system with the existing full-time and part-time systems of training and education, supplementing and developing them [1,10–12].

In 1997, the Russian Ministry of Education initiated an experiment to introduce distance education technologies in digital education in Russia. During its holding, which took place in Russia from 1999 - 2014, a variety of digital technologies in distance education were developed and tested in the field of distance education, as well as educational materials, interactive teaching aids, instructional videos, audio programs, educational computer programs, etc. P. [2]. The Ministry developed special and didactic methods of distance learning, determined the approximate composition of the educational and methodological complex, created educational Internet portals, and spotted some important

characteristics of the technical and information support of the distance educational process.

Entering the 21st century has only reinforced the need to take advantage of the many opportunities provided by digital technology. In 2014, the Ministry of Education and Science of the Russian Federation issued an order "On the use of e-learning and distance technologies in the educational process", digital learning in distance education began to be seen as a form of education. In this regard, it seems important to consider the possibilities of distance technologies in digital education and highlight the main directions of their use in the educational process of the university.

## 2. RESEARCH METHODOLOGY

The author used following research methods to achieve the goal and solve the tasks: analysis of psychological and pedagogical, scientific, methodological, popular science and educational literature, Internet sources; analysis of curricula, programs, textbooks, federal standards; supervision, interviews with students and teachers; observation and analysis of the teachers' activities and students to study the state of the problem.

An electronic course was developed to explore the possibilities of distance educational technologies for full-time and part-time students of the FEFU School of Education in Astronomy discipline in the Moodle distance learning environment for the section "Small bodies of the Solar System", providing a phased and continuous increase in the effectiveness of future training physics teachers in astronomy. The combination of software products developed during the course creation determined

the interface of the distance learning environment, the structure and content of the electronic course, and made it possible to formulate the basic requirements for them. As a result, guidelines for the use of the electronic course utilizing the Moodle medium in teaching astronomy to students of a pedagogical university were compiled.

Qualitative and quantitative analysis methods were used to assess the effectiveness of the tested training technology at all stages in the study. The impact of distance learning technology on the student learning process was assessed through observation and analysis of the results.

### 3. RESEARCH RESULTS

Timely developed and implemented educational content, the ability to quickly switch from one form of training to another, individualization, intensification of the learning process and information interaction - there are requirements that can be realized through distance technologies in digital education. To achieve these goals, today, the following distance education technologies are used in universities, both in a separate form and in a mixed form: case and network technologies; technologies using the television and satellite data channels.

Higher education institutions use the following learning models with distant learning technology [4–6]:

- externship-based training, where students study the training material independently, with the subsequent passing of exams on topics covered;
- university-based training, with a distance learning - this is a system of education, which is based on information technology and computer telecommunications and used by the largest universities in the world with the utilization of case technologies;
- training, based on the cooperation of several educational institutions, in which each educational establishment specializes in training specialists for a particular training course;
- study in specialized educational institutions carried out by specialist training centres using distance education courses without other forms of training;
- training using autonomous teaching systems, based only on radio and television broadcasts;
- study in a virtual educational environment takes place on an individual route, with access to several educational courses at the same time.

It should be noted that the effectiveness of training using one or another model of distance learning technologies in digital education depends on the training level of teachers, the organization and choice of the technologies used, the

means and forms of training, and it also directly depends on the technical equipment of the university. For example, when learning on the Internet, it is necessary to have a software environment on the platform of which distance learning will be deployed. This training can be used to study both the basic and the variable parts of the study cycle. Remote educational technologies are used both in full-time and part-time forms of training, which allows for the high-quality organization of independent student work under the supervision of a teacher.

Distance educational technologies in the university are implemented through [16–17]:

1. vocational training by following the requirements of modern education (introduction to the educational process of innovation);
2. the development and implementation of the main aspects of distance learning technologies (technical, psychological, pedagogical, social, economic, legal aspects);
3. the launch of creative teachers' activities in real-time;
4. the use of copyrighted methods in the education, using distance learning technologies in the process of self-learning and self-control;
5. the use of distance learning technologies by teachers in the learning process.

A review of distance learning technologies in digital education shows that there is a wide range of opportunities for their use in the educational process, combining these technologies or organically introducing some elements into full-time or distance learning.

Remote educational technologies are mainly used in the study of theoretical multimedia materials for better visualization of objects and processes increases. One of the most important facts for the teacher is to be willing to apply new technologies in their work. To do this, the teacher should not only have professional knowledge in his speciality but also be able to work with applied and communication computer programs, be able to create and post-training material on the global network. The advent of the Internet has led to the active deployment of electronic training courses on the network, which looks like a single didactic system based on computer technology, providing the educational process according to work plans using informational, controlling, simulation, modelling and demonstration materials [13].

The use of distance educational technologies gives the students equal opportunities in obtaining an education, while they are used both to provide access to the study process at a distance and to organize this process inside the university.

The distance educational technologies that came in the form of the software product of large IBM companies, Oracle helped to expand the capabilities of distance educational technologies and digital education in general, but the environments received final recognition after the creation of additional modules in them, which are responsible for the means of communication between the participants of the educational process. Thus, the necessary conditions for the organization of the educational process with the use of distance learning technologies are technical and software equipment of the institution, financial capabilities, regulatory and information base, the presence of an open or closed distance shell, the availability of specialists for the organization of technical and methodological support for the educational process, in the implementation of which an important factor is the choice of a Learning Management System (LMS) [14–15].

In the world, there are a huge number of LMS, developed by companies of foreign countries and working not only in the distance education system but also in business. The high cost, high maintenance costs of these systems, the absence of a russified product were a deterrent factor to their widespread integration into the educational process in the Russian Federation until the 90s. The first distance shells, recognized in our country:

1. IBM LOTUS is a line of world-class program packages that have been introduced not only in enterprises but also in the education system (LOTUS LearningSpace product is responsible for organizing joint work of students and teachers, allows you to track performance, manage the learning process).
2. LMS WebCT - a program that allows you to develop a training course based on WEB technology, using the already built-in, ready-made interface (in the form of colour schemes, text pages) with the provision of a set of training tools (chat, forum) and a set of administrative tools, which is necessary for course creation and maintenance.
3. LMS Prometheus - a system for working on the Internet, which allows you to automate the entire training cycle. It is used in state and corporate structures, educational institutions of Russia. It can integrate with personnel, accounting, information and ERP-systems (Enterprise Resource Planning - integrated enterprise management information system).

Currently, with the offer of a free software product and open source code, several new companies have entered the educational services market: eFront, Sakai, Open Elms, OLAT, ILIAS, Dokeos, Chamilo, and many others.

eFront: Russified eFront system supports the international standard SCORM. It has all the necessary basic functionality (forums, chats, polls, glossary, event schedules, certificate generation, user management, the formation of educational content and documentation). Belongs to the new generation of eLearning systems, combine the functions of learning management systems (LMS), management systems and the creation of training materials (LCMS). eFront provides opportunities to solve problems in the organization of the educational process in institutions, advanced training, certification and selection of employees in organizations. The shell is based on eFront Core, a system distributed with a free license.

Sakai: The Sakai system is built on a modular basis. Developed by major universities in the world (the University of Michigan with the participation of Indiana and Stanford University), the system has been implemented and operates in more than ten Russian universities. It is a set of software tools that provide communication and group activities, both at the workplace and remotely. Using a browser, people can select a set of tools on the course website, thus changing the functionality for their purposes.

Open Elms: the project is commercial, has all the basic necessary functions. The developer company has agreed to use this system for free, without the ability to contact the developers for additional services. The Open Elms system supports the SCORM standard. The program is not Russified.

OLAT: developed in 1999 at the University of Zurich (Switzerland). The system is developing quite actively. It supports all major international standards for electronic courses and tests (SCORM and IMS QTI), allows you to place all types of media content. The system is fully Russified but does not have documentation in Russian.

ILIAS: supports the basic international standard SCORM. The system has a test constructor that supports various types of questions. An ILIAS installation requires an Apache server with PHP support and a MySQL database. ILIAS is translated into many languages of the world, including Russian.

Dokeos: a free open source software product, there is a paid version that has wider functionality and has technical and software support for the system. The disadvantage is not guaranteed SCORM support. The system serves about 4.2 million users worldwide. In Russia, the system is not widespread.

Chamilo: the system works on a modular basis, supports course schedules, forums, chats, wiki, single file storage, messaging between users and the ability to group the students. Good integration with Facebook, YouTube, SladeShare and others. Not Russified.

The author also emphasizes open and closed source distance learning systems: BlackBoard, Moodle [3].

Blackboard LMS: A closed-source program used by more than 10,000 organizations around the world, developed by Blackboard Inc. The software includes modules: Blackboard learns (training system), Blackboard Collaborate (virtual classes), Blackboard Mobile (mobile learning), Blackboard Connect (mass online distribution

system), Blackboard Transact (identity system), Blackboard Analytics (storage system and data analysis). The educational social network Blackboard Learn is integrated with educational institutions (working on the Blackboard platform), which allows dialogue between students from different educational institutions studying the same subject area. The program has a built-in function to check for plagiarism.

Moodle LMS (Modular Object-Oriented Dynamic Learning Environment): this is a virtual learning environment; since 2002, more than 300 developers have been participating in its development, for which modularity and support for open integration protocols with the very beginning were a priority. Moodle has established itself as a stable working integration platform on which support for all types of educational activity is implemented at a fairly high level [18–19]. It works on Windows, Mac and many varieties of Linux supports translation into many languages, including Russian. When installing the program, you must have the PHP installation server (Personal Home Page Tools - “Tools for creating personal web pages”), as well as a SQL database (Structured Query Language). Moodle has approximately 43 million users registered on 54 thousand educational portals in 211 countries of the world. Moodle can be installed on a regular workstation, or at a hosting company. It is used in the academic sector of the educational system, in institutions or training centres of the corporate sector.

The Moodle program makes it possible to work in the school’s local networks, on the Internet, is compatible with many browsers, has a friendly interface, supports archiving of training courses, allows teachers to change parts of the course sections, transfer the system to different operating platforms, etc.

The advantages of the Moodle system are:

- open-source;
- the ability to create your course in the chosen discipline, using educational material in various formats (flash animation, pictures, video-audio files, text) to generate educational material in the form of lectures, practical exercises, lessons, tests designed for students to work in real-time, including without contact with the teacher;
- the course design has a modular structure. The LMS Moodle program allows you to use more than 360 standard and additional functional elements - modules when designing electronic training courses. This structure of the system makes it easy to transform it into the needs of any educational process. Standard modules of the program are: Forum, Lecture, Seminar, Task, Chat, Resource, Test, Glossary, Wiki, Database, Scrom package, etc. Additional modules include OpenMeeting (video and audio conferencing application), Google Apps authentication module, Google Apps for Moodle, Hidden Text

filter, sharing resource creation module, project management module, voice response recording and publishing them as answers to assignments, etc. [7–8, 9];

- the program can be used not only in distance learning but also in full-time study.

The disadvantages of the system include the fact that Moodle is, at most, only a distance learning system, while most commercial distance learning systems are not limited to a standard set of modules and have long gone beyond the scope of distance learning functionality. The advantages of the Moodle system among similar software include its popularity in the academic sector.

#### **4. RESULTS AND DISCUSSION**

Thus, the analysis of remote software environments showed that the Moodle virtual learning environment has the most suitable capabilities for creating a visual and information-rich course using various modern media technologies: gif and flash animations, video and audio files, etc. that can most effectively reflect the content relevant material in an electronic distance learning course. Today, the increased demand for the use of distance learning technologies in the higher education system is considered as one of the conditions for the successful implementation of the federal state educational standard (GEF) of the third and subsequent generations. In the Far Eastern region, one of the leaders in introducing and successfully using distance education technologies in digital education is the Far Eastern Federal University (FEFU). One of the tasks he sets is the development of not only the regional distance education system, but also the international, as well as the training of qualified specialists for the Far East and the Asia-Pacific region.

One of the proofs of the above is the active inclusion of university teachers in the creation of a variety of distance learning courses. This includes active cooperation with the domestic open electronic platform Universarium, and the placement of electronic courses on the Blackboard platform, and the creation of independent distance learning courses for authors. One of such developments is the creation by teachers of the FEFU School of Pedagogy of an electronic course in the discipline "Astronomy".

Recent studies in outer space have opened up a new stage for humanity in the knowledge of the structure and evolution of the Universe. From the research, apparatuses launched several years ago that was sent to carry out several missions, in particular, the study of the small solar system bodies, periodically new interesting facts come in. Discoveries in this area have acquired an avalanche-like character, the results of such studies, which have great importance in the development of science, are for the most part published on foreign websites NASA and ESA and cannot be included in Russian classical textbooks on astronomy on time.

A study of Russian-language sites containing information about space showed that only Internet portals Astronet and Galspace practically update the information as it becomes available. The world's leading universities use almost all of the new information on comets, asteroids, etc., contained on the NASA and ESA websites. On its basis, laboratory work is being developed and used to study the small solar system bodies. There is no publicly available electronic training course on this topic in Russia. In this regard, the question of the development and implementation of electronic courses using a distance environment in the educational process of the university is urgently raised. Also, the development of an electronic course on astronomy "Small Solar System bodies" for physics students of pedagogical universities is determined by the fact that astronomical knowledge is an integral part of students' physical education. Their implementation will help smooth out the existing contradiction between the number of hours allocated to this discipline and the capacious, rich content of the training course. It is possible to alleviate this situation when studying the section "Small Solar System bodies" within the framework of a pedagogical university through the creation of an electronic training course in the Moodle distance learning environment.

The structure of the electronic course of the section "Small Solar System bodies" is as follows. The course consists of three thematic modules:

1. Comets. Meteors. Meteorites.

## 5. CONCLUSION

The introduction of distance learning forms allows future teachers to skillfully carry out educational activities in a distant mode (distance educational project, tele-testing, web quest, educational server, and others). Also, studying subject areas at the FEFU School of Pedagogy, the future teacher should be able to manage the Moodle distance learning environment (as one of the simplest and most convenient), in which the teacher creates training modules, filling each module with the necessary content (texts, supporting files, presentations, questionnaires etc). When using the Moodle distance learning environment, a web browser is sufficient, which facilitates the learning environment and makes it convenient for both the teacher and students. According to the results of the students' assignments, the teacher can give grades and comments. Thus, the Moodle environment is also a centre for creating educational material and ensuring interaction between participants in the educational process.

The teacher may, at his discretion, use both thematic and calendar structuring of the course. Thus, the curriculum is divided into sections by topic. In calendar structuring, each week of studying a course is represented as a separate section, such patterning is convenient for a distance learning organization and allows students to plan their academic work correctly. Editing the course content is carried out by the author in an arbitrary order and can

2. Asteroids.
3. Trans-Neptune objects.

Each thematic module contains:

- the orientation part, which displays the goals, information resources (the topic, the start and end dates of the course, etc.), the content of the training elements, which is displayed on the navigation bar and in the text box;
- the information part represented by web pages on which the content is displayed;
- diagnostic part in the form of tests and practical tasks.

The implementation of the project to create an electronic course in the distance learning environment Moodle enables students to remotely study material on the discipline "Astronomy" in the section "Small Solar System bodies". And also to perform test and laboratory tasks, ask questions to the teacher, send the completed practical work (The Moodle remote educational environment is installed on the server facilities of the FEFU School of Pedagogy). Work with the electronic course can also take place within the classroom time.

easily be carried out directly in the learning process. Various elements are easily added to the electronic course: lecture, assignment, forum, glossary, wiki, chat, etc. For each electronic program, there is a convenient page for viewing the latest changes.

Thus, the Moodle distance learning environment gives the teacher an extensive toolkit for presenting the teaching materials of the course, conducting theoretical and practical classes, organizing educational activities both individual and group. Besides, the capabilities of the information technology in the university expand the cognitive capabilities of both students and teachers.

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