

# *University Information System: current state and development objectives*

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**Abstract** — The article presents the current state of application of information systems in the field of Russian higher education. The main activities of higher educational institutions as well as their management processes are still not fully automated or partially automated. International e-learning platforms are considered. The analysis of the practice of using distance learning platforms at 100 leading universities and an assessment of their use were carried out. The requirements for a unified information system are formulated for the purpose of integrated automation of the main activities of higher educational institutions. The proposed system will improve the quality of the educational process and optimize the process of making management decisions. The necessity of creating a unified information system of the university with the participation of professional communities, both from education and from the field of information technology under the leadership of the state is substantiated.

**Keywords** — *information system, informatization of education, higher education, E-Learning, distance learning.*

## I. INTRODUCTION

Information and communication technologies penetrate into all spheres of human activity forming a unified information global system. An important element of this system is the informatization of higher education. Digital technologies open new directions in education, thereby expanding the quality and efficiency of the educational process and complementing traditional educational technologies. The use of new information services and technologies of education, electronic educational resources, equipment with modern educational and production software and hardware, means of open and distance learning allow higher education institutions (both public and private) to transfer to a new level of knowledge management. Russian universities have an urgent need to optimize their learning processes and increase their efficiency. Most modern universities passed the stage of automating basic business processes, computer equipment is being used, as well as the specialized supporting software (office software products, accounting and personnel records systems, etc.). Information and technical support is provided by IT staff of universities. There is a transition to Russian software, including the open one. Meanwhile, the basic processes of educational activity as well as their management processes are still not fully automated or partially and separately automated. Universities solve the issues of automating the educational process in stages, when required.

Information learning systems are applied individually, at the discretion of own strategy of informatization [9].

## II. MATERIAL AND METHODS

In practice, various unrelated software acts as the information system of the university. Distance education systems are successfully used, aimed primarily at the automation of learning at a distance in almost all universities, but their application is mostly local. Such systems are used in distance or in additional education. The issue of automating traditional full-time education is often beyond attention. Universities do not use one unified information system in which all phases of the life cycle of the educational process can be traced. There is a need to develop and implement high-quality information systems that automate all the basic processes in many higher educational institutions [8].

From the 1970s to the 1980s, the research institute of the Higher School of the USSR was originally engaged in the issue of automated university management (AUM). AUM was used in many higher educational institutions of our country and covered the processes of registration of the faculty, applicants and students, current progress and attendance [1]. Modern use of e-Learning systems is based on the principles of LMS and LCMS systems [4]. **LMS learning management systems** are used to organize, create, conduct and manage training courses, they allow the student to receive distance learning materials in a virtual classroom and interact with the teacher online. **LCMS learning content management systems** provide teachers with an effective tool for creating learning materials. Currently, these two systems are continuously developing, integrating with each other and complement each other. In general, the use of such systems makes it possible to automate the storage and registration of electronic courses. All training materials are stored in a single knowledge base. Students have access to course materials distantly with the Internet connection. There is an opportunity to add new teachers and students, create and assign new e-courses, if necessary, it is possible to differentiate access rights. In turn, e-courses can be divided into modules which will improve the efficiency of studying the material and simplify information search. The student has the opportunity to independently choose the order of studying materials according to the educational schedule convenient for them. For teachers,

the system makes it possible to systematize their lectures and teaching materials, prepare the training materials in accordance with modern professional standards, receive reports on students' activity and performance, conduct an independent rating of the learning outcomes, determine objective criteria for grading knowledge and point out shortcomings in progress. The modules for creating and generating management reports based on existing data are available in the system which contributes to solving the problem of managing and administering the educational process as a whole.

An important feature of modern learning systems is their openness. The LMS system uses web technologies by applying open international standards for creating, managing, and providing SCORM and xAPI training courses [5]. There are many different LMS and LMCS training systems on the software market, mostly designed for creating distance learning courses. The development of these software products is carried out in two directions: commercial and non-commercial. Representatives of the first direction - Lotus Learning Space, Mirapolis, First Class and other systems are primarily used in the field of business education. Systems are focused on integration with the enterprise resource planning systems (ERP), human resources management systems (HRM systems) and electronic document management systems (EDMS). Among the representatives of non-commercial software products, the leaders are the Moodle, Sakai and Open Edx platforms.

### III. RESULT AND DISCUSSIONS

Moodle LMS system allows universities to effectively implement distance learning technologies, as it combines advanced functionality, flexibility, reliability and ease of use. The basic unit of the Moodle training system is the training course. Within each course, the system makes it possible to organize the interaction of the student and the teacher on the basis of forums, chats and email. Training materials are sent in electronic form using text files, web pages on the system portal, audio and video recordings, Wiki knowledge system. Learning outcomes are recorded in a special section and are available for further check. Moodle is based on the principles of using a free object-oriented learning system, it's distributed under the GNU GPL license, free of charge, translated into dozens of languages, including Russian. The international programming team has been working on the system for over 17 years. The Moodle headquarters are located in Australia. Moodle is the most used distance learning system in the world, the official website of the Moodle e-learning environment in the statistics section <https://moodle.net/stats/> provides information on the number of installed and registered Moodle systems in the world. As of March 2019, LMS system has more than 100 thousand installations in more than 100 countries. In Russia, about 3 thousand systems were installed, a share of installations on the segments of state networks is 60% [2]. This distribution shows that the majority of Russian universities applies this training system to some extent. It should be noted that the total number of installations includes both operating and used systems, and not operating for various reasons. Moodle traces every installation, even if it was done for testing purposes or if installation failed.

The Open EdX learning system is a relatively young open platform that forms a set of standards for the creation and management of distance courses in the MEP format (mass online courses). Today, MOOC is one of the most convenient ways of additional distance education, available for everyone who has the Internet access. Most of the world's famous universities organize and place MOOC courses based on Open EdX. The advantage of using this platform is that the course participant does not need to look for the material and sections in which it is placed. In the MOOC course, knowledge is presented sequentially, step by step. Access to the next course step is opened only at the completion of the current course step. The disadvantage of such knowledge providing can be the inability to quickly transfer from course to course which is appropriate for obtaining a comprehensive knowledge of the subject.

In Russia, the Open EdX platform is used quite rarely, but we should note the national project "Open Education" - an educational platform offering online courses in the subjects of Russian universities. The platform was created by the "National Open Education Platform" Association established by leading universities - Moscow State University named after M.V. Lomonosov, SPPU, SPSU, National Research Technological University "MISiS", NRU HSE, MIPT, UrFU and University of Information Technologies, Mechanics and Optics [6]. Course materials are developed in accordance with federal state educational standards. Courses are freely available, there are no requirements for the level of education of the participant. Before starting work with the course, the participant is obliged to pass personal identification. According to the results of the successful completion of the control measures of the bachelor degree or specialist program course, a certificate is issued to a participant.

According to expert estimates of the experience of the 100 best universities of Russia in 2018, an assumption was made that the relevant sections of distance education are posted on the websites of universities [3]. We have created a program in php language to find the occurrence of search words on the required information resources of the studied selection of universities. The algorithm of the program makes it possible to find the required occurrences of words on all html pages of Internet sites. These search word markers were selected: "LMS", "Moodle", "Sakai", "Open Edx", etc. It was determined that 80 Russian universities already use LMS-systems. 80% use the Moodle system. Among the remaining 20%, the used systems are Open EdX, Sakai, solutions on the 1C platform: Enterprise (1C: University, 1C: University) with distance education modules, etc. It is important to distinguish both universities in general and faculties and departments among the users of the Moodle system. Most of the educational institutions from the top 20 of the studied selection use LMS systems for the whole institution. In this case, one installation is used for all faculties and departments, training courses and materials are stored in one database, the entry point to the distance education system is one. However, there are many educational institutions, among which the LMS systems are used by faculties or departments separately, not systematically. In such universities there is no strategy to use a unified information LMS system.

Since higher education institutions have passed the stage of independent creation of information systems, its transfer to a new qualitative level becomes relevant. The information system should automate and streamline the management of the educational process at all stages. It is necessary to put the student and the teacher at the head of the system. The student is taken into account throughout the entire life cycle of the educational process: from the initial stage of preparatory courses and admission to the university (as an applicant), the transition to the new academic year and the stage of graduation. It is important that it makes it possible to manage study groups, create separate groups of students for each academic year, transfer students to another group, give them academic leave, expel, and keep records of the student's academic card and his/her progress. Examination and test records are conducted only in electronic form, paper-based media are not used. For teachers, the system will allow them to flexibly distribute the workload, help to keep track of changes in curricula, remind of upcoming events, automatically check the student for admission to the session. The results of the work of students and teachers with the mandatory participation of faculties and departments are recorded in the rating system and are provided to everyone for review, the grading procedure is fully automated, transparent and open. The grading system will allow the teacher as well as all interested parties of the learning process, to identify weaknesses in the study of the material. The information system is obliged to function taking into account the peculiarities of psychophysical development, individual capabilities and state of health of both students and teachers [10].

The access to the library database is available for students and teachers through the information system of the university. The operations of reservation and selection of the necessary sources of literature, registration of new acquisitions, the formation of an electronic catalog are available. In turn, the system will help the department of the university library to determine seasonal peak loads, plan requirements of demand and availability of mandatory copies, quickly replenish library funds with textbooks and study guides necessary for research work and the educational process in accordance with the course work programs.

At the initial stage of development of information support, educational institutions were forced to provide technical equipment (computer equipment, specialized software) to students. At present, the level of technical equipment has reached a critical mass, information content is accessible to everyone, it is now technically possible and informationally safe. Access to the system from students' personal technical devices (laptops, tablets, smartphones) becomes customary and necessary. Modern technologies allow developing client-server software for mobile platforms with access to the student's personal account to obtain information about the class schedule of the group or the faculty as a whole, current academic backlogs, current news of the university life [9].

A key feature of the information system is the ability to support management decisions and operational control of key performance indicators of the university. The module of the decision support system (DSS) will allow at all levels of management to generate reports with different levels of detail.

The system provides tools for planning the effectiveness of educational programs, evaluating the performance of planned indicators for structural units at all levels - teaching, methodical, department, deans, staff and accounting, financial control in the context of articles. The outcome indicators of the university activity are available to relevant ministries and other regulatory bodies.

In addition to the maintenance of the educational process, this system can be adapted and integrated with other processes of the educational institution, such as accounting, economic service, procurement of inventory and equipment, technical means, permit system. According to the results of the students' academic progress, the information system will calculate and charge the scholarship with the subsequent transfer of information to the accounting information system. With proper integration with the union system, the amount of union dues can automatically be deducted from the scholarship. It is possible to develop a module responsible for students registration in a dormitory, college town or campus. A student eligible to get a place in a dormitory will be registered in the system from the stage of applying, concluding a contract, distributing to free rooms, relocation and until the stage of leaving the dormitory. The system will allow to plan and carry out the calculation of payment for residence. System security should be based on the principle of organizing roles that can be assigned to all users depending on their functional responsibilities. The information system of the university should be closely integrated with the access control system, which will allow to automatically record all participants in the educational process on the territory of the institution, that is, to ensure that the working time of university staff and attendance of students is recorded online. Access control should be carried out through turnstiles integrated with the information system under consideration.

It should be noted that in addition to optimizing the educational process, the introduction of the system will lead to a reduction in labor costs in the administrative and economic services of the university. At the same time, the staff of the information technology department, managing and serving the information system of the university, will be expanded. It is necessary to provide jobs for technicians, engineers, analysts and developers.

#### IV. CONCLUSION

It is advisable to provide access to the information system of the university to the business community of professionals in order to attract interesting trainers and organize business trainings. The new format of training, organized on the basis of the fundamental natural-scientific training of students, together with the practical competencies of the business, will increase the level of knowledge and skills of both teachers and students.

As previously noted, there is no single solution for the comprehensive automation of the university learning process in the current software market. In this regard, the issue of the further development of information systems of the university is relevant. The state could become a driver of the development and automation of the educational process. The information block of higher education as the fundamental basis of society should become an organic component of the state policy of

informatization. The Federal Law “On Education in the Russian Federation” of December 29, 2012 (273-FZ) declares the need to develop and use the electronic information and educational environment in full, regardless of the student's location [7]. However, the law does not regulate the composition and functionality of the information system and refers the issue of its use to the educational organization. We see two ways of development, the first one is the development of a unified state information system of the university and its implementation in all higher educational institutions of the Russian Federation, the second one is the provision of a conceptual model of the information system, standards and protocols, including international, to the professional community of universities. In this case, the state could act as a data exchange intermediary, and universities could develop their own information systems in accordance with the adopted roadmap. In any case, the data should be stored in a single format, integrated with a single entry point and accessible from the outside to both the state and all parties interested. The choice of the development way is a debatable question; it is necessary to involve the professional community, both from the educational sphere and from the sphere of information technologies.

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