# Digital transformation as the main condition for the development of modern higher education

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**Abstract.** The article considers the potential and limitations that arise in the higher education system as a result of the e-technology use. E-learning has become an integral part of the 21st century education system. The pace of dissemination and implementation of e-technologies in all spheres of public life, in science and education in particular, is constantly growing. There are different views in the scientific community and the public on the digital transformation of education. However, with the entry into our lives of COVID-19, the use of e-technologies in education ceases to be a matter of innovation, and becomes a vital necessity for the functioning of the educational system and the activities of educational institutions. Analysis of more than 50 concepts that characterize the modern education system, educational technologies and the process of digital transformation of education allowed the authors to draw conclusions about the importance of information technology in education and the main trends in their development. The article also summarizes the different views of scientists on the digital transformation of higher education, the use of e-technology in the educational process. The advantages that e-technologies provide to the educational process and the challenges of their use that need to be addressed are outlined. The study of the experience of the leading universities of Ukraine allowed the authors to draw conclusions about the state of digital transformation of higher education in Ukraine. Elaboration of scientific literature, own observations and research have allowed to define the tendencies of development of higher education in the epoch of digital transformation.

**Keywords:** e-learning, educational technologies, e-technologies, pedagogical innovation, higher education, digitalization of education

## 1. Introduction

Today we can see a growing demand for distance learning due to obvious reasons, namely: people avoid mass events and prefer to study online. The COVID-19 pandemic has dramatically changed the way we teach and study, leading to the growth of online and blended learning, which in turn has highlighted the importance of digital services such as artificial intelligence, big data and information systems of higher education management. That is why the e-learning trend is growing. E-learning is the process of providing education through electronic devices and the introduction of e-technology in the learning process. E-learning can be implemented in both staff training and student training. Educational e-technologies provide the necessary tools for learning and provide a quality learning and teaching process. Higher academic performance, more student involvement, better learning outcomes are what we get with e-learning. Using

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modern educational technologies to support both teaching and learning, we fill the learning process with digital learning tools to expand the offer of courses, disseminate experience and learning material; we support training 24 hours a day, 7 days a week; develop 21st century skills; increase involvement and motivation, and most importantly we speed up learning. The implementation of educational e-technologies corresponds to the global trend of digital development of education and changes the education system, which is undergoing radical digital changes.

## 2. Material and methods

The analysis of the number of documents on the information technology in the education system and the main trends in their development allow to estimate their importance. To implement this task, the most commonly used concepts (more than 50 concepts) on general problems of education and information technology were identified and the frequency of use in the documents presented on the Google platform was analyzed.

Besides, the methodology of systematic literature review (SLR) of double-blind peer-reviewed scientific articles, which focus on the digitization of higher education and the impact of educational e-technologies on its development, was used. However, an SLR is neither a formal full-length literature review nor a meta-analysis, because it conforms to a rigorous set of core principles: systematic, transparent, reproducible and updatable, and synthesized (summarizing the evidence relating to the review questions. Books, journal articles, conference proceedings, and other scientific publications were searched on the Internet in electronic databases using the keywords identified by us. These keywords reflect the essence of the studied phenomenon.

To find out how much importance is attached to the problem of digital transformation of education in Ukrainian universities and the state of its solution, we conducted a study of work plans and decisions of academic councils for 2020–2021 from the 50 best Ukrainian higher educational institutions (HEI) listed in the "Top 200 Ukraine 2021" ranking [20], which are published on the official websites of universities. According to the latest statistics, at the end of 2020 there are 281 HEI of the III–IV accreditation levels in Ukraine [22], therefore, 18% of their total number are included in our research. The study of the leading universities experience provided an opportunity to get a general idea of the state of digitalization in the most successful HEI of Ukraine.

Generalized ideas from the literature on the experience of implementing e-technologies and research results on the digital transformation of higher education, the impact of e-technologies on higher education institutions, the educational process, the results of our own research are used to identify trends of e-technologies in higher education.

## 3. Literature review

Education is a human right and public good – and it must remain so in digital as well as in physical spaces [23]. Hanna [9] determined that distance education is changing the landscape of higher education and many faculty are now developing Web-based courses and research and offers a specific set of pedagogical and assessment strategies that they have found to

be successful in online settings. Hanna [9] have found that classes delivered on the Web provide a viable option for professional. Seaman, Allen and Seaman [21] analyzed higher education institutions in the United States that use distance learning, statistics on the number of students studying remotely, determined the best universities. At the book "Innovating Education and Educating for Innovation: The Power of Digital Technologies and Skills" consider such important problems as digital technologies in education, innovative pedagogic models, measures of innovation in education, the potential of technology-supported learning [17]. Gudanescu [8] shows a short presentation of the new educational technologies applied in the worldwide learning systems. Canals, Burkle and Nørgård [3] summarized the problems and made a meaningful analysis of the role of technology and the Internet in the future of higher education, namely: the use of the concept "leadership" in learning technologies; new approaches to teaching and learning; strategies for developing and promoting the professional development of teachers; how digital technology and the Internet affect access to knowledge, as well as research on the development of online and blended learning in North America. In the article "Will MOOCs transform learning and teaching in higher education? Engagement and course retention in online learning provision" the advantages and disadvantages of using MOOC are identified [5]. Marcus [14] analyzes how modern technology can improve learning for Generation Z and others on the example of higher education institutions in the United States. The book "Transforming Higher Education through Technology-Enhanced Learning" [16] represents an important snapshot of higher education's current thinking about the impact of technology on its own teaching and learning. The results of the Benchmarking and Pathfinder Programme are ginen, in which 77 institutions Higher Education in UK participated between 2005 and 2008. Kwon et al. [12] consider the history of online learning, determine that modern education is characterized by a paradigmatic shift, which is based on the peculiarities of the use of network technologies for collaborative learning in higher education. It is also noted that modern education is characterized by a change in the identity of the main components: the teacher, learners and learning management systems (LMS), which are characteristic of online learning. In the article "Process modeling and decision mining in a collaborative distance learning environment" [19] the most important factors that affect the effectiveness of groups in the use of distance learning are identified. In 2021 UNESCO Strategy on Technological Innovation in Education (2022–2025) was adopted, which states that modern technology and digital innovation in education must be used to ensure inclusive, effective and relevant learning. The strategy also sets out recommendations based on the evaluation of UNESCO's work on the use of information and communication technologies in education. Under this strategy, UNESCO is committed to providing technical assistance and developing the use of digital methods in education at the state level, supporting the development and implementation of regulations, guidelines and framework documents to help ensure that technological innovations will be developed to strengthen education as a common good that meets the interests of students and teachers [24]. The Rewired Global Declaration on Connectivity for Education [23] identify new areas of digital transformation of education, the basic principles that must be followed at the international, national and local levels, to be aimed at making technology a means of human-centered education. The main principles are: equal access to modern educational technologies (bridging educational gaps to ensure equal access to the Internet at any time and in any place for individual students and teachers); increase investment in free high-quality digital

educational content (provides free digital learning platforms in line with national curricula to include attractive, accredited, well-organized and easy-to-find digital learning content available to all from a wide range of Internet-connected devices); moving education to the digital space requires pedagogical innovations and changes (the use of new forms of teaching and learning through interactive and multimedia capabilities of Internet technologies, combining them with the best characteristics of full-time learning). Thus, analyzing the literary sources, we can conclude that the issue of digital transformation of higher education and education in general in recent years has received considerable attention both at the global and local levels. The formation of a scientific base from the problems of the problem is given the opportunity to identify trends in the development of higher education, causing expansion in the practice of modern e-technologies.

## 4. Results and discussion

Analysis of the number of documents on the problem of digital transformation of education and trends in education and educational technologies showed that the most commonly used concept is "Information learning technology", 11,5 billion documents are dedicated to it; "Information technologies of university management" – 11 billion documents; "Information Systems Approach to School Management" – 10,3 billion documents. There is a significant number of documents related to the concepts of "Cloud-based AI Education Applications" – 9,3 billion; "Information and communication technologies in education" – 8,9 billion; "Mobile Learning" – 8,8 billion; "Education Management Information System" – 8 billion.

Compared to them, the number of documents on educational technologies and trends is much smaller: "World Trends in Learning" – 8,1 billion; "Learning technology" – 6,9 billion; "Learning" – 3,9 billion; "Educational Technology" – 3,6 billion documents.

New trends in learning characterize such concepts as "Artificial Learning" – 8 billion; "Robot Learning" – 7,2 billion; "Electronic Campus" – 6,9 billion; "Artificial Intelligence" – 4 billion; "Communication technologies in education" – 6,7 billion; "Computer-based learning environment" – 6,6 billion; "Digital Transformation of Education" – 5,5 billion; "Education Ecosystem" – 4,76 billion; "Distance Learning" – 4 billion; "Open courses" – 3,5 billion; "E-learning" – 3,7 billion; "Distance Education" – 3,7 billion; "Emotion AI" – 2,9 billion; "Data management training courses" – 2,8 billion; "Machine Learning" – 2,5 billion; "Educational Data Mining" – 2,44 billion of documents.

The ratio of the number of general education concepts and concepts that characterize educational IT shows that today education is perceived as a process based on IT, which reflects the essence of the modern educational process. The technical component (IT) has become an integral part of the educational process, along with those who teach and those who are taught. The volume and potential of IT is constantly growing. If in the early stages of IT development information technologies were mainly carriers and transmitters of information, now they can perform the function of organizing various activities of students and fundamentally changed teachers' work. The teacher is becoming more and more virtual. Manifestation of this trend has become distance learning courses and open courses.

A significant group consists of concepts to which millions of documents are devoted: "Cloud-

based E-learning Platforms" – 862 million; "Cloud technologies in education" – 413 million; "Smart Campus Technologies" – 394 million; "Blended Learning" – 126 million; "Blockchain in Education" – 190 million; "Virtualization of learning" – 49,4 million; "Augmented reality in science education" – 47 million; "Competency-Based Education Platforms" – 24,9 million; "Immersive Technology Applications in Education" – 13,6 million; "Design and implementation of augmented reality learning environments" – 11 million; "Lynda.com platform" – 6,7 million; "Intelligent Tutoring Systems" – 5,5 million; "Adaptive Cloud Learning Platforms" – 3,5 million. This group of concepts reflects the trends of recent years of IT development – the creation of cloud technologies and platforms, the use of Blockchain in Education, intelligent learning systems, the use of augmented reality and more. Thousands of documents are devoted to the concept of "Augmented reality gamification" – 827,000 documents; "Informatization of education" – 576,000 documents; "Augmented reality in professional training and retraining" – 210,000 documents.

The analysis shows that there is already every reason to predict – the next stage of digital transformation of education may be the educational process with two participants: the student – IT, without a teacher and even formal educational institutions. IT has the potential to use artificial intelligence to design and implement educational systems based on societal needs, student characteristics, and information available in the world.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) on its website provides a list of educational programs, platforms and resources that can be used in the modern educational process in distance learning. So the main digital learning management systems include the following: CenturyTech – personal learning pathways with micro-lessons to address gaps in knowledge, challenge students and promote long-term memory retention; Class-Dojo – connects teachers with students and parents to build classroom communities; Edmodo – tools and resources to manage classrooms and engage students remotely, offering a variety of languages; EkStep – open learning platform with a collection of learning resources to support literacy and numeracy; Google Classroom – helps classes connect remotely, communicate and stay-organized; Moodle – community-driven and globally-supported open learning platform; Paper Airplanes – matches individuals with personal tutors for 12–16 week sessions conducted via video conferencing platforms, available in English and Turkish; Schoology – tools to support instruction, learning, grading, collaboration and assessment; Seesaw – enables the creation of collaborative and sharable digital learning portfolios and learning resources; Skooler – tools to turn Microsoft Office software into an education platform. Massive Open Online Course (MOOC) Platforms UNESCO include: Alison – online courses from experts, available in English, French, Spanish, Italian and Portuguese; Canvas Network – course catalogue accessible for free for teachers in order to support lifelong learning and professional development; Coursera – online courses taught by instructors from well-recognized universities and companies; European Schoolnet Academy – free online professional development courses for teachers in English, French, Italian and other European languages; EdX – online courses from leading educational institutions; Future Learn – online courses to help learners study, build professional skills and connect with experts; Icourses – chinese language courses for university students; Udemy – English, Spanish and Portuguese language courses on ICT skills and programming; XuetangX – online courses provided by a collection of universities on different subjects in Chinese and English. The site presents collaboration platforms that support live-video commu-

nication, namely: Dingtalk – communication platform that supports video conferencing, task and calendar management, attendance tracking and instant messaging; Lark – collaboration suite of interconnected tools, including chat, calendar, creation and cloud storage, in Japanese, Korean, Italian and English; Hangouts Meet – video calls integrated with other Google's G-Suite tools; Teams – chat, meet, call and collaboration features integrated with Microsoft Office software; Skype – video and audio calls with talk, chat and collaboration features; WeChat Work – messaging, content sharing and video/audio-conferencing tool with the possibility of including max. 300 participants, available in English and Chinese; WhatsApp – video and audio calls, messaging and content sharing mobile application; Zoom – cloud platform for video and audio conferencing, collaboration, chat and webinars. The list of external repositories of distance learning solutions is also given [6].

Thus, decentralized interactive e-learning platforms are already operating in the world: Lynda.com (Linkedln Learning), which presents more than 17,400 courses and study plans in various specialties, which enroll millions of students; LiveEdu, where you can watch the work of professionals, lessons and conferences in the field of programming and design in real time. Modern interactive platforms create fundamentally new educational opportunities. For example, LiveEdu allows students to focus on real projects rather than theoretical material, teaches practical skills and provides opportunities for practical implementation in work proposals, creates certain content for both teachers and students using the block principle. The platform allows you to cross national borders, reduce operating costs and increase data availability. Another platform Education Ecosystem provides training based on the creation of real projects in the field of programming, game development, artificial intelligence, cybersecurity, blockchain, big data.

The new field of learning was launched with the help of IT – robot learning, formation of their "emotional intelligence" (Emotion AI).

A new stage in the development of IT is that they are actually forming a complex human living environment, which has become an important learning tool in contrast that they used to shape the educational environment (Smart Campus Technologies, Electronic Campus).

When experts consider the problems of using IT in education, they often mean the informatization of educational activities. But the modern university implements three missions: educational, scientific and the third mission to improve public life, in addition, an important aspect of the functioning of a higher educational institution is management.

Educational e-technologies have not only significantly influenced the expansion of the higher education market, but have also led to changes in the understanding of the role and importance of higher education institutions. E-technologies, which are now being introduced into the education system, contribute to the formation of more diverse and flexible educational institutions. Even the functions of higher education are changing, which is aimed not only at reproducing new professionals and conducting research, but also at improving public life, solving social problems and developing society, regions, communities where they are located [4, 25]. The third mission (TM) of universities – "the contribution to society" is increasingly being implemented through IT. It is the Third Mission that changes the approach to scientific activity. If the task of a scientist was to conduct research and publish its results during the previous years, the TM provides for the mandatory bringing of research results to their implementation in practice at the local, regional and national levels. Nowadays, the effective implementation of TM is

impossible without the widespread use of IT, which allows to establish cooperation between freelancers and stakeholders, to create project, grant groups, analytical centres for ensuring of accelerated social development. IT is the basis for implementation of most activities for the implementation of TM universities.

Thus, e-technologies provide great opportunities for the implementation of this new "third mission of universities" to directly influence the development of society and the region, establishing cooperation between educational institutions, communities, businesses and other organizations, conducting social and practice-oriented research, consulting and educational support, etc. E-technology is changing the educational paradigm to a more accessible one, where there are no space and time constraints, focused on the needs of consumers of educational services and the emergence of new types of educational institutions that actively use cyberspace.

Regarding the impact of IT on research, it can be noted that it is mainly due to the internationalization of research. This is facilitated by the means of dissemination, storage, receipt, processing of information, the formation of international research groups for the implementation of research projects. IT is taking on more and more of the functions previously performed by researchers. With powerful computer systems IT can now perform tasks that took hundreds of years to complete. The basis for this is software for processing big data. All this significantly transforms the tasks, content and scope of scientific activity, which is constantly increasing the amount of work performed by IT.

As we have noted, an important aspect of university activity is management, it is reflected in such concepts as "Management Information System" (MIS) – 4,5 billion; "Automated Information System University Management" – 4,1 billion; "information technologies of university management" – 11,6 billion; "Management information system" – 11,5 billion; "Information Systems Approach to School Management" – 6 billion; "University Management Software" – 6,8 billion etc.

For example, the Management Information System or MIS is not only a central data warehouse, but also software that can not only collect, organize and store students' data, but also process and analyze information and generate various reports from them.

Modification of MIS – Education Management Information System (EMIS) can monitor the implementation of university educational programs, manage the allocation of educational resources, develop a strategy for implementing work processes for the smooth operation of the educational system. Such a system aims to collect, integrate, process, maintain and disseminate certain data and information to ensure the development of management decisions, planning, monitoring and management at all levels of the education system.

E-technologies are actively used in the modern world educational system to manage, evaluate the performance of educational institutions, and determine the ratings of scientists, universities and others. Computers and telecommunications are key technologies that are changing higher education.

Thus, the development of IT can be considered the main means of developing university education.

The use of new e-technologies affects the process of transformation of higher education and changes the traditional process of teaching and learning. The rapid development of globalization, which lowers international barriers and transforms the business world, also expands the potential for universities. The growing need for lifelong learning opportunities to keep pace with

social, economic and technological change is driving the demand for affordable alternatives to traditional real-time learning. As technology transforms the education market, the balance of power shifts from the education provider to the education consumer. Consumers of education are now free to choose learning opportunities that meet their goals from a variety of sources. The importance of territorial location of an educational institution as a factor in the choice of its consumers of educational services is decreasing. Thus, the introduction of new educational technologies becomes a guarantee of competitiveness of educational institutions that fight for students. That is why the use of educational technologies in the educational process is very important.

Analyzing the world experience of using modern educational technologies, it can be argued that there are many obstacles to the introduction of educational e-technologies in the educational process in higher education (cost of technological applications, academic traditions, ignorance of teachers and their resistance to the introduction of educational e-technologies). According to the Campus Computing 2000 study, the most important problem in educational e-technologies for higher education institutions around the world is to help teachers integrate information technology into their teaching and provide appropriate user support [7]. At present, the hopes that e-technology will reduce the cost of education by reaching more students are not justified. Educational institutions are forced to constantly update their technical equipment, spend on new educational programs and e-technologies that are constantly updated, on teacher training. Thus, the impact of e-technology on the cost-effectiveness of the educational process remains a prospect. Indeed, this is an extreme view. The future is in the combination of e-learning with traditional one and the formation of a new system of blended learning, which takes place in the educational practice of today [2, 3].

Modern educational e-technologies aimed at universality and personality-oriented. E-learning is a collaborative educational tool that allows students and teachers to share and discuss information. Analyzing the sources, we determined that modern educational technologies include the following: e-learning, video-assisted learning (video streaming), blockchain technology, big data, artificial intelligence (AI), learning analytics, gamification (learning simulations), immersive learning with VR and AR, STEAM, social media in learning, 5G.

E-Learning (distance learning) became the top 2020 educational technology trend overnight because of the rapid spread of COVID-19. E-Learning is education or training delivered electronically. It can be slide-based online activities, or it can also be an online course that helps train in necessary skills. E-Learning has been around for a long time and continuously developing. Variety is the outstanding feature of online learning platforms. You can teach your students in real time (synchronous) via live stream or group meetings using Zoom or Microsoft Teams, or you can use recorded (asynchronous) methodologies with a wide range of media and digital functions. Video-assisted learning – using videos, especially animated videos, are extremely beneficial to enrich lessons and make content comprehensible. It improves students' outcomes and reduces teachers' workload. Blockchain technology is used in Massive Open Online Courses (MOOCs) and ePortfolios to verify skills and knowledge. Artificial Intelligence (AI) now is the "in thing" in the US EdTech market. AI can automate basic activities in education, like grading. AI driven programs can give both learners and educators helpful feedback. Learning analytics allows educators to measure and report student learning just by the web. Learning analytics helps educators identify blocks of students who may have academic or behavioral challenges.

Gamification involves the use of game elements in the learning process. Learning with VR and AR – help explain complex concepts (VR provides a constructed reality, AR gives an enhanced view of a real image).

Despite the almost irresistible appeal of modern educational e-technologies (promoting collaborative learning, helping to personalize and individualize learning, the ability to transmit large amounts of information through networks, adapting educational programs to the specific needs of each), informational educational technologies pose higher education and difficult problems – constant updating (financial costs for implementation and use). At present, reducing the cost of higher education through the introduction of new educational e-technologies remains a prospect.

However, there is no doubt that educational e-technologies can also help make education much more accessible and the educational process more interactive, flexible, accessible, shared and focused on addressing the individual needs of students [18]. Technology has greatly expanded the demand for lifelong learning. E-learning removes not only the spatial constraints on learning opportunities, but also the limitations in the choice of study time. This opens up new opportunities for the working adult population. With the emergence of a free market for educational systems and programs, new approaches and methods of documenting educational achievements are emerging, based on the measurement of competencies rather than credit hours. Competence in skills or subject matter is documented, regardless of where the study took place [2].

The introduction of new educational e-technologies in higher education is changing the role of teachers. University professors change their role from knowledge translators to experts, consultants, guides who direct the search educational activities of students in the desired direction. Professors can use educational e-technologies in the preparation and conduct of classes, research, communication with students and colleagues from anywhere on the planet, which gives them some freedom. E-technologies can also free up teachers' time from broadcasting information. This time can be used to interact with students and adapt their courses to their individual needs and interests [16]. It can be achieved by creating flexible course modules, elective courses that students can master according to their own professional goals and needs. On the other hand, the use of educational e-technologies and the modern educational paradigm requires high level of teachers' training for using these technologies, continuous improvement of their skills and mastery of new e-technologies. Thus, the importance of teachers' information (digital) competence increases.

Emphasis on the responsibility for the effectiveness of the educational process is shifting towards students, who become an active participant in the educational process from a passive listener of lectures. Students can present their work online on learning platforms, participate in both online discussions and seminars, access course materials whenever and as many times as needed. E-technologies give students the opportunity to cooperate in learning, apply team learning methods, establish communication with students of the group, other universities, etc., motivate students to improve learning outcomes [1].

The influence of educational e-technologies on the educational process and the readiness for their use by students are presented in the results of the study of trends in the development of civil servants' e-learning [10]. The study interviewed civil servants "C" and "B" categories from regional and district state administrations, as well as employees of city and town councils

from Luhansk and Ivano-Frankivsk regions, applicants for the second level (master's degree) of higher education. The majority of respondents (70%) rated their own readiness to use ICT technologies in the educational process at 8–10 points (on a 10-point scale, where 10 is the maximum level and 1 is the minimum level). Only 1,8% of students rate their readiness lower than 5 points. Indeed, new generations of students easily embrace new e-technologies and even have an advanced awareness of IT development.

This study also identified threats and benefits to the introduction of e-technology in education. Students consider the greatest threats in the formalization of the educational process, creating favorable conditions for the spread of plagiarism, oversaturation of students with information, the constant lag of e-technologies used in the educational process of their educational institutions from the world level. Among the advantages of using e-technologies are the following: they allow to master a larger amount of educational information, increase the availability of information, facilitate communication with teachers, solve organizational problems of the educational process, facilitate research and more [10].

Other researchers note that new e-technologies increase not only the responsibility of students, but also the ability to control their own learning process. On the other hand, the control of the curriculum by the teacher and even the administration of the institution is reduced. The learning process acquires democratic features [2, 16].

Thus, the use of educational e-technologies can help make education a much more interactive and collaborative process, helping to create a better teaching / learning experience that leads to higher learning outcomes.

Awareness of the need for digital transformation of education in Ukraine at the state level is evidenced by the submission for public discussion of the draft Concept of Digital Transformation of Education and Science for the period up to 2026 [11]. The document presents a comprehensive systemic strategic vision of digital transformation of these areas and meets the principles of implementation of executive principles of state policy of digital development, approved by the decree № 56 of Cabinet of Ministers of Ukraine on January 30, 2019 [14], as well as priority areas and tasks (projects) of digital transformation for the period up to 2023, approved by the decree № 365-r of the Cabinet of Ministers of Ukraine on February 17, 2021 [15].

The ultimate goal of this Concept is "the use of digital technologies to transform processes in education and science in order to simplify, automate and facilitate them for users" [11]. The concept identifies two main areas for achieving this goal and the corresponding five strategic goals:

Direction 1. "Effective use of digital technologies in the educational process" is implemented by three strategic goals ("Digital educational environment is accessible and modern"; "Education workers have digital competencies"; "The content of ICT education meets modern requirements").

Direction 2. "Optimization of management, regulation and monitoring processes" is implemented by two strategic goals ("Services and processes in education and science are transparent, convenient and effective"; "Data in education and science are accessible and reliable").

However, the digital age has already arrived and Ukrainian universities should adapt to the new realities of existence now, without waiting for the adoption of new concepts. Universities

around the world are competing for students, academics and finance in this digital age. The winners will be those who become relevant in time and introduce new digital opportunities.

Our research based on the study of plans and decisions of academic councils meetings of leading domestic universities allowed us to get a general idea of the state of digitalization of higher education. The Academic Council of the University is a collegial governing body, whose decisions are approved by order of the Rector. Regular meetings of the Academic Council of the University are held, as a rule, monthly, where the most important issues of the university's activity and development are considered. The agenda of these meetings is determined by the work plan. The work plans and decisions of the Academic Council in most Ukrainian universities are published on official websites in accordance with Art. 79 of the Law of Ukraine "On Higher Education" [13].

In the research we considered the official websites of the 50 best higher educational institutions of III-IV levels of accreditation according to the ranking of Ukrainian universities "Top-200 Ukraine 2021" [20]. Official documents on the activities of the Academic Council of universities for 2020–2021 were examined. However, the analysis showed that not all universities provide complete information on the activities of the Academic Council, which made it impossible to make an analysis and conclusions for 20% of the HEI. Some universities publish only meeting plans, or only minutes of decisions. Therefore, only plans were analyzed in 10% of higher educational institutions; in 20% of higher educational institutions – only decisions; both plans and decisions were analyzed in 50% of the higher educational institutions (figure 1).
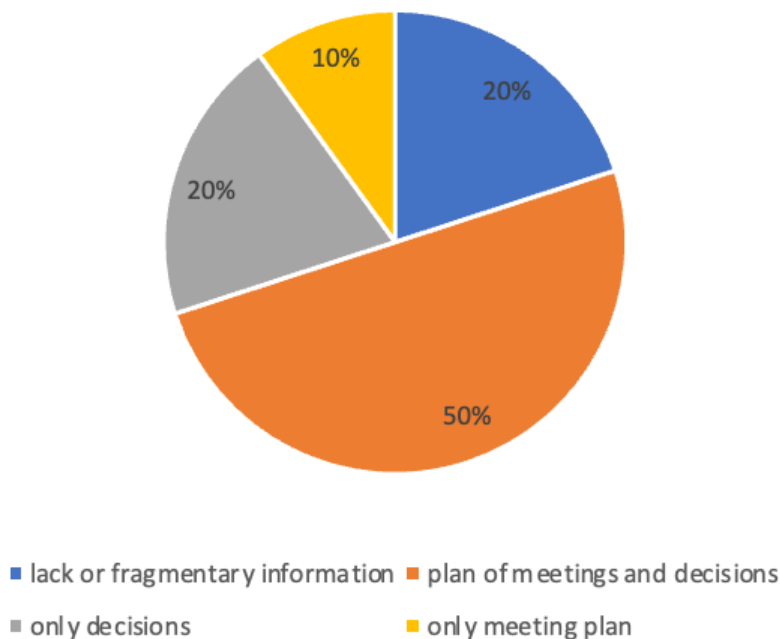


**Figure 1:** The state of publication of information about the activities of the Academic Council from university websites, which determined the possibility of analysis during the study.

The thorough analysis of the issues declared in the plans of the Academic Council meetings showed that only 36% of the universities we studied submit issues related to the digital trans-

formation of education to the Academic Council. Thus, if we do not take into account 36% of universities that do not publish plans for meetings of scientific councils, 28% of Ukrainian leading universities, even in modern conditions, do not attach importance to the problem of digitalization and do not include relevant issues in the work plan of the Academic Council. Generalized information is shown in figure 2.
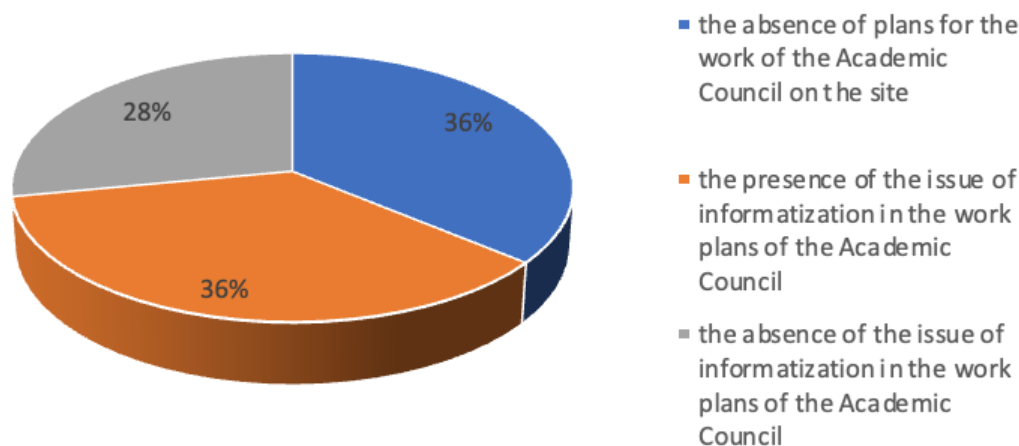


**Figure 2:** The presence of issues related to the digital transformation of education in the work plans of academic councils of universities.

Among the issues on the agenda of academic councils, most of them concern the problem of introducing the mixed form of education and organization of educational activities of an institution in the pandemic. Examples of such issues are: the introduction of digital technologies in the educational process, the state of preparation of distance learning courses based on Moodle, approval of the Regulation "On distance learning", distance education in the educational process of the university, the continuation of mixed educational process, the organization of educational process in distance form, on the effectiveness of distance learning, on the introduction of e-learning technologies, on the introduction of e-services, etc. There are issues that reveal the problem of digitalization of the university management system, such as the state of implementation of automated control system of the educational process "MIA-education", e-government. A number of issues are devoted to the problem of positioning of universities in the information space of the Internet, for example, about the information activities of the university, the state and improvement of information content of departments' websites, the effectiveness of the university in the web space. Only 6% of universities in our sample found a comprehensive approach to digital transformation of education, as evidenced by the inclusion in the work plan of the Academic Council such issues as: the state of digital transformation at the university, the state and prospects of university informatization, the state of digital infrastructure, development of digital infrastructure of the university – the key to its success: status and prospects, the functional strategy of informatization, the implementation of the project "Digital University", the approval of the Concept "Digital University", etc.

The analysis of the decisions of academic councils of universities showed that 26% of universities do not publish them on the website, which made the analysis impossible. Decisions of

academic councils in 32% of universities do not have decisions on digital transformation, 42% of universities have questions about the digitalization of the educational process and the activities of the university.
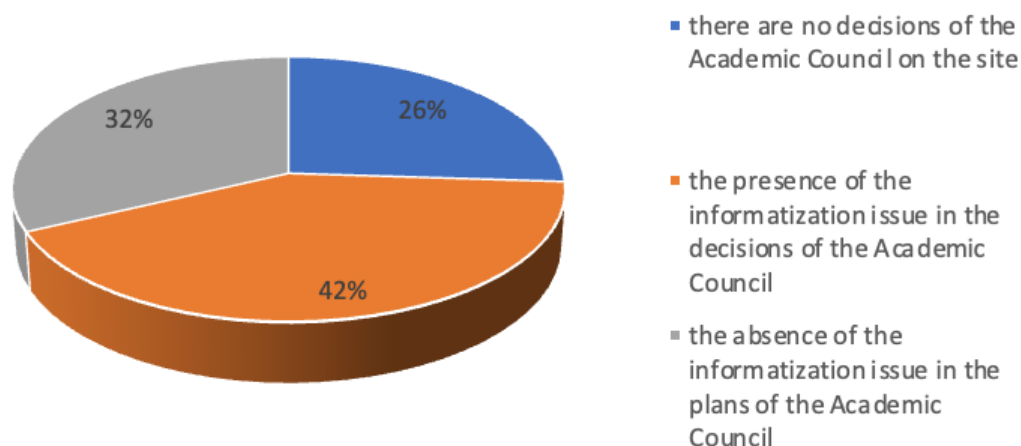


**Figure 3:** The presence of issues related to the digital transformation of education in the decisions of academic councils of universities.

The analysis of the decisions'content of the Academic Council gives an idea of the directions of implementation of digital transformation in higher education institutions. Examples of decisions aimed at digitalization and organization of the educational process in the pandemic are: decisions on filling the virtual learning environment, improving distance and blended learning to fully ensure the educational process at the university in the quarantine; organization of distance education, filling the information platform "Misa"; introduction of the mixed form of educational process organization, adoption of the functional strategy of informatization, approval of the Regulations on electronic training courses; on amendments to the Regulations on the DistEdu Electronic Educational Platform (Moodle); implementation of the learning management system LMS; creation of digital educational environment, etc. Examples of providing the necessary conditions for digitalization are the following decisions: the creation of the modern information environment at the university and the development of computer network infrastructure; introduction of systematic training of scientific and pedagogical staff on the application of the latest teaching methods; purchase of specialized software; arrangement of access to Wi-Fi; approval of the Regulations on remote work of employees; website modernization, etc.

The following decisions testify to the digital transformation of management processes: introduction of an electronic document management system; analysis of the university's experience in introducing electronic record books into the educational process; introduction of the online reporting system "International Activities of Departments", introduction of electronic administration of the educational process on the platform "Electronic Campus", introduction of the automated management system; introduction of electronic scheduling systems, university auditorium fund, dormitory student registration, etc. Solving the issues of promoting the university brand and popularizing the achievements on the Internet are demonstrated by the following solutions: implementation of the project "3D tour of the university", "Virtual Museum of I.

Pulyuy"; application of the virtual "Office of Innovation and Technology Transfer"; analysis of the digital presence of the academy in a competitive environment, the adoption of information and advertising strategy of the university, etc.

Thus, most Ukrainian universities are aware of the need for digital transformation and are taking some measures to implement it, as well as implementing complex projects "Digital University". In the modern sense, the Digital University is the application of innovative approaches to learning, mastering technology and skills by students; new research opportunities; use of new technological systems and increase the efficiency of processes in the activities of the university.

Undoubtedly, in today's digital age, universities need a strategic vision for the digitalization of educational institutions, which should be in the first place with senior management with the support of the heads of all other departments.

## 5. Conclusions

No one knows what higher education will look like in 2030 or 2100. Undoubtedly, educational e-technologies will become one of the driving forces that will contribute to the transformation of education, which is already in full swing. Opportunities to use modern educational e-technologies for learning and online learning can increase the productivity of education by accelerating the pace of learning; reduction of costs for training materials or program delivery; and productive using of the teacher's time. The degree to which online learning takes place and the way it is integrated into the learning process may vary from country to country and from higher education institution, but it is hard to deny that the use of modern educational technologies improves teaching and learning. The analysis allowed to highlight the trends in the development of higher education, which are caused by the spread of modern e-technologies in educational practice and its digitalization:

- Strengthening the impact of education on the development of society – the world, countries, communities.
- Information technology (in the narrow sense) now defines all other educational components.
- Educational e-technologies have significant potential in the organization of educational activities for the transfer of information, evaluation and accounting of educational activities.
- Democratization of education – reduction of restrictions for those who study and teach, increase of autonomy.
- Dissemination of the mixed form of education, which combines all previously accepted forms of education in higher education.
- Increasing responsibility, initiative and subjectivization of students' position.
- Strengthening the influence of external factors on the development of education. Previously, educational systems were more closed, conservative, slow to develop.
- Creating opportunities for the realization of individual interests and educational needs of students.
- Use of soft technologies of education development management: HEI rankings, international olympiads, international publications, international standards, etc.

- Strengthening the practical orientation of educational systems.
- Advanced awareness of new generations in the development of IT.
- Changes in requirements for teachers – information competence comes to the fore.
- Internationalization of education – general criteria for evaluating the results of secondary and higher education, the opportunity to study in different countries, exchange of teachers, enrollment in other HEIs, UNESCO activity, elimination of national restrictions on science, dissemination of joint scientific publications.

Thus, we can conclude that modern digital transformation of education is the main means of developing higher education and applies to all areas of activity of modern universities.

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