

Digital Educational Environment of a Modern University: Theory, Practice and Administration

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ABSTRACT

The article reveals theoretical and practical aspects of the digital educational environment of a university. The main normative and legal documents of Ukraine regulating the informatization of the sphere of national education are determined. The experience of introduction of the system of electronic educational courses by the leading institutions of higher education of Ukraine is analysed; the concepts of “distance education”, “digital educational environment”, “educational management” are specified. It has been found that education is a social institution with its own laws, principles and regulations, so the ability to manage education is as important and difficult as finding the right vector for development of all mankind. The benefits of education transformation are listed: development of students’ self-determination, ability to concentrate on the most valuable teaching material; increase of mobility of personality, ability to adapt to the dynamic environment; ensuring cooperation with diverse audiences; creating an individualized educational trajectory of the student; comfortable learning environment. An attempt is made to identify the definition of “digital educational environment” as a set of relevant resources that is able to ensure the implementation of educational, scientific, international and managerial activities of higher educational institutions. It was established that higher educational institutions of Ukraine in the conditions of distance learning increase the capacity of the digital educational environment. The conditions and modern vectors of information educational development are considered, and the basic problems, needed to be resolved at the state level, are defined. Strengths (flexible schedule of educational tasks, provision of inclusiveness, control and evaluation of the results of educational activities, individual consultations in remote mode, etc.) and weaknesses revealed of the development of the digital educational environment (the delay in the creation of digital training courses, lack of information literacy of teachers, low level of integration of digital learning environment and teaching disciplines, etc.). Presented the model of digital education environment of the university from the position of organizational and administrative activity.

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Described four operational modules of the specified model: scientific and technical module (repository, open publication system, digitalization of the library fund); educational module (electronic management system of educational courses, online learning, control of students’ knowledge quality); administrative module (electronic document management, education environment management, digital archive, online questionnaires, operational process management, digital security systems, innovative activities in the education and information environment); informational module (official website of the institution of higher education, personal pages of teachers, 3D-courses, pages of the university in social networks). It is established that the level of compliance of all activities of the designated operational areas is an indicator of the successful functioning of the university under the conditions of digitalization of the educational environment.

CCS CONCEPTS

• **Applied computing** → *Learning management systems; Distance learning; E-learning.*

KEYWORDS

digital educational environment, Moodle, distance education, model of digital educational environment of the university

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1 INTRODUCTION

The complex social challenges posed by the global COVID-19 pandemic have not left any area of public life unchanged. The spheres of material (industry, transport, construction, types of household services) and intangible (education, culture, art) production faced the need for partial or complete transition to the digital environment. Not all of them succeeded with maximum efficiency at once: there was a lack of experience in the digital environment, there was a lack of specialists and equipment. The same problems befell the educational environment of Ukrainian education, which found itself in a situation of distance learning [29].

For the higher educational sector, this situation has become a kind of challenge, a call for action, and general secondary educational institutions are on the verge of disrupting the educational process, caused by a lack of computer technologies for both students and teachers, low level of information, communication competence

of participants in the educational process, sometimes the lack of Internet, etc.

Distance education has been introduced in Ukraine for almost 30 years [20]. This is evidenced by the legal framework of Ukraine, which regulates the informatization of education as a priority of state educational policy: Laws of Ukraine “On the basic principles of information society in Ukraine for 2007–2015” [3], “On Education” [8], “On Higher Education” [7], Order of the Ministry of Education and Science “On approval of the Regulation on distance learning” [5], Order of the Cabinet of Ministers “On approval of the State Program “Information and communication technologies in education and science for 2006–2010” [2], “On Approval of the Distance Learning System Development Program for 2004–2006” [1], Decree of the President of Ukraine “On the National Strategy for Development of Education in Ukraine until 2021” [6], Resolution of the Verkhovna Rada of Ukraine “On the recommendation of parliamentary hearings on topic: “Strategy of innovative development of Ukraine for 2010–2020 in the context of globalization challenges” [4], etc. In general, the legal documents defining the principles of distance learning in Ukraine are balanced and in line with modern demands of educational institutions. Today, material and technical problems that need to be addressed at the state level in the near future are still relevant.

However, the main achievements in the organization of distance education have occurred over the past two years. The vast majority of higher educational institutions in Ukraine have mastered the LMS Moodle [23]. In addition to Moodle, among the distance learning technologies the most popular and convenient platforms were: Zoom, Google Classroom, Kahoot, Google Meet, EdEra, Prometheus, etc. Of course, in the conditions of abrupt transition to online learning, the primary means of communication with students of all levels were such popular messengers and services as: Viber, Telegram, Messenger, WhatsApp, Instagram.

It was found that the introduction of distance learning at different educational levels is relevant among scientists both theorists and practitioners. The demand of the society is such that it requires radically new approaches to the organization of the educational process.

The *purpose of the article* is to analyze the digital educational environment of a higher educational institution through the prism of the theory and practice of educational management.

The defined purpose causes the following tasks:

- (1) To determine the current state of theoretical development of basic concepts in the field of digital educational space.
- (2) To analyze the state of use of the digital educational environment in the universities of Ukraine.

This problem remains relevant given that the intensive search for forms, methods and adequate means that would increase the effectiveness of training of future professionals in the current challenges that force the introduction of blended learning.

2 RESEARCH OF THE TERMINOLOGY OF THE DIGITAL EDUCATIONAL ENVIRONMENT

The logic of the study requires clarification of such key concepts as: “distance education”, “digital educational environment”, “educational management”.

The website of the Ministry of Education and Science of Ukraine states that “distance education is an opportunity to study and receive the necessary knowledge remotely from school at any convenient time” [22]. There is also a list of distance learning models, including: independent study of the material (external); university studies; cooperation of educational institutions; autonomous educational institutions; autonomous educational systems; distance learning using multimedia programs.

Distance learning is a set of modern technologies that provide delivery of information interactively by means of use of information and communication technologies from those who teach (teachers, prominent figures in certain fields of science, politicians) to those who study (students or listeners).

The transition to distance learning was not easy for anyone: educators, teachers, parents, and even academics were put in a time limit. It was necessary to organize the educational process as quickly and as smoothly as possible in accordance with the conditions of the general quarantine. Experience has shown that distance education has many advantages, including the following:

- flexibility (adjusting the distance learning course to the level of knowledge and training of education students);
- innovation (implementation of the latest psychological and pedagogical and special methodological developments);
- usability (no pressure to the venue and time);
- economic efficiency (organization of distance learning is cheaper than traditional);
- modularity (design of the distance learning course in such a way that it takes into account different levels of training of educational specialists);
- diagnostics (more opportunities to control the quality of learning);
- geographical non-limitation (the absence of geographical obstacles to obtain education at various educational institutions of the world).

Today’s digital university is a thoroughly changed structure, the content of education, approaches to administration, human capital development, scientific activities, the quality management system of education [21].

Digitalization is a reflection of the current paradigm of social development, in which competitiveness and efficiency are vital qualities. Digitization helps to simplify the educational process, making it more flexible and adapted to the realities of today, which ensures the formation of competitive professionals [16, p. 188].

According to Zaika [36], the main advantages of the digital transformation of the educational process are the following:

- a flexible schedule of educational work and, accordingly, the possibility of choosing the individual pace of the educational plan is created;

- the conditions for the implementation of inclusive education are being created;
- the structure of the teacher's activity is changing; the main functions that take up most of his or her time are: design of educational work, preparation of teaching assignments for self-study of the whole content of the discipline, control assignments with the levels of protection of validity of the results, individual counseling in distance mode, control and evaluation of the results of educational work;
- the organization of training and management of the educational process is changing. The first priority is the organization of the training of independent work of education students and coordination of their activities through distance learning tools. The main efforts are focused on the organization of the educational process, taking into account the characteristics, aspirations and abilities of each educational student;
- academic mobility in a digital education environment will enable education students to change their educational path at any time with minimal loss of time and maximum retention of academic achievements obtained in the previous stages of education.

At the same time, there are still a lot of unresolved problems. Thus, we agree with the opinion of Kucherak [19], who outlines these problems of development of the digital education environment:

- lack of scientific systematic planning, blindness in construction. In the construction of digital environment to some universities lack scientific and well-organized general plan;
- the distinction of building digital learning resources. Digital learning environment is a complex system, which mainly consists of two parts: hardware environment and software environment. However, in the process of building the digital educational environment, many universities emphasize the construction of hardware and neglect the construction of software. To ensure the quality and quantity of digital resources it is important to provide quality educational resources for frontal teaching;
- information literacy of teachers and digital skills must be improved. The teaching mode in the digital educational environment differs greatly from the traditional teaching mode and imposes high demands on instructors. Teachers use traditional educational ideas and educational concepts, it is difficult for them to accept new ideas and concepts based on digital learning. On the other hand, due to the lack of necessary training and various forms of continuous education it is important for teachers to technically adapt to the new requirements of the digital learning environment;
- maintenance of the information system does not work. The university uses more varied information systems. At the same time, they also face a lot of management problems and receive a lot of additional workload, including maintenance of equipment, information security, data management, etc.
- the level of integration of the digital educational environment and teaching disciplines is far from reaching the level

of deep integration. An incomplete number of digital teaching models have not been truly integrated into conventional teaching. Various technologies have not become organically integrated, but brought a lot of work for teachers.

We are convinced the distance learning process allows the higher education applicants to receive a quality educational service, plan and implement an individual educational trajectory, use the benefits of dual education to improve their professional competence, and combine the participants of the educational process beyond age, social limitations, health, increasing the social and professional mobility of the population.

We agree with the position that distance learning is a fundamentally new educational system, which includes the following components: e-learning course management system (platform, website, environment) with all the necessary means of communication; database of educational materials; monitoring and evaluation tools; participants in the educational process (subjects and technical specialists).

According to Voronova [32], the rapid development of the digital educational environment leads to the fact that the management system of distance learning, distribution of educational materials with shared access for participants in the educational process up to this day were educational innovations, and now are quite traditional. This can be evidenced at least by the fact that educational institutions of all levels in Ukraine do not just try, but actually work remotely: classes take place according to schedule, teachers have developed and actively use a set of control (final, thematic) tasks to test knowledge, etc. And it is worth noting the organization of a pilot external independent evaluation for graduates of general secondary and vocational education remotely in 2020, which ensured, above all, the compliance with anti-epidemic safety measures for all participants, establishing a realistic assessment of their own capabilities and level of knowledge in the chosen subject by students, and the Ukrainian Centre for Educational Quality [10] had the opportunity to test the power of the digital environment and the professionalism of a team of specialists.

Digital educational environment is a set of tools, resources and services of information and communication networks that provide communication, interaction, learning, participation in virtual learning communities to form the relevant competencies of students [34]. A modern university graduate must have such a set of competencies that would ensure his high competitiveness in the labor market. And taking into account global changes in society, its rapid digitalization, information and communication competence of a specialist in any field of activity becomes leading.

Studying the use of informational and educational environment, Zabolotna and Ilchenko [35, p. 6] note, that the single informational environment allows optimal and effective solution of the following problems:

- transition from reproductive to creative and consultative activities;
- providing participants in the educational process with access to information related to planning, organizing and monitoring of the educational process;
- Ensuring communicative interaction between teachers, education students and the administration of the school;

- effective use of educational and methodological complexes that are constantly updated in accordance with the requirements.

According to Bykov et al. [13], the informatization of education directly depends on the objective conditions and current trends in the information society, which include:

- ensuring the mobility of information and communication activities of participants in the educational process in the information space;
- development of cloud computing and virtualization technologies, corporate, public and hybrid ICT infrastructures;
- accumulation and processing of significant amounts of digital data, formation and use of electronic information databases and systems, in particular scientific libraries and scientometric databases;
- deployment of topology of broadband high-speed electronic communication channels;
- progress of robotics, robot technical systems, in particular, 3D printers and 3D scanners;
- development of the software production industry (publication of electronic educational resources);
- expansion of networks of ICT service providers, primarily cloud services, and networks of data processing centers.

Investigating the current state of use in the domestic educational space of cloud-based systems (a system that has the ability to automatically adjust its parameters to different individual characteristics and educational needs of participants in the learning process [21, p. 8]), Vyshnivskiy et al. [33] determine that for effective interaction of all participants in the educational process the digital environment is possible only with the use of electronic textbooks, repositories of digital educational resources, virtual laboratories, multimedia teaching aids, rating systems for assessing the achievements of students.

Distance learning is carried out by home technologies: pedagogical and information and communication. Pedagogical technologies of distance learning are technologies of intermediary active communication between teachers and students using telecommunications. The teaching material is presented in a structured and electronic form [15].

Information and communication technologies of distance learning are technologies of creation, transmission, storage of educational materials, organization and support of the educational process of distance learning through telecommunications. Distance learning technologies in higher education reveal the possibilities of a positive impact on the solution of the following problems in the training of future professionals [25]:

- increasing the level of quality of education in higher education institutions;
- implementation of the needs of future graduates in educational services;
- increasing the professional mobility and activity of future graduates;
- formation of a unified educational space within the framework of higher education;
- individualization of education with the mass nature of higher education.

For example, in the Kryvyi Rih State Pedagogical University to improve the level of information and communication competence was organized by the course to improve the qualification on the theme: “Information and communication technologies in full-time (blended) learning” [23]. The teaching staff was able to take these courses under the supervision of the chair of the Department of Computer Science and Applied Mathematics. During the lessons the teachers were directly trained to work in the educational environment, namely:

- create e-mail and work with a google disk (creating files, downloading documents, making URL links, etc.);
- work in Moodle (enroll and enroll students in the course, regulate the time of students’ performance of educational activities, fill in the electronic magazine and the message of success);
- model own educational course, enforce its structural elements (syllabus of the discipline, lecture plan, practical training plan, guidelines, independent work, individual tasks, questions for self-monitoring, module control work, examination test, etc.);
- use forms of work (scientific quizzes, crossword puzzles, etc.) that are interesting for students;
- perform open and uninterrupted monitoring of the students’ knowledge quality.

Among those who took advanced courses, each department of the university had a manager – a person who has access to the creation of new courses for members of their department and provides advice without intermediary on the work in Moodle [11]. Thus, modern information and communication technologies are the basis, which the digital environment is not only formed on, but also directly implemented through a system of principles and technologies for the development of the educational system.

Therefore, for the effective functioning of the digital education environment of the educational institution, the aspect of its management is important. For a deeper understanding of this issue, let us analyze the scientific works of the researchers on the problems of education management.

Management in the broadest sense of the word is the theory and practice of managing social organizations. Education is a social institution, where there are its own laws, principles and regulations. Accordingly, being able to manage education is as important and difficult as finding the right vector for the development of all mankind.

The management of the educational process is a successive sprinkling of clearly defined procedures for educational and cognitive activities. The peculiarity of managerial activity in education lies in the constant search for new approaches to the implementation of such activity.

Management in education has its own specifics and laws. The specificity of education management lies in the peculiarities of the subject product, value and results of work of the education manager. The subject of work of the manager of the educational process is the activity of the subject of management. The work product is information about the educational process. The means of work is the word, the language. The result of work of the manager is

the level of literacy, education and development of the object of management – educational learners.

The main functions of management in education:

- making logical decisions;
- organizing the implementation of the decisions taken;
- bringing the decision to the participants;
- creation of conditions for effective work of the educational institution;
- creation of proper conditions of activity for each participant of the educational process;
- motivation and stimulation of activity of the participants of the educational process;
- control of implementation of decisions.

The understanding of education management has three dimensions: from the position of hierarchy in the organization, where the leading tool is the influence on the person from above; from the position of culture (social norms, values, specifics of behavior, etc.); from the position of market relations, i.e. equitable relations horizontally, which are based on partnership in the organization of joint activities and the provision of educational services [26].

Educational management is not a new concept for Ukrainian education. Batsurovska and Samoilenko [12], Doronina [14], Konratyeva [17], Nikolaienko et al. [25], Osadcha [27], Tkachenko and Khmelnytska [31] determine the features in the understanding of the definition of “educational management” (figure 1).

So, the knowledge and ability to use the functions of management – planning, organization, motivation, coordination, control – is an integral part of the managerial competence of the head of the educational institution.

3 ANALYSIS OF DIGITAL EDUCATIONAL ENVIRONMENTS OF UKRAINIAN UNIVERSITIES

To obtain objective results of the analysis of digital environments of domestic universities, we choose higher education institutions from one economic region of Ukraine, in particular the Central-Eastern and various branches – agrarian (National University of Life and Environmental Sciences of Ukraine), classical (Sumy State University), technical (Black Sea National University named after Petro Mohyla) and pedagogical (Kryvyi Rih State Pedagogical University).

The Centre for Information and Communication and Distance Learning Technologies has been established at the National University of Life and Environmental Sciences of Ukraine [24]. The main areas of its work include: development of methods and creation of electronic learning resources for distance learning; support of resources of scientific and educational consultative environment.

During the existence of the centre, an educational and information portal was developed and implemented in the educational activities of the university (download of lecture materials with multimedia presentations, materials for laboratory and practical classes; implementation of modular and final quality control of educational activities of students); institutional repository (electronic archive of articles of scientific and pedagogical workers; conference materials; dissertation abstracts; diploma theses of students; methodical materials to ensure the educational process, etc.); agrarian

open encyclopedia (materials for distance self-education; harmonized standards); site “Agrarian sector of Ukraine” (the basis of the national remote information and advisory system in the fields of agricultural production and in the field of agricultural science and education).

Sumy State University, in addition to Moodle platform, provides distance learning for students through an open electronic resource of structured collections of organizational, educational and methodological materials of disciplines, which is included in training, re-training and advanced training programs for various levels of education and additional educational programs (OpenCourseWare) [30].

Ostrovska [28], analysing the possibilities of Moodle system of the Black Sea National University named after Petro Mohyla as a basic platform for the introduction of distance education notes the following advantages [9]:

- placement of information materials intended for applicants for higher education for independent preparation for classes (calls for videos, PowerPoint-presentations, lectures, plans for seminars and practical classes, electronic versions of recommended scientific sources, questions for final control, etc.);
- organization of direct communication between students and a teacher by means of a chat;
- implementation of computer control of learning outcomes (modular tests, tests, exams);
- transparent evaluation of the work performed by students.

For comparison, let’s take another institution of higher education – Kryvyi Rih State Pedagogical University with its system of management of educational electronic courses [18]. University administrators monitored the use of the system by participants in the educational process. According to the results, it was found that the vast majority of scientific and pedagogical staff of the university (more than 75%) use it to organize and manage the educational process. Analysts have found that there is a need to intensify the use of Moodle platform in various forms of learning, including laboratory and seminar classes. It was established that the most popular are the use of resources for organization of independent work of higher education and control measures (current, modular, credit, etc.).

The model of digital educational environment of the university, proposed by the authors, includes four operational modules. Let’s describe each of them.

Scientific and technological module. Nowadays universities are becoming research centers that actively develop new technologies. The scientific structure is located in the digital dimension of the educational institution and includes a depository (for archiving scientific works of teachers and students); open publication system (a special platform of the university for submitting scientific works for publication); digitalization of library forms (to increase the possibility of using the sources in a remote format).

The educational module. Digitalization has become an indicator of the quality of educational services. The main advantage of educational electronic platforms is the possibility of using their potential regardless of external socio-political factors (lockdown, local conflicts, natural disasters, teaching foreigners). This area includes an electronic management system for educational courses, educational process (various forms of learning), the possibility of conducting

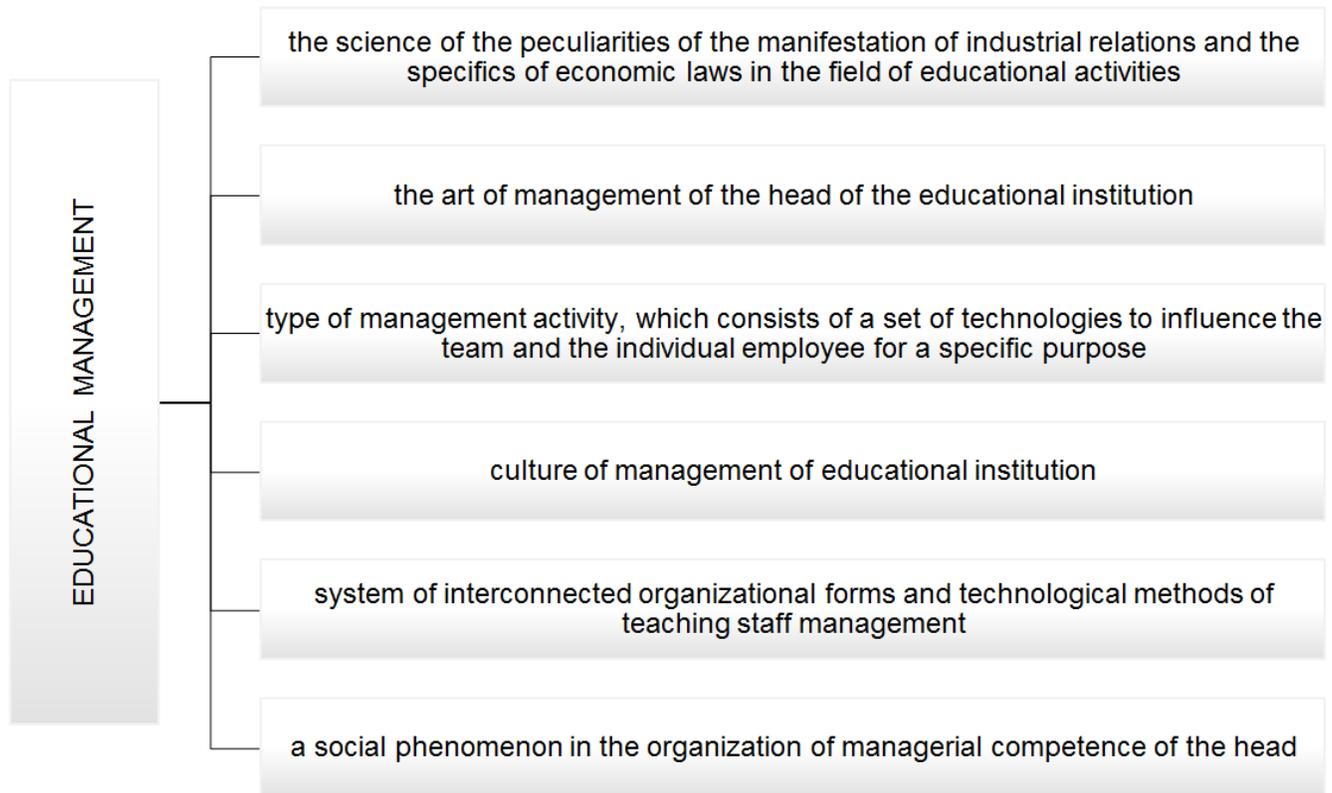


Figure 1: Positions on the definition of “educational management”.

classes in online format, control of the quality of students’ knowledge.

The administrative module is represented by the activities of individual structural units of the university, which carry out organizational and administrative supervision of the educational process and service supervision of educational students. Electronic document management, management of the educational environment, digital archives, online-enrollment, operational management of processes, digital security systems, innovative activities in the educational and information environment – components of administration.

The informational module includes the ability to collect, process, systematize and store up-to-date data about the educational institution, its infrastructure, instructors, etc. Such information is important for the popularization of higher education institution, the formation of a positive image, improving the position of the school in the national educational ratings, for monitoring the quality of educational services.

Given the purpose of the study, the analysis of scientific achievements and existing models of management of educational environments of domestic universities, we offer a model (figure 2).

Summarizing the modules of the model, we state that they are the components of organizational management of the institution of higher education in modern conditions. The presented model demonstrates the synergy and interdependence of all areas for the

successful administration of the university, in particular the digital educational environment.

4 CONCLUSIONS

Today in Ukraine there is a modern educational space with all the conditions for mastering basic competencies (informational, social, interactive). Education will become more accessible and comfortable due to the organized digital environment. First, it will really save time, financial and human resources. Secondly, the digital environment today is one that is fully exploited by young people and can serve as a breeding ground for the implementation of any innovations.

Currently, the quality use of the digital education environment by many educational institutions remains a challenge due to a number of problems: Lack of a clear scientifically based plan for development of the digital environment; inadequacy of digital educational courses for the consumer of educational services; low level of information and communication competence of individual educational specialists and educators, etc.

As a result of the analysis of theoretical sources the need for standardization of the definition of “digital educational environment of the university” in the scientific and practical plane for its wide use in the scientific environment, educational process, other spheres, branches of science and technology is established. The system of management of electronic educational courses is an

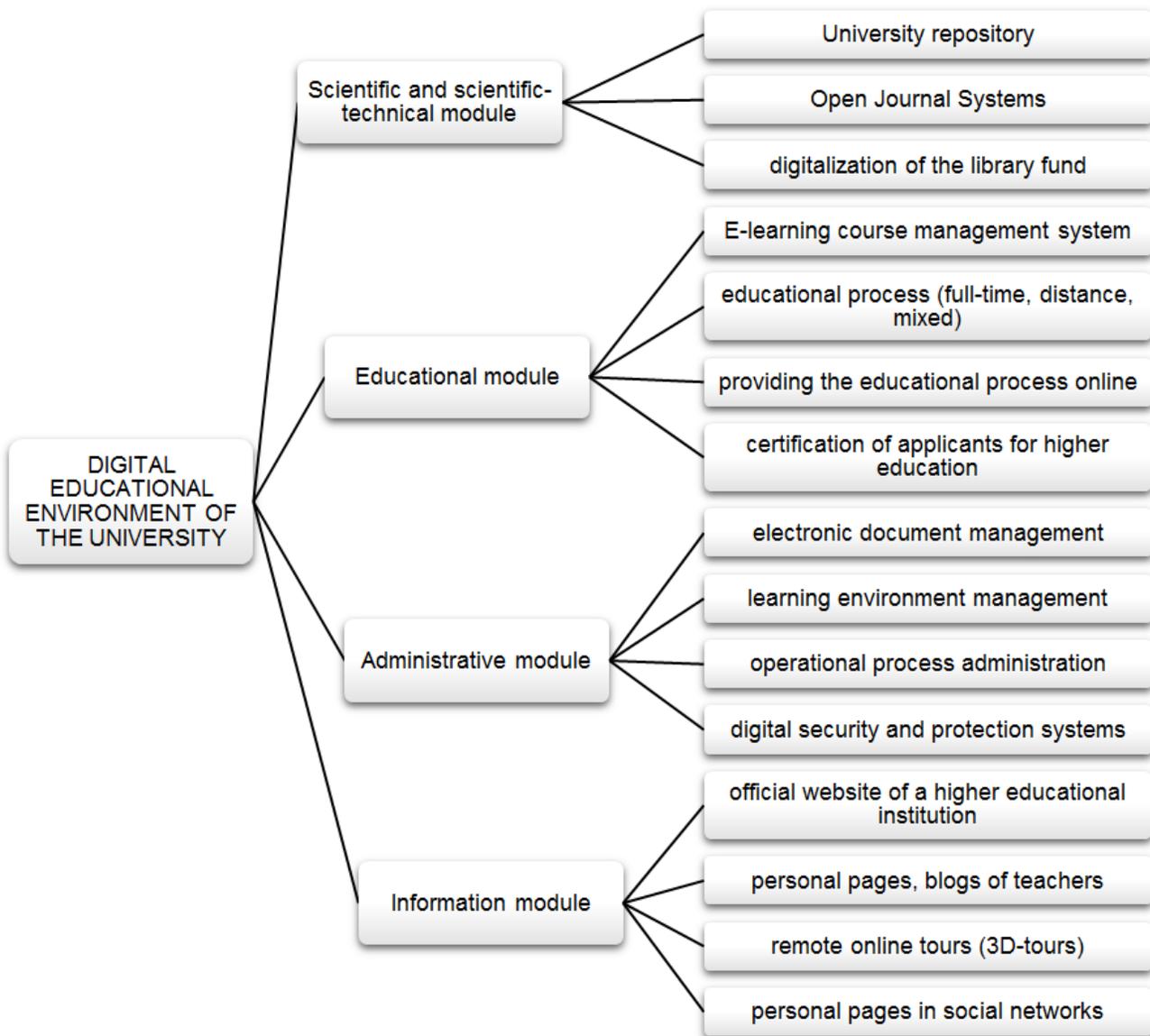


Figure 2: Model of digital educational environment of the university.

integral part of the educational environment of the university, but not the only one.

Thus, we offer our own interpretation of the definition: “digital educational environment of the university” is a set of resources aimed at organizing and ensuring the educational process, implementation of scientific, technical and international activities, creating conditions for educational services and management of higher education.

Given the imperfection of the existing model of digitalization of education, the lack of clear instructional materials in the national legal field and the experience of domestic universities, we offer ongoing training, seminars or refresher courses for research and teaching staff (3–4 ECTS credits per academic year) concerning use

of resources of the digital educational environment of the university in different forms of educational work, in different forms of education (full-time, part-time, evening education) and learning conditions (full-time, distance, mixed). This will allow to increase the level of information and communication competence of teachers, and accordingly to increase the quality of educational services, including distantly. Today, every leader of an educational institution is aware of the inevitable digital transformation. In terms of digital transformation the successful development of an educational institution requires managers with the latest competencies.

The process of administration of the digital educational environment of the university should be systemic, logical and universal for different fields of knowledge and specialties, and cross-sectoral in

providing management activities in higher education. The proposed model of digital education environment of the university is a combination of interconnected operational areas of activity (scientific and technical and scientific-technical, educational, administrative and informational), which ensure the successful functioning of the entire institution of higher education in a distance and full-time education environment.

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