Smart technologies: perspectives of usage in higher education

Abstract

Purpose. The system of higher education is ineffective – it has to change the concept of educational process, which is peculiar for increase of the volume of education of labor resources. According to this, there's a necessity to pass to the system of higher education with elements of smart technologies. The purpose of this article is to determine the role of smart technologies as an innovational and intellectual tool in development of the system of higher education and formation of actual skills with students.

Structures / methodologies / approaches. The aspects of classical education in universities with elements of remote forms of implementation of smart technologies on IT platforms are studied; peculiarities of smart technology as intellectual tools of higher education are analyzed; perspectives of usage of smart technologies as innovational tools for development of higher education are determined. The research methods include analysis, synthesis, abstraction, comparison, and logical method.

Findings. Information technologies become an inseparable part of life of society and human. A new network generation of people that cannot imagine life without new technological devices is growing. However, despite this, modern education does not sufficiently influence the development of human capital in the conditions of digital environment.

Originality / importance. Scientific novelty consists in conducting the research in the sphere of significance and perspectives of implementing smart technologies into the systems of higher education of the Russian Federation. This article could be interesting for public officers who form the program of development of higher education and academic staff of higher educational establishments.

Key words smart technologies, smart education, system of higher education, electronic platform, certification, project system of education.

Introduction

Higher education is one of the main stages in formation of professional qualities of a human. At that, change of the paradigm of higher education in the Russian Federation in the conditions of transition to the Bologna process requires transformation of the system of classical education, transforming the forms and technologies of distribution of knowledge and skills. Technologies of "clever education" - smart technologies in the system of smart education come to the foreground. Smart technologies in the system of smart education are an innovational educational environment of higher school, in which emphasis is made on application of technologies in scientific and educational activities of lecturers, scientific personnel, and students for using and distributing global knowledge. The final stage of implementing smart technologies into the system of higher education is transition to active content – i.e., formation of educational activities on the Internet by implemented technologies and developed standards in the network of all higher educational establishments.

The Russian Federation has been delaying with the process of transition of higher education to smart technologies. In a lot of European countries (the UK, Germany, Italy, Hungary, the Czech Republic), these technologies are standard approaches in the system of higher education. Thus, topicality of the research consists in the fact that in the modern educational conditions smart technologies are regular tools of formation of the skills of a highly-qualified specialist, and absence of these innovational tools in the process of Internetization and informatization of the Russian higher education creates larger vacuum in the received competences between students of the global R&D centers and classical Russian universities.

Smart technologies are tools that are the main elements of the system of new global knowledge, which transformed from information standards to innovational

approaches to acquisition of professional skills and competences on the basis of systemic vision and constant update of existing knowledge. Firstly, smart technologies grouped the ideas of innovational education that is based on acknowledgment of classical (traditional) elements of education and new sources of knowledge. Secondly, the functions of lecturers, scientific officers, and students in the system of smart education change by creation of new educational environment. These subjects pass from the role of lecturer and listener to controller and researchers. Thirdly, application of smart technologies erases boundaries between scientific research and educational activities. Each of the above subjects becomes impersonal and forms own skills and competences that are required by this individual. At that, compatibility of operational systems according to various smart programs of the educational process of different directions of training ensures formation of new fundamental sciences, which, based on mobility and speed of information flows, will create new innovational and technological directions of research. According to this, at the initial stage of transition to smart technologies in the system of higher education a student will independently select a study plan, schedule, consultation with autonomous lecturer, operational programs, technical devices for educational activities, and various media components (tests, web services, etc.). As a result, transition to smart technologies in the system of higher education will allow:

- students – to receive the necessary volume of information on any topic of scientific research;
- forming new programs for quick training of students within a specific specialty;
- increasing the level of technological innovativeness in the educational environment of higher education;
- within cooperation of several universities – performing fundamental research of new directions of global knowledge.

Methodological aspect of studying the issue of smart technologies in the system of higher education

The performed research is based on the methods of analysis, synthesis, systemic approach, abstraction, and historical and logical methods. The classes of methods that are used for solving the formulated tasks of the research are determined by its logic and used method of formalization. Based on this, the method of multi-aspect comparisons and method of analysis of hierarchies were distinguished.

Theoretical peculiarities of development of smart technologies in the system of higher education

The theoretical and methodological foundations of implementing smart technologies into the system of higher education are viewed in the works (Gein et al., 2016, Loia et al., 2016, McCardle, 2002, Schwarz et al., 2010, Vásquez-Ramírez et al., 2016), and (Warren et al., 2016). Due to studies of these authors, it was possible to generalize the best practices in the sphere of smart education and to compare this educational system with the elements of classical education. Peculiarities of smart technologies as innovational tools in the system of higher education are studies in the works (Gerova et al., 2016), (Gilbert et al., 2010), (Rai et al., 2016), and (Salah et al., 2014). These peculiarities were determined on the basis of analysis of the educational environment of Western countries. Among Russian scholars who studied these problems in the modern conditions of functioning of higher education it is possible to distinguish (Martynova, 2008), (Pollak, 2015), (Chernykh and Borisenko, 2015), (Shakitova, 2015), (Shiriay, 2015).

Classical education in universities with elements of remote forms of implementing smart technologies at IT platforms

What is classical education of the modern type? At present, classical (traditional) education accumulates lecture and seminar sessions, in which the subject of initiation and control is lecturer of higher school. Thus, the communication basis of the educational process is built unilaterally, which does not conform to preconditions of development of modern higher education. At that, lectures and seminars have equal forms of provision of necessary information in the educational process (Figure 1).

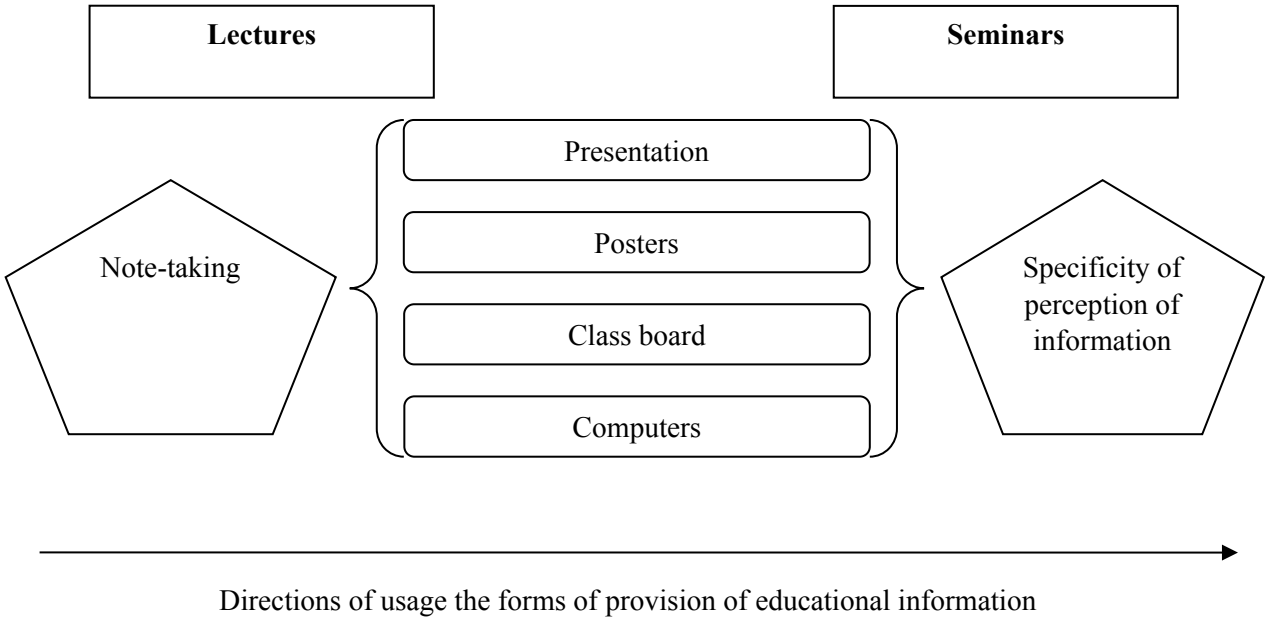

Figure 1. Forms of provision of information at seminars and lectures.

Classical education in its traditional form (lectures and seminars) does not correspond to the demands of the modern society: the level of knowledge of students and speed of perception of information are not considered. As a result, effectiveness of studying reduces, interest of students to the studied topic is absent, and cognitive and educational function are absent. Based on these drawbacks, the remote form of education entered the process of mastering of knowledge and skills of classical (traditional) education. This form of education conforms to standards of the Ministry of Education and Science of the RF and envisages remote teaching of information and communication technologies.

The remote form of teaching is the first stage of implementing smart technologies into the system of higher education. Important elements of remote form of education are Internet connection and participation in Internet tests, video chats, and video conferences. Remote education requires a certain online platform for studying. Within the existing paradigm of development of higher education, these platforms are the offline educational environment (within the educational system of university) and online educational resources that implement the concept of web-education for various directions of activities (LendWings, Uniweb, TeachPro, Web.University, and Eduson).

Implementation of smart technologies into the system of higher education requires formation of platforms of electronic education, formed on the basis of top-priority requirements to mastering of information (Table 1).

Table 1. Platforms of online education that were developed in 2014-2017.

Platform	Priorities of platform management of smart technologies	Technologies of functioning
Platform of online education of the first priority (2014)	Formation of content for starting a specific online course	IMS Learning Resource Metadata
Platform of online education of the second priority (2015)	Provision with online courses and support for joint usage of various platforms for joint usage of online and offline courses	Knowledge Initiative
Platform of online education of the third priority (2016)	Creation of platforms for continuous exchange of educational data	E-Learning Framework
Platform of online education of the fourth priority (2017)	Creation of platforms for implementing a wide range of information tasks and combining service technologies	M2M

Platforms for implementing smart technologies are created for openness and wide usage of information resources in various spheres of activities – e.g., economy, behavioral finance, and management of public opinion. Thus, platforms of smart technologies are capable of forming a new paradigm of online higher education and stimulating the development of digital economy in various directions of activities. The distinguished platforms correspond to the priority of management of smart technologies – namely, the tasks for which they were created. Thus, the platform of online education of the first priority was just a fundamental spot for development and distribution of online courses on the Internet. At that, the platform of online education of the fourth priority implements the task on management and analysis of big data for formation of a wide specter of information tasks on the basis of smart technologies.

According to the concept of implementation of smart technologies into educational process of a higher educational establishment, students of various universities from all over the world acquire knowledge and skills according to the individual model of mastering of competences. Teacher and student jointly develop an individual plan of mastering of educational standards at which the student selects his own trajectory of development, sets final goals, and uses smart technologies that he needs for achieving them.

Thus, classical education with remote forms is just a stage that has to be passed for creation of the system of higher education on the basis of smart technologies. An important aspect is electronic platforms that form and implement the elements of smart education.

Smart technologies: intellectual tools of higher education

Apart from the forms of implementation of smart technologies, an important aspect is their significance as intellectual tools of higher education. The concept of implementing smart technologies into educational process of higher school is brought down to application of a flexible interactive educational environment,

adaptation of educational process to individual qualities of student, and free access to global knowledge of the whole world. According to this, smart technologies are an intellectual source of formation of this concept and implementation of its main principles in practice. For better understanding of this thesis, let us distinguish the main types of smart technologies that allow forming a new educational environment of higher education (Figure 2):

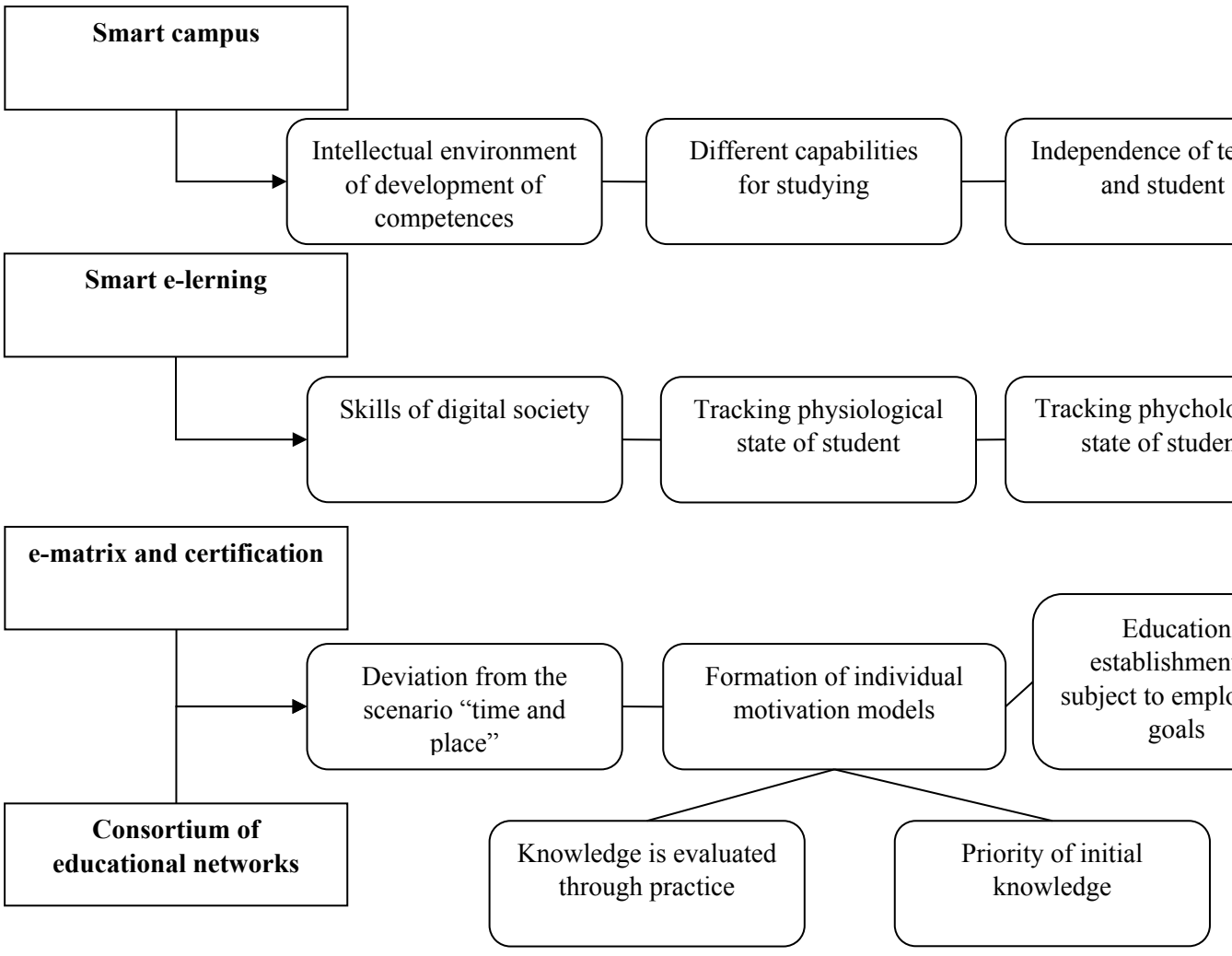

Figure 2. Types of smart technologies and the main principles of their implementation i

1. Smart campus is an integrated educational network of universities that – with the help of common energy resources, technological components, and interaction between students, lecturers, and scholars raises effectiveness of own development. In this case, smart technology is used for implementing large-scale educational programs by using innovational and individual educational plan and creating technological tools for provision of educational and scientific process. Based on this, smart campus allows creating an intellectual environment with formal and informal process of studying, based on formation of necessary skills and capabilities with student, and excludes importance of such factor as place and role of studying, prioritizing mobility, continuity, and global information access.

2. Smart e-leaning is the process of learning that is conducted via Internet devices and technological interactive systems. In smart e-learning, the system of higher education includes provision of students with cloud technologies, analysis of big data, work with natural interface, formation of consumer IT, constant connection with network, and acquisition of skills with machine control. Here we speak of implementing the elements of the concept of "second digital divide"[1] for effective usage of information technologies in the system of higher education. E-learning could be a basis for new models of higher education: model of classical education with elements of remote education, model of online learning, model of open educational resources, model of global online educational systems. These models will be divided based on the competence-based approach to learning, and students will select the models that best fit them according to the specifics of individual development. Besides, implementation of technologies of smart e-learning requires usage of cross-platform software for adapting the existing operational systems to the common certified standards SCORM.

3. E-matrix and certification are courses of online education that allow obtaining the certificate that is equaled to a diploma from an educational establishment. These certificates are issued for the specialties that are practical and

[1] Second digital divide is a scientific concept that states that created technologies and new information networks can provide a new effect for development of the educational environment. The main factor is motivation of the academic staff.

rather narrow. In future, these courses might replace diploma on higher education or form a system that will allow obtaining a diploma of researcher (theorist) in a higher educational establishment, and diploma of practitioner – through the e-matrix courses.

4. Consortium of educational networks is a platform or documentary source that stimulates implementation of modern educational technologies and methodologies into activities of educational establishments, application of international educational standards, and formation of integrated information educational environment based on philosophy of e-learning, formation of a new paradigm of management of knowledge and stimulation of increase of accessibility and effectiveness of the educational process. Consortium of educational networks allows adapting educational programs to student's portfolio, applying technologies of joint learning for mastering of larger volumes of information, and passing bureaucratic (routine) work to automatized machines.

Perspectives of usage of smart technologies as innovational tools for development of higher education

Due to the fact that smart technologies are at the initial stage of implementation into the Russian educational market, it is possible to note that this tool has innovational character. This is due to the fact that smart technologies project the elements of digital society- i.e., society of the future. Firstly, implementation of electronic technologies into the educational process of the system of higher education forms clearer and more regulated relations between lecturer and student, which changes the educational process and the main stages in mastering of knowledge. Figure 3 shows interrelations between students and teacher in the educational with smart technologies. Thus, while in classical education the main systems of knowledge are fundamental and applied competences, due to implementation of smart technologies the educational resources appear at smart platforms and smart devices. That is, apart from the

internal component of the educational process in establishments of higher education, an important role belongs to external (integration) systems that allow developing the received fundamental and applied competences of student.

The main subjects of the educational process are student and teacher. Despite the different statuses of the subjects (student learns and teacher teaches), a lot of their systemic connections are common. For example, the process of obtaining competences, which consists of self-education, presentation, discussion, thesis defense, attestation, and practice. At that, educational process becomes more autonomous. However, this does not mean that teacher does not participate in it. On the contrary, this participation becomes individual, which is manifested in communication with student for the directions of knowledge in which the teacher specializes and the student conducts research.

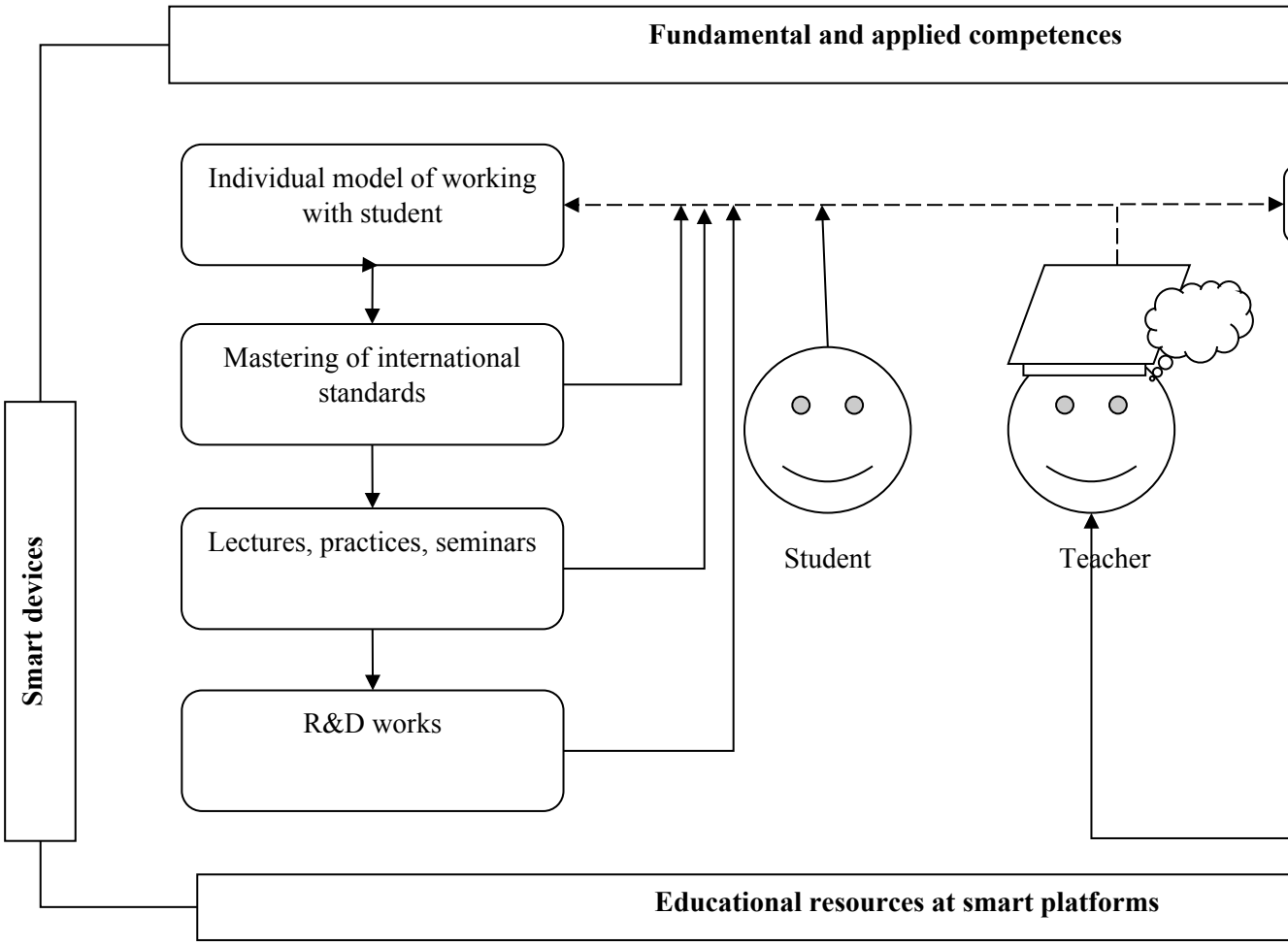

Figure 3. Interrelations student/teacher in the educational environment with

Smart technologies allow teacher to publish his courses (courses replace disciplines) based on existing technical content, which saves time as an important resources in the environment of smart education. In the automatized system, teacher may vary created courses depending of the modules required by student and then actualize the materials according to new knowledge in the general university repository. While in the classical system of higher education, knowledge of teacher is final product, implementation of smart technologies makes his knowledge temporary, for it is changed and supplemented in "cloud". For a student, smart technologies are perspectives for acquiring unique individual skills and knowledge; objective formation of models of competences that emphasize practical activities; participation in the digital system of public development; receipt of adaptable and adequate knowledge according to socio-economic conditions of territories.

Conclusions

Smart technologies are significant elements for creating a new system of higher education and implementing the tools of flexible learning for creation of interactive environment in educational establishments of the Russian Federation. The performed research of perspectives of using smart technologies as innovational tools in higher education allows forming a range of directions of development of smart education in Russia.

1. Classical education in its traditional form (lectures and seminars) does not meet the needs of the modern society. This educational system does not take into account the level of knowledge of students and speed of perception of information, there's no interest of students to the studied topic, and cognitive and educational function is not adopted in the educational process.

2. The initial change in the system of classical higher education was implementation of remote form of learning, which is the first stage on the path to implementing smart technologies into the system of higher education. At that, important elements of the remote form of education are Internet connection,

participation in Internet tests, video chats, and video conferences, and creation of electronic platforms that later transform into platforms of online education.

3. At present, the main smart technologies that ensure effective educational process in an establishment of higher education are: smart campus (integrated educational network of universities, which, with the help of common energy resources, technological components, and interaction between students, teachers, and scholars, increases effectiveness of own development); smart e-learning (the process of learning conducted through Internet devices and technological interactive systems); e-matrix (courses of online education that allow obtaining a certificate that is equaled to diploma of an educational establishment); Consortium of educational networks (platform or documentary source that stimulates implementation of modern educational technologies and methodologies into activities of educational establishment, application of international educational standards, and formation of the integrated information educational environment based on the philosophy of e-learning, formation of a new paradigm of managing knowledge and stimulating the increase of accessibility and effectiveness of educational process).

4. Usage of smart technologies in the system of higher education allows making the process of learning more effective due to implementation of online environment into the educational plan of each student. Besides, these technologies envisage modernization of all methods used in the educational process, from preliminary work on creation of disciplines (courses) to technical measures on provision of interactive environment. According to this, the process of learning may have no traditional elements of classical education – faculties, chairs, and branches of higher educational establishments – which will allow increasing effectiveness of managerial activities of educational organization and reducing financial and time expenditures for execution of R&D works in the sphere of leading innovational technologies.

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