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Digital technologies as education innovation at universities

Vladimir Kryukov
Vladivostok State University of Economics and Service, Russian Federation

Alexey Gorin
Vladivostok State University of Economics and Service, Russian Federation

This paper analyses the use of digital technology-based education innovations in higher education. It demonstrated that extensive implementation of digital technologies in universities is the main factor conditioning the acceleration of innovative changes in educational processes, while digital technologies themselves become one of the key mechanisms for creating the competitive advantages between educational institutions in the market of educational services. An analysis of the application of digital technology-based education innovations in higher education enabled the authors to develop a layer model of assessing the readiness of universities to implement digital technologies, presented as a unity of three interrelated criteria determining the readiness of universities for the use of digital technologies in the education process: organisational and methodological, technological, and professional. The proposed model can serve as a foundation for the development of quantitative indicators describing the potential of universities in terms of the implementation of digital technologies and their successful use. The authors also share the experience of using digital technologies at the Vladivostok State University of Economics and Service.

Key words
Innovation, University, Digital Technology, Informatisation

Introduction

Modern social, economic, and cultural conditions compel higher education institutions to comply with new requirements that are based on the following idea: universities should remain competitive in the changeable conditions of the educational market which is possible only if innovations are implemented in the education process actively and effectively.

The necessity of institutional innovations in higher education is indicated in “The National Security Strategy of the Russian Federation until 2020”. The strategic importance of the innovative development of universities is also emphasised by the whole range of works by Russian and foreign researchers such as (Kuzminov, 2007; Sadovnichy, 2000; Filippov, 2003; Christensen, 2011; Hentschke, 2011; etc.).

However, as statistical data show, the share of Russian universities developing and implementing innovations does not exceed 5% (Vladyka, 2010); only two Russian

universities are listed on the Academic Ranking of World Universities (ARWU, World Top 500 Universities), with only one university listed on the Times Higher Education (THE, World Top 200 Universities) and QS World University Rankings (World Top 200 Universities) . All this gives the particular relevance to further work on unlocking the innovation potential of Russian universities

The main factor conditioning the acceleration of innovative changes in the education process is the extensive implementation of digital technologies in universities. They become one of the key mechanisms for creating the competitive advantages of education institutions in the light of the expansion of the Internet, the development of a new lifestyle, and the emergence of "digital natives" who are familiar with computers from an early age and wish to use smartphones, tablets, laptops, and the Internet in their studies (Kryukov and Shakhgeldyan 2012a). Consequently, to remain competitive, a modern university should be ready to offer such opportunities to the new generation of students by introducing the innovative forms, methods, and technologies of learning. Blended learning, a flipped classroom, massive open online courses (MOOC-platforms), the BYOD-concept (Bring Your Own Device) at university — all these and other technologies should be the focus of experts and teaching staff, while their application in the education process should be based on the reliable organisation, technology and pedagogical methodology.

Digital technologies are becoming one of the main priorities in the higher education development plan, and using technologies in class might serve as an appealing factor for universities to attract potential students (Kling, 1996). As rightly noted in (Hitt, 1998), "technologies give rise to promising changes which are so significant and pervasive that it becomes impossible for universities to separate their strategic plans, goals, and activities from initiatives, resources, and data administration".

The purpose of the research conducted within this study is to analyse the application of digital technology-based education innovations in higher education and share the experience of using digital technologies at the Vladivostok State University of Economics and Service.

The analysis of empirical data and theoretical sources concerning this subject enabled the authors to develop a layer model of assessing the readiness of universities to implement digital technologies.

The problematics of using digital technologies in the education process

The analysis of informatisation at universities shows that many users either do not know about available resources and services or do not understand how to employ them or even do not have the opportunity to do so (Kryukov & Shakhgeldyan, 2012a). Faculty members often do not have tools for immediate publication of learning materials or regulatory and reference documents to make them accessible to the certain target group. Universities experience an obvious shortage of high-quality digital learning materials. What they have is difficult to "deliver" to students since different materials (programs, presentations, video lectures, tests, individual tasks, manuals, etc.) do not form a logically unified system or database. There are problems with access rights differentiation for users and administrators; the information analysis of key data administration tasks is often lacking (Kryokov, 2009). There is an

urgent need to apply more actively collaborative software, webinars, mobile applications, and big data methods of analysis of learning results to the education process.

It is worth considering external factors that influence the implementation of digital technologies at universities: demography, globalisation, new generations of students, education reforms, and new technological challenges. Corporate IT environment services and their implementation at universities should develop and adjust themselves in accordance with these factors. It would be simplistic to expect that the statement "We use progressive technologies" itself, without any practical actions, will increase the quality of education. Information technologies ensure the collection, processing, presentation and publication of data related to education, and help tutors to better provide all the necessary learning materials for teaching and learning activities, to identify gaps and adapt the content of these materials and pedagogical approaches to a certain group of students. What is the value of information technologies in the development of university studies? Some experts put forward the following arguments (Kryukov & Shakhgeldyan, 2007):

- improving the quality of education by using available information more fully and by stimulating the motivation of learners and the creative activity of tutors;
- improving the efficiency of the learning process by its individualisation and intensification;
- adoption of new education technologies and shift from passive to active learning — scaffolding and project-based learning, business games, visualisation, simulation modelling, distance learning, and a "flipped classroom";
- information support for the integration of different activities (theory, research, and practice) to form necessary competencies;
- changing corporate culture and reducing students' dependence on their tutors;
- improving the quality of the assessment of learning achievements by computer-based testing.

The practice of "naive" informatisation shows the nonlinear relations between its educational efficiency and investments in digital technologies. The studies conducted in Europe did not reveal any improvement in the quality of knowledge depending on time spent by students on the computer or the equipment of the universities with information technologies. Only when the implementation of information technologies is aimed at the development of students' skills and competencies, the quality of education can be expected to increase. At the first stage, when funds are invested in basic equipment of classes with computers aiming at teaching information technologies to students and enabling teachers to use visual aids in classes, the positive effect is noticeable — in fact, it consists in the organisation of learning computer science and information technology. However, further investments in digital technologies, for example, in digital resources for different subjects, usually do not have a direct impact on learning outcomes. This situation is typical of many countries with the ratio of one computer to five or more students. The same is true for business. Karr notes that those companies that have reached a high level of informatisation find further investments ineffective as they cannot get additional benefits and adapt their business processes to modern information technologies (Karr 2005). It results in the universities management's concern since they believe that without the effective use of digital technologies their value is not proportionate to organisational efforts and

financial costs, and the activity of students and teachers is not directed at the education efficiency of this process.

Learning environments, network test systems and electronic communications destabilise the hierarchy within universities: teachers cease to be the main figures and sources of knowledge, while students become less dependent on teachers' personal preferences and likings and get an opportunity to study anytime, anywhere, and from any teacher. Development of electronic learning causes institutional problems, as it requires a new kind of information culture, new forms, models and content of education, its organisation and technical solutions. These changes prevent electronic learning from becoming a popular pedagogical practice. Most people, especially teachers, are conservative and not ready to recognise the fact that the implementation of digital technologies changes the context of learning. To justify this position, some provide examples of the differences between oral, written and electronic culture as historical types of mass communication (Poster 1990). Naturally, these differences lead to changes in knowledge sharing. However, modern electronic technologies do not necessarily simplify the meaning and ceased to be unidirectional (when one person gives information, and others receive it). For example, webinars and video conferencing, which have become widely practised recently, support different variants of communication and interactivity. However user-friendly and effective new technologies might be, many teachers still argue that digital learning does not guarantee the same quality as face-to-face learning. However, two circumstances encourage optimism and give hope that universities will face the future and take advantage of technological achievements: emergence at universities of an active group of young enthusiasts who have already mastered new education technologies and promote them, and the students' willingness to use modern digital devices and services in their work. Furthermore, the number of users of MOOC-platforms (now about 20 million people) confirms people's wish to use modern digital technologies, which undermines the argumentation of sceptics claiming that electronic learning does not ensure the necessary quality of education.

The strategic importance of digital learning is also justified by the results of research conducted by the European University Association in October-December 2013, which involved 249 universities from 38 countries (Gaebel et al., 2014). The study showed that 91% of European universities used blended learning technologies, 82% offered online courses, and 40% produced online courses in collaboration with other institutions. At 42% to 71% of universities (depending on their specialisation), more than 50% of students were engaged in different forms of electronic learning. More than 80% of universities have a well-developed infrastructure of electronic learning (online repositories for learning materials, learning management systems, student online portals, Wi-Fi, online libraries, computer rooms, and software for online courses). About 12% of European universities develop and offer the users MOOC-platforms.

In Russia, one of the recognised leaders in the use of digital learning is Tomsk Polytechnic University (TPU). Recently the E-learning Institute at TPU has published the results of a study on the attitude of students and professors to digital learning (Mnenie prepodavateley TPU ob ispolzovanii elektronnykh kursov v uchebnom protsesse, 2015; Mnenie studentov TPU ochnoy formy obucheniya ob ispolzovanii elektronnykh kursov v uchebnom protsesse, 2015). The survey received responses

from 225 professors and 814 students. According to the results, about 95% of teachers and 97% of students considered e-learning to be appropriate for the education process. The majority of university teachers believe that digital technologies give them an additional opportunity to engage students in the learning process (87.6%), enable them to manage students' work effectively (90%), and have a positive impact on the learning outcomes (81%). Students highlight the following advantages of e-learning: regular access to learning materials (97.4%), online tests and online homework (85.4%), and the opportunity to consult a tutor anytime (77.6%). The authors of this study note the growth of the figures in 2015 compared with 2014.

In 2014, at the commission of the Rectors' Council in Primorsky Krai, specialists from Vladivostok State University of Economics and Service (VSUES) analysed the use of e-learning methods and digital technologies at universities in Primorsky Krai. The study showed that many universities in the region were characterised by a well-developed information infrastructure, but in a number of cases professors did not have the opportunity to develop and distribute e-learning materials, efficiently manage students' individual work with digital resources, or communicate with students via forums and webinars due to the lack of professional skills and/or tools designed for the given purposes. Besides, not all the universities had an adequate regulatory framework to use digital resources in the education process, while the notion of e-learning was often replaced with the idea of "learning with the partial use of electronic teaching materials and technological tools".

It is worth noting that the use of digital technologies as a source of education innovations is substantially limited by current technological solutions that can be divided into three groups depending on the level of innovation potential (Table 1).

Table 1
Technological solutions used by universities in the education process

Group	Technological solutions
I	Use of computers with application software clustered into separate segments within the LAN and based on the centralised server and communications equipment; information services of limited application (usually e-mail, file services) are provided; Internet access for students and teachers is organised. Some classrooms are equipped with projecting equipment.
II	All the computers are combined into the corporate network with sign-on authentication. Campus territory is partially covered with Wi-Fi. A data centre provides information services necessary for the learning process: corporate e-mail and file systems, the repository of learning materials, a content management system, electronic workflow, electronic scheduling, network testing system, webinars, video streaming, etc. Most of the classrooms are equipped with multimedia and projection equipment.
III	There is a high-speed multi-service corporate network and data centre; automated resource allocation (virtualisation and cloud-based computing) is applied. All the campus territory is covered with Wi-Fi; the corporate information environment connecting all the services, applications, services and platforms is established; e-learning based on the Learning Management System (LMS) is actively implemented. All the classrooms are equipped with multimedia and projection equipment.

Universities using the Group I technological solutions hardly have any innovation potential and do not develop education innovations based on digital technologies. The Group II technologies help to develop digital learning resources, but it is only the Group III solutions that form the innovation infrastructure of e-learning, through which the education process is carried out "on the basis of information and technologies used in educational programmes, facilities, as well as information and telecommunications networks that enable the transfer of data and hence the interaction between students and teaching stuff" (Federal law, 2012).

However perfect hardware and software infrastructure might be, it cannot by itself serve as a factor in the efficient development of educational innovations. The education efficiency could be expected only in those cases when the use of innovations is, firstly, aimed at the development of skills and competencies of all the participants, secondly, when it is based on a well-developed strategy consistent with the main strategy of a university and a detailed regulatory framework, and, thirdly, when it is constantly improved on the basis of QA monitoring data of the education process.

To develop education innovations effectively, universities should build a student-centered model taking into account his/her personal, cognitive and cultural needs when creating information services. Teachers should stop being the sole bearers of knowledge and become "learning managers and tutors directing and controlling students' efforts giving individual tasks, appointing relevant learning resources, providing collaborative learning, and <…> consulting both personally and in learning environments" (Kryukov and Shakhgeldyan, 2007). In this respect, Vladivostok State University of Economics and Service has achieved considerable results.

Vladivostok State University of Economics and Service: experience in e-learning

The idea of the Electronic Campus of Vladivostok State University of Economics and Service (VSUES) (Kryukov and Shakhgeldyan 2012b) implies, among other things, the development of an integrated information-and-education environment working as a complex of software and hardware facilities, digital learning resources, as well as organisational and methodological support. Its purpose is to satisfy the needs of users (students and professors) for information services and educational materials.

The central component of this environment is the Learning Management System (LMS). As such, LMS Moodle, a free open-source learning platform, was chosen in VSUES. It is worth noting that, despite being open-source, the functionality of the Moodle system is quite comparable to similar well-known commercial products in the market and even surpasses them in some respects. The open source code of Moodle allowed the university to integrate it with other information systems and services of the Electronic Campus of the VSUES, while its module structure enabled specialists to create additional modules to adapt this system to the specific nature of e-learning implementation at this university.

In this system the VSUES teaching staff develops electronic courses which are characterised by the following: the transfer of information to students by way of texts, presentations, multimedia, and hyperlinks to Internet sources; the examination in the form of tests and online tasks; the interaction between students and their professor

through webinars, forums and chats; collaborative learning and research work carried out by students using wikis, seminars and forums; the control of students' progress through the analysis of test results and user activity logs. For the moment, VSUES professors have designed more than 200 electronic courses for distance learning and face-to-face activities within the framework of the so-called "blended learning".

The opportunity to acquire knowledge anywhere, anytime and at one's own pace is of increasing importance for the students of VSUES, which is going to switch to a new educational model called "3+1" (three years of theory and one year of practice) when after three years of studies all the bachelor's students serve a one-year internship before their graduation. In this context, the role of digital technologies becomes more and more significant.

The crucial e-learning tools used by the VSUES are the following information systems:

- student's account, i.e. a customised virtual workspace that provides all the necessary information and access to learning resources and applications;
- depository of full-text digital learning sources designed to store, search and provide access to learning and methodological materials and academic papers;
- the system of interactive testing of students (SITO) to control their progress using tests;
- webinar platform for distance learning and consulting;
- depository of video recordings designed to store and provide access to information and learning videos.

Alongside with information systems designed for the administration, financial management and management accounting, learning and research management, and the corporate information environment management, the above-mentioned information systems are indispensable parts of the Electronic Campus that includes the network, information and computational resources created and used by VSUES and provides the basis for the use of modern digital technologies in the university management and learning process.

The technical infrastructure of the Electronic Campus includes virtualisation-based terminals using "zero clients"; corporate computer network and telecommunications equipment; data-processing centre supporting server and client virtualisation by cloud service automation; a system of data storage; and peripheral equipment (printers, scanners, projectors, and interactive whiteboards). An important feature of the Electronic Campus of VSUES is the wide use of VMware cloud-based solutions and virtualisation of training and working places (Gmar et al., 2014).

As for digital learning, the majority of classrooms (85%) have multimedia presentation equipment, and there are more than 300 Wi-Fi hotspots on campus and in dormitories.

Teachers and university staff are granted access to specialised classrooms equipped with modern telecommunications and interactive equipment. For example, professors regularly use a video conferencing room with a capacity of up to 80 people and simultaneous interpretation facilities. All the videos recorded in this room are stored on a server for further processing and creation of video lectures or other learning

resources. There is another room for video conferences and webinars with a capacity of 34 people which is equipped with an audio visual system including an interactive whiteboard, a projector, four flat panels, and a sound system. The seats have cloud-based terminals, web cameras and headsets.

Foreign languages are studied in language laboratories with a capacity of 15, 25, and 30 people. Computers are equipped with Dialog Nibelung software, manufactured by the Russian company Lain LLC, which helps teachers to organise interactive lessons. In one of the language laboratories, it is possible to use special simultaneous interpreting software called Sanako Lab 100 STS. The capacity of the laboratory is 21 people (16 delegates, four interpreters, and teacher). The equipment includes a multimedia projector, personal computer, interactive touchscreen tablet, document camera, and audio recorders.

In January 2015, the university surveyed students and professors to analyse their attitude to the use of technologies in the learning process. About 20% of students and teachers participated in the survey. Most respondents were Bachelor's students in their second year, senior lecturers, or associate professors.

The absolute majority of respondents supported the idea of using technologies in the learning process, namely 85% of tutors and 87% of students. 95% of students and 75% of teachers used the e-learning environment regularly (from once a day to 2–3 times a week). Both teachers and students (63% and 61% respectively) recognised the usefulness of e-learning workspace in their work. This supports the conclusion that e-learning technologies are worth developing at universities.

Professors were also asked to answer the following question: "If you do not use the e-learning environment, what are the reasons for that?" Responses revealed that 15% of teachers found it difficult to master this technology, 11% of respondents did not have time to do it, another 11% saw no reason to use e-learning tools, and 4% of teachers found it hard to switch to a new model of education process (blended learning). All these replies show a low degree of information and technology competence among teachers, who do not use the e-learning environment, and their lack of desire to change the existing framework.

The teachers' most popular answers to the question "What teaching objectives do you fulfil using the e-learning environment?" were the following: "providing students with learning materials" (74%), "organising students' individual work" (63%), and "assessing students' skills" (56%). Students' responses fully correlate with their teachers' replies.

According to these data, many professors use the e-learning environment only as a means of automating traditional teaching tasks such as providing theoretical knowledge and its assessment. But what they leave beyond this framework is the activities where the application of e-learning tools would be most effective: different kinds of electronic communication between teachers and students (consulting forums, online discussions or webinars), network projects, collaborative learning and assessment, the development of individual tasks based on the learning outcome of courses and individual learning trajectories.

Thus, the results of this survey on the purposes for using e-learning tools and reasons for not doing so show the need for a systematic approach to the professional development of teachers in the field of e-learning technologies. Our previous attempts to introduce programmes of professional development (involving the leading specialists in the sphere of e-learning in Russia) did not increase the engagement of professors in the e-learning process and the quality of existing educational resources. The new programme of professional development includes legal, pedagogical, organisational, methodical and technological aspects of e-learning. During the training, teachers are going to analyse questions concerning blended learning, use of active learning methods in a class, characteristics of the management of distance learning technologies, etc. Naturally, such a programme itself should be carried out using modern education technologies (reflective approach, active learning methods, e-learning, webinars, and so on).

Both teachers and students' replies to the question about advantages of e-learning correlate well with their answers to the previous question. The most popular answer among professors was the following: "Giving access to learning materials anytime and anywhere" (89% of respondents). For students, the main advantage of e-learning is the opportunity to study at one's own pace, anywhere and anytime (67%). It is worth mentioning that 49% of students thought it was advantageous not to be obliged to attend classes in person.

As for the drawbacks, teachers mentioned an increase in workload caused by the need to master e-learning tools, create and maintain electronic courses, which naturally brings to the fore the issue of amendments to the existing labour standards. Another disadvantage mentioned by the major part of teachers and students was the lack of "real" communication in class (48% and 38% respectively), which highlights the need for the more active use of webinars and video conferences.

The data received during this study correlate with the results of a more recent survey carried out by the Department of Marketing Research of VSUES in November and December 2015. This time, 963 full-time students participated in the survey. The absolute majority of students believed that it was necessary to use digital technologies in the learning process. This opinion was shared by up to 86.5% of young people. First and foremost, students noted the importance of electronic sources and technologies to download learning materials (83.9%), doing tasks (73.8%) and completing tests (71.6%). Using university technologies to communicate with peers and teachers turned out to be less important for them, but these aspects were mentioned by respondents, too (52.2% and 40.8% respectively). To get access to information and communication means, they used smartphones — 92%, laptops — 73%, and tablets — 35%. To sum up, the majority of students had special devices for efficient work with digital content. About 90% of young people used communications services in their daily life, with social networks being popular among 86% of students. Only half of respondents used e-mail services. The most popular social network among students was VK. The university information services most often used by the young people were the following: Student's Account — 95%, Grades — 83%, Schedule — 82%.

It can be stated that, despite certain problems that have to be resolved in the future, the methodological, information and technological foundation of e-learning at VSUES is of high quality, and its development is one of the main priorities of the university.

The layer model of e-learning readiness of universities

We have defined three qualitative criteria to determine the readiness of a higher education institution to apply modern digital technologies to the learning process: organisational and methodological, technological and professional criteria. The organisational and methodological criterion is based on recognising the importance of the correct organisation, regulatory framework and methodological support for the successful application of technologies to the learning process. The technological criterion is the basis without which it is impossible to create an effective information environment, organise the implementation of new educational forms and models, including e-learning. Besides, this criterion is the recognition of an important role played by technologies in shaping not only modern universities but also society as a whole. The professional criterion concerns the need for systematic and thorough work to create information culture among students and professors, to stimulate the continuous professional development of teachers and prepare students for using technologies in their academic and professional activities. The interconnection of these criteria allowed us to form a layer model of the readiness of universities for e-learning, a hierarchy of qualitative criteria that show if institutions have all the necessary conditions for the implementation of digital technologies and their successful use (Table 2). The given model can serve as a foundation for the development of quantitative indicators describing the potential of universities regarding educational innovations. The qualitative criteria determining the readiness of universities for the use of digital technologies in the education process are outlined in Table 3.

Table 2
The qualitative criteria determining the readiness of universities for the use of digital technologies

	CRITERIA		
	Organisational and methodological	**Technological**	**Professional**
SUB-CRITERIA	Regulatory framework Organisational and methodological support Innovations, models and methods of teaching	Infrastructure Technical support Information support	Level of teachers' and students' competence Professional development Professional collaboration

Table 3
The layer model of e-learning readiness

LEVELS	CRITERIA AND SUB-CRITERIA		
	Organisational and methodological criterion		
	Regulatory framework	**Organisational and methodological support**	**Innovations, models and methods of teaching**
I	There are no regulatory documents defining the use of digital technologies in the learning process.	Processes and mechanisms of applying new models and technologies are not defined. There is no structure providing organisational and methodological support of e-learning processes. Technology-based monitoring of intermediate learning outcomes of students is not carried out.	There is no analysis and justification of modern technologies and their usefulness in the learning process. Innovations based on the use of digital technologies in the education process are not developed.
II	There are some regulatory documents defining particular aspects of using digital technologies in the learning process.	Some processes and rules of collaboration between departments and services of the University regarding the use of digital technologies are defined. There is a department that defines organisational and methodological support of e-learning processes. There is a two-stage (intermediate and final control) system of monitoring of students' learning outcomes based on tests.	Particular aspects of using digital technologies are analysed ("naive" informatisation). Monitoring of the influence of digital technologies on the quality and efficiency of learning is not conducted. Certain technology-based innovations do not lead to the change of models and methods of teaching.
III	There is a strategy of using digital technologies in the education process specified in documents, the mechanisms of its implementation are defined. There is a regulatory framework defining the use of digital technologies in the learning process.	There are processes, rules, and stimulating and controlling measures concerning the use of digital technologies at all the levels of the university organisation framework. Activities of learning, supporting and technical departments are coordinated and aimed at the effective and successful application of digital technologies to the learning process, including e-learning and online courses on MOOC platforms. A multi-level system is created to monitor students' achievements. It includes well-developed feedback mechanisms and the opportunity to individually correct learning activities.	A complex analysis of efficiency and success of digital technologies in the education process is undertaken. The monitoring of the influence of digital technologies on the quality and efficiency of learning is conducted. Models, forms and methods of teaching by digital technologies improve, and the learning process are purely innovative.

LEVELS	Technological criterion		
	Infrastructure	**Technological solutions**	**Information support**
I	There are computer classes and a network of computers connected to LAN segments. Some classrooms have multimedia and projecting equipment.	There are the centralised server and communications equipment enabling users to employ basic information services and providing the teaching staff and students with Internet access.	Basic corporate services (e-mail, file service, content management system, electronic workflow, electronic library catalogue) are either absent or used by the selected group of users.
II	All computers are connected to the corporate network with sign-on authentication. Support of virtual local networks and opportunity to access the Internet from any computer are available. Some zones on campus are equipped with Wi-Fi. The majority of classrooms have multimedia and projecting equipment for presentations and multimedia projections.	There is a data centre that supports server virtualisation technology and guarantees the smooth and safe use of digital technologies in the learning process. Certain integration tasks are fulfilled (data, services).	Necessary conditions are created for the active work with information services and applications that are useful in the learning process: corporate e-mail and file systems, the repository of learning materials, a content management system, electronic workflow, electronic scheduling, a network testing system, webinars, video streaming, etc.
III	There is a high-speed multi-service corporate network that supports telecommunications, IP telephony and Wi-Fi. Students and teachers have the opportunity to access Wi-Fi through their mobile devices everywhere on campus. Conditions are created for the implementation of the BYOD concept. All the classrooms have multimedia and projecting equipment for presentations and multimedia projections. Information intensive infrastructure is created, which includes additional equipment necessary in the learning process: language laboratories, videoconferencing and simultaneous interpretation booths, interactive multimedia panels and platforms.	There is a data processing centre that supports server and client virtualisation by cloud automation, the designated data storage system, the backing-up of computing and communication resources (clusterisation) for the smooth and safe use of digital technologies in the learning process. The united system of access rights management is available. The tasks of integrating data, services, applications and processes are completed.	The corporate information environment of the university unites all the services, applications, and platforms required in the learning process. The information learning environment is used actively as a basis of e-learning and networking with other universities.

LEVELS	Professional criterion		
	Level of competence	**Professional development**	**Professional collaboration**
I	Level of competence of university staff required for the use of digital technologies in the learning process is not defined. The level of qualification does not allow the majority of staff to actively use digital technologies in the teaching process. Level of competence of students required for the use of digital technologies in the learning process is not defined. The process of informing students about available e-learning resources and services is not organised.	Professional development of teachers is either organised in other institutions at the initiative of staff members themselves or not conducted at all. Students are not aware of the advantages of using digital technologies in the education process.	Professional collaboration hardly takes place or does not exist at all.
II	Level of competence of university staff required for the use of digital technologies in the learning process is defined. There is a person responsible for the implementation of digital technologies in every department. The level of qualification of half of the teachers allows them to actively use digital technologies in the teaching process. Level of competence of students required for the use of digital technologies in the learning process is defined. All students are aware of and actively use digital e-learning resources and services (schedule, grades, corporate email and file services, webinars, etc.). Every student has access to digital materials in the e-learning environment of the university.	Programmes of professional development are created for teachers to stimulate them to use digital technologies in the teaching process. There are methodological and learning materials for students describing the advantages of digital technologies and providing information about the ways of using e-learning resources and services for studying purposes.	Professional collaboration takes place occasionally. Sometimes students do network projects and interact with their tutor and peers using e-mail and other Internet services within the framework of particular disciplines.
III	Level of competence required for the use of digital technologies in	The system of professional development programmes is created for teachers to	There are creative unions of teachers who use digital technologies in the teaching

	the learning process is established and confirmed officially for the majority of teachers, enabling them to effectively use digital technologies in the teaching process. Before appointing a person to a certain position, his/her compulsory certification is conducted to define his/her technological competence. The majority of students are ready for the effective use of digital technologies in the learning process and their future professional work.	stimulate them to use digital technologies in the teaching process. There are interactive multimedia materials developed for students describing the advantages of digital technologies and providing information about the ways of using e-learning resources and services for studying and working purposes.	process, at the level of their department or the level of the university as a whole. Professors and other university staff keep in touch with each other in the e-learning environment and create learning resources and courses together. Students are engaged in the active project work on the majority of subjects. The interaction of students with their tutor and between each other is carried out in the e-learning environment.

Conclusion

The key aspect of understanding of the transfer to the full-scale use of digital technologies and the e-learning environment is the organisation of education at university: the amount of work in class decrease, while the amount of individual work increases for both teachers and students; students work more in the electronic environment under the supervision of their professors. Learning management becomes more effective: learning resources are constantly updated, they are more easily accessible and "recyclable". New opportunities for the organisation of systematic assessment emerge measuring acquired knowledge and skills. The dependence of students on their teacher decreases, as well as mutual psychological pressure in the process of their communication. Digital technologies stimulate the development of individual abilities, independence, initiative, and responsibility of students. E-learning supports the transfer from the explanatory and reproductive methods of teaching to a reflexive model that implies an increase in individual work, creativity, the fulfilment of one's potential and regular communication with teachers and other students.

It is expected that global demand for higher education will increase from the current 100 million people up to 250 million people in 2025. This tendency is caused by the increasing number of young people from India, China and North Africa willing to have a higher education degree, as well as by the need of the adult working population to get another degree or improve their professional competencies. Can Russian universities satisfy the growing need for higher education?

Considering the political and economic challenges experienced by the country, the most adequate option available now is to develop the advanced learning models and methods, as well as digital technologies to ensure the high quality of teaching at university and make the national system of higher education appealing not only to Russian students but also to their foreign peers.

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