Aspects of Digital Transformation of Higher Education in the Republic of Kazakhstan

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Abstract. The scientific article analyzes current trends in the digital transformation of higher education in the Republic of Kazakhstan. The digital transformation of the education system in any country is based on the integration of digital technologies and solutions into the processes of the organization. New solutions, in turn, make it possible to comprehensively modernize university models, as well as increase the efficiency of their activities and develop their competitive advantages. In the context of the global digitalization of higher education, it is important for Kazakhstan to use technological potential to ensure a leading position in the educational industry of the region, as well as, with the help of innovative systems, to solve internal issues of a socio-economic nature. Since the processes of digital transformation of higher education are based on digitalization, the key concepts and practices of "digitalization" and its role in the higher education system have been studied. The authors, along with the Kazakh experience, also considered the strategies of digital transformation of higher education in foreign countries: Italy and Norway. During the study, a set of general scientific and special methods of cognition was used, with the help of which the processes and phenomena considered in the work were analyzed. Despite the differences in the level of development, in comparison with foreign countries, Kazakhstan has similar approaches to determining priorities for the digital transformation of the university system. Digitalization provides significant opportunities for Kazakhstan to improve educational innovation. The analysis shows that digital technologies in education make it possible to ensure a change in discourse from the model when the university taught, to the model when the university is transformed into a space for self-development of students in professional and business activities, as well as a zone of influence on sectors of the economy. In an environment of increasing multidisciplinarity, the active role of the state in digital transformation makes it possible to orient universities to the new needs of stakeholders. This research was funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (grant no. BR21882302 Kazakhstani society in the context of digital transformation: prospects and risks).

Keywords: digital transformation · digital technologies · higher education · e-learning · e-transformation

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1 Introduction

Background of the study. At the present stage of the country's development, digitalization is an integral part of the life of society and the state, including the spheres of education and science. Kazakhstan, as a country striving for innovative development and modernization, today is actively introducing digital technologies into various sectors of the economy, including higher education. For this reason, digitalization, as a key term, closely penetrates the higher education system, because this process has a profound impact on the educational environment, changing the ways of learning, knowledge transfer and research. It provides new opportunities for the educational process, enriching it with digital tools, platforms and resources. In addition, digitalization is changing approaches to managing universities, transforming business models and internal ecosystems.

Thus, digitalization in the context of higher education is the process of integrating digital technologies, tools and resources into educational and management processes in order to improve the quality of learning, the availability of knowledge and the development of the education system.

The relevance of the research topic is due to the fact that the introduction of digital technologies is currently being actively promoted at the state level in Kazakhstan. Strategic and program documents are being adopted aimed at the innovative development of the country in the digital era. However, it is important to identify whether the priorities of Kazakhstan's digital transformation correspond to global challenges and megatrends. For example, do the content of education and educational formats correlate with such megatrends as a change in the technological structure, a change in management models, a change in the structure of employment and lifestyle, a new financial architecture, a new model of family and childhood? [1].

It should also be noted that in the 2023 Digital Competitiveness Ranking of the International Institute of Management Development (IMD), which assesses the extent to which countries are studying and assimilating digital technologies leading to the transformation of public policies, business models and society as a whole, Kazakhstan ranked 34th out of 64 countries. At the same time, the highest indicators were achieved in the direction of "Knowledge", that is, training and education [2]. In this regard, it seems relevant to analyze what factors associated with the higher education system influence the improvement of Kazakhstan's position in the world ranking of digital competitiveness.

Review of the theoretical basis of the study. Kazakh authors quite often in recent years have turned to studying the experience of digitalization of higher education in order to scientifically substantiate the introduction of certain innovations in the area under consideration in our country. However, the analysis shows the lack of systematic research into the processes of digital transformation of higher education. Selected aspects are studied: online learning, the use of ICT in teaching, etc.

The digitalization of higher education in Kazakhstan plays a key role in transforming the educational environment, contributing to the development of new approaches to learning and enriching the educational process with new opportunities, which ultimately leads to an increase in the quality of education in the country. In other words, the digitalization of higher education in Kazakhstan is a complex process covering several key aspects that play an important role in modernizing and improving the educational system.

And at the same time, digitalization stimulates research activities and innovative projects in universities, facilitating access to scientific resources and promoting the development of new technologies and teaching methods.

Therefore, R. Bugubaeva et al. conclude that digitalization opens up more opportunities for access to education and improvement of the educational process and content. Thanks to the digitalization process, the teacher turns from a carrier of knowledge and skills into a navigator who helps navigate certain knowledge bases [3].

A. Cherniavsky analyzes the digitalization of higher education in Kazakhstan from the perspective of three main principles for universities: "Digital education and research" - it is recommended to teach and research using digital technologies; "Strategy and partnerships" - it is recommended to consider digitalization as part of your overall strategy, to adapt business models for digitalization; "Infrastructure and campus" - it is recommended to create a technological environment for activities at the university (Wi-Fi availability, data centers, smart buildings, etc.) [4].

At the same time, A. Ibraeva and S. Egemberdieva highlight problems that can affect the processes of digital transformation in education:

- insufficient level of digital skills of teachers;
- low level of preparedness of the university infrastructure for the introduction of modern educational technologies;
- insufficient quality of electronic educational materials for online learning;
- low level of students' readiness for self-study [5].

Positive practices of implementing modern technologies in the educational process are described by N. Kushzhanov, K. Balginova and others [6]. Thus, in their opinion, in many countries digitalization is a strategic development priority. Increasing digital literacy at all levels of the education system is becoming a priority. Therefore, it seems important to use modern IT technologies in training, including mobile applications on smartphones and tablets and social networks. The Kazakhstani higher education system requires digitalization not only in terms of the development of IT universities, digitalization should fundamentally affect all universities: economics, law, and natural sciences. Thus, the emphasis on knowledge in the field of IT technologies among economists and lawyers will allow us to move to a qualitatively new high level of education [7].

However, if Kazakh authors primarily consider individual aspects of digitalization and digital transformation of universities, then foreign researchers have a more systematic approach to defining digital transformation, including in the context of education. Thus, G. Vial, having systematized more than 20 existing definitions of the definition of "digital transformation", concludes that digital transformation is a process in which digital technologies create disruptions that cause strategic reactions from organizations that seek to change their ways of creating value, at the same time managing structural changes and organizational barriers that influence the positive and negative outcomes of this process [8]. Based on the research of G. Vial, F. Martin and K. Xie define digital transformation for digital learning in the context of higher education as the use of digital technologies to achieve significant improvements in education, improve the experience of students and teachers, and create new models of learning through policies, planning, partnership and support [9].

Digital transformation is also defined as "a series of profound and coordinated changes in culture, workforce and technology that enable the creation of new educational and operating models and transform an institution's business model, strategic directions. And value proposition." Digital transformation can make educational institutions more resilient, flexible and relevant as they face a host of increasingly complex challenges, including declining student enrollment and rising public skepticism [10].

In the works of Russian researchers, digital technologies in higher education are considered as a tool for creating interactive educational materials that make the learning process more fun and effective. This includes multimedia lectures, virtual laboratories, animations and educational games [11].

In addition, the use of digital technologies allows us to customize the educational process to the individual needs of each student. The use of adaptive programs and systems allows each student to go at his own pace and delve into topics that interest him.

Another key problem in the field of digital transformation of the education system is viewing digitalization as a means, and not as a catalyst for systemic changes. Point solutions prevent the full potential of digital solutions from being realized. When considering the problems of digitalization and digital transformation, higher education systems often focus on successful models in the field of secondary education and/or the business environment, which can contribute to the formation of negative consequences when adapting approaches without taking into account their own specifics [12].

It is necessary to take into account these challenges and actively work to overcome them in order to maximize the potential of digitalization of education. At the same time, attention should be paid to the prospects that digital transformation opens up, such as improving the quality of education, expanding the accessibility and flexibility of the educational process, as well as the development of innovative teaching methods.

It is also important to determine what requirements must be placed on modern teachers and students, what models of university management are effective in the context of digitalization, and what actions need to be taken to mitigate the negative consequences of digitalization of higher education (for example, the ability to use modern information technologies by teachers in the educational process, readiness students for independent work, etc.) [13].

The novelty of the study lies in the systematic analysis of the experience of digital transformation of higher education in the Republic of Kazakhstan, including in comparison with foreign experience in order to identify the most successful cases for their possible implementation in Kazakhstan.

The research hypothesis lies in the assumption of the possibility of improving approaches to managing Kazakhstani universities, building the educational process, developing university infrastructure, technology platforms and university laboratories under the influence of digital transformation.

The purpose of the scientific article is to analyze the Kazakh and foreign experience of digital transformation of higher education in Kazakhstan to compare compliance with current needs and identify promising opportunities.

Achieving the stated goal will be facilitated by the following tasks:

– study the experience of digital transformation of the higher education system of Kazakhstan and the best practices of foreign countries;

– determine the directions for further development of the digital transformation strategy in Kazakhstani higher education.

2 Digital Transformation of Higher Education in the Republic of Kazakhstan

In the Republic of Kazakhstan, the concept of "digitalization" in the context of the higher education system is enshrined in regulations and strategic program documents. One of such acts is the Law of the Republic of Kazakhstan "On Education", which reflects the introduction of digital technologies into the educational process, as well as the creation of conditions for the development of digital educational platforms and infrastructure [14].

In general, the Law "On Education" is a key document of modern educational policy, including the introduction of digital technologies in education. It helps provide more effective learning, preparation for future jobs and the development of competencies needed in the digital age.

At the same time, the term "digitalization" was found in the State Program "Digital Kazakhstan" [15]. As part of this program, the Government of Kazakhstan created and implemented education management systems (organization of a single, centralized repository of subjects and objects of education at the levels of preschool, secondary, technical and vocational, higher education; subsystem "Automation of public services of the Ministry of Education and Science of the Republic of Kazakhstan"; subsystem "Activity Control educational organizations"; subsystem "Planning and analysis of educational development", etc.).

In addition, according to the Ministry of Education and Science of the Republic of Kazakhstan (currently the Ministry of Education and the Ministry of Science and Higher Education), starting from the academic year 2018–2019, updated educational content has been gradually introduced. At the same time, in 2018 the number of graduates with basic IT competencies amounted to 271.8 thousand people (of which 130 thousand people were in universities), in 2019 - 283,191 people (of which 142,435 people were in universities), in 2020 year - 320,828 people (of which 176,445 people are in universities). To increase the number of graduates with IT competencies, the disciplines "Digitalization in Education" and "IT and Digital Resources" were added for pedagogical specialties. At the same time, together with universities, educational programs in leading specialties were updated taking into account modern trends. Along with this, as part of the digitalization of education, special training courses on digital literacy were introduced for teachers.

In addition, in 2019, the "OpenU" project was implemented - an educational platform that provides free access to online courses from leading universities and teachers of the country for everyone without restrictions, to which all universities in Kazakhstan were connected. Meanwhile, in 2020, as part of the rapid adoption of measures to respond to the emergency situation caused by the coronavirus pandemic in the country, the platform "online.edu.kz" was implemented for posting video lessons for students [16].

The nationwide Strategy "Kazakhstan-2050" in the context of digitalization of education pays significant attention to the development of information technology and the digital economy [17].

Key priorities and initiatives related to higher education are reflected in the annual Messages of the Head of State K. Tokayev. An example is the Message of the Head of State dated September 1, 2020, in which he emphasized the importance of developing digital platforms for the development of distance education, which received impetus due to the spread of the coronavirus pandemic [18].

In his Address dated September 1, 2021, the President noted that within the framework of the National Digitalization Project, it is necessary to train at least 100 thousand highly qualified IT specialists, as well as improve the quality of information systems for remote learning formats [19].

In the Address of September 1, 2023, digitalization received the greatest attention. Thus, the Head of State stated that it is necessary to transform Kazakhstan into an IT country, increase the export of IT services to $1 billion by 2026, apply artificial intelligence technologies, which, in turn, implies not only the active introduction of information technologies into educational process, but also the creation of a favorable environment for the development of the innovative IT sector and the training of qualified personnel in this area through the higher education system [20].

In the post-pandemic period, approaches to the development of higher education were significantly revised, taking into account digitalization trends. In June 2022, the Ministry of Science and Higher Education of the Republic of Kazakhstan was created in Kazakhstan; one of the key areas of activity was the digitalization of science, higher and postgraduate education [21].

The Concept for the Development of Higher Education and Science in the Republic of Kazakhstan for 2023–2029, adopted in March 2023, identified the development of digital technologies in education and access to any digital educational resources in the world for retraining and obtaining the necessary competencies as a weakness – deficit of digital skills. One of the priorities of the Concept is the development of infrastructure and digital architecture of higher education, as well as increasing the digital competencies of citizens [22].

Correlated with the digitalization of higher education is the Concept of digital transformation, development of the information and communication technologies and cybersecurity industry for 2023–2029, for the needs of which by 2029 the training of highly qualified IT personnel should increase from 35 thousand to 40 thousand. For these purposes, it is planned to organize the patronage of specialized universities over regional universities in order to improve the quality of education to a higher level [23].

Since the Republic of Kazakhstan officially joined the Bologna Declaration in 2010 and became a member of the European Higher Education Area, we will consider the experience of digital transformation of higher education in individual countries participating in the European Higher Education Area, including Italy and Norway. These countries were among the first to adopt Digital Transformation Strategies specifically for higher education. While in most countries, including Kazakhstan, the digitalization of higher education is part of national strategies or included in strategies for the formation of a digital society.

Italy

Italy was one of the first to adopt a strategy of using new technologies in teaching and learning for higher education [24].

At the same time, the main national participants in digital transformation are:

- Italian universities,
- Ministry of Education, Universities and Research and Ministry of Economic Development,
- Agency for Digital Italy, created to support the achievement of the goals of the Italian digital agenda, the diffusion of digital technologies and digital innovation,
- Manifesto of the Conference of Italian University Rectors – National Plan for Digital Universities and Open Science Initiatives. The manifesto presents a vision and strategy for promoting digital technologies in universities.
- CINECA is a non-profit consortium formed by 68 Italian universities, 9 Italian research institutes and the Ministry of Education, Universities and Research. This organization supports technology transfer by connecting universities with industry and government agencies.

In 2018, the Conference of University Rectors proposed the adoption of a National Plan for the Development of Digital Universities. The plan is a comprehensive strategy for addressing the challenges and opportunities of new digital technologies. Its goal is to bridge the gap between the Italian higher education system and other higher education systems in European countries. The plan covers areas such as teaching and learning, competencies, research, national action and coordinated governance.

As a result, Italy managed to achieve the following successes:

- in organizing digital learning using massive open online courses (our own online learning platforms have been developed);
- in the use of blockchain technology (issuance of authentic electronic certificates and diplomas confirming skills);
- in the formation of "open" university science (wider dissemination of research results in digital format through the "open access" model);
- in strengthening the role of universities as centers of the digital ecosystem in the digital transformation of non-academic institutions through the broadcast of digital culture and knowledge exchange [25].

In 2020, Italy adopted the National Strategy for Digital Skills until 2025, the main priorities of which are: digitalization of the school system; development of digital skills and digital culture among students; digital teacher training; strengthening ICT training as part of cross-cutting skills and pathways; strengthening orientation programs for high school graduates together with IT companies; cooperation between universities and schools on vocational guidance; implementation of digital portfolio; cooperation between universities and the business community; strengthening human capital and infrastructure; re-design of training programs taking into account digital transformation [26].

Norway

In order to maximize the use of new technologies in higher education and research, Norway has adopted the Digitalization Strategy for the Higher Education Sector 2017–2021. The Norwegian government has highlighted the digitalization of higher education as a separate strategic document, since each sector of the economy is responsible for using

common solutions and complying with common frameworks and requirements. Each sector has a responsibility to create solutions that can be shared with other businesses and sectors. The industry goals of digitalization and ICT in the higher education sector were identified:

– High quality education and research.
– Research and education for well-being, value creation and adaptation.
– Good access to education.
– An efficient, diverse and robust higher education sector and research system [27].

In 2023, Norway presented a new Strategy for Digital Transformation in Higher Education, based on the lessons of the COVID-19 pandemic. This strategy replaces the Higher Education Sector Digitalization Strategy 2017–2021. Analysis of the Strategy allows us to conclude that the policy of digital transformation of higher education has been significantly revised. If previously the emphasis was on digital skills and infrastructure, now approaches are oriented taking into account the needs and capabilities of participants in the educational process. Thus, six strategic directions have been identified:

1. Digitalization for flexible education: introduction of such learning concepts as "physical presence", "fully digital learning", "blended learning" (some classes take place online, some classes take place offline) and "hybrid learning" (part of the group participates online, some are offline).
2. Digital innovation in teaching and learning: Digital skills acquired by teachers should be developed to promote innovation in all forms of teaching, learning and assessment, and digital technologies should be used to facilitate the learning process.
3. Digital topics, methods and skills in all disciplines: Regardless of the field of study, students should study topics related to digitalization in interaction with the rest of the academic content of the course.
4. Open science and new research opportunities: improving the quality of research through digital technologies and the use of new research methods and analysis tools, the availability of research results, subject to ensuring reliable data confidentiality and respect for security, intellectual property rights and trade secrets.
5. Using education and research data: Using data to conduct higher education research to drive even more innovative decisions and economic growth, while respecting confidentiality.
6. Management and culture of digital transformation: digital transformation in higher education should be rooted in management at all levels and contribute to improving the quality of education, research and knowledge dissemination, digital culture should contribute to improving the quality of education and research [28].

Discussion

Digitalization of higher education in Kazakhstan plays a key role in the modernization of the educational system, influencing teaching methods, accessibility, quality of educational processes and preparing students for the challenges of the modern world.

Consideration of the historiographical and source study base, the key concept of "digitalization" and its role in the higher education system of Kazakhstan made it possible to see how digital technologies are transforming the educational environment. They

increase access to knowledge, make learning more flexible and interactive, and help students develop modern skills.

In Kazakhstan, the digital transformation of higher education can be divided into two levels: national at the level of the Ministry of Science and Higher Education and local at the university level. Table 1 characterizes current processes and promising development trends at both levels. At the same time, elements of digital transformation are reflected in various documents, that is, there is no unified strategic approach to determining priorities for digitalization of higher education.

Table 1. Digital architecture of higher education in the Republic of Kazakhstan

National level of digital transformation of higher education	University level of digital transformation of higher education
Implementation of national information systems for monitoring and management: National Educational Database, Unified Higher Education Management System, Unified Platform for Higher Education Automation of public services and implementation of digital tools	Implementation of learning management systems (LMS) and their integration with government information systems and databases Formation of a student's digital profile
Determining national digitalization priorities taking into account the needs of the economy ("digital university")	Implementation of digital tools of the Ministry of Science and Higher Education (digital diplomas, digital forms of strict reporting, online provision of public services, statistical data)
Funding innovative forms of access to information (online educational platforms, global digital libraries)	Monitoring and optimization of current business processes
	Using Big Data for Decision Making
	Introduction of digital services and solutions ("digital" HR, online admission to studies, online distribution of dormitories, Face ID, electronic library card, etc.)

However, there are challenges such as limited digital access, poor infrastructure and cybersecurity issues that require attention and further improvements. A broader initiative is needed to ensure accessibility and development of education from a digital perspective.

However, the digital transformation of education is not only challenges, but also huge prospects. The development of new technologies, the creation of high-quality educational platforms, as well as the development of flexible and innovative teaching methods, the transition from a "digital university" to a "smart university" can become key factors in the further improvement of the educational system and the development of a new economy in Kazakhstan.

Thus, digitalization in higher education in Kazakhstan is a process that requires not only technological innovation, but also broad social support and strategic planning.

It opens the door to new educational horizons, but requires constant development and adaptation to ensure equal educational opportunities for all participants in the system.

In this regard, it seems necessary to develop a separate sectoral Digital Transformation Strategy in Kazakhstan, which will allow to maximally cover all levels of the digital architecture of higher education. This approach will allow us to focus on digitalization and move to a qualitatively new level of management and organization of processes in the country's universities.

3 The Ethical Side of Digital Transformation of Higher Education

The digital transformation of higher education in the Republic of Kazakhstan is accompanied by a number of ethical issues and challenges that require attention and solutions.

The adopted "Concept for the Development of Higher Education and Science in the Republic of Kazakhstan for 2023–2029" pays special attention to the issue of privacy and data protection, since with the development of digital technologies new opportunities arise for collecting, storing and analyzing student data. However, this also raises questions about the privacy and security of this data, especially given sensitive information such as grades, personal data and research results [29].

Digital transformation in the Republic of Kazakhstan must take into account the needs of all students, including those who have limited access to technology or who have special needs. It is important to ensure that online resources and tools are accessible to all students, regardless of their physical or technological limitations.

According to the Concept, the creation of digital campuses is one of the tools that are used to develop the digital architecture of Universities. Citizens are given the opportunity to gain knowledge, skills and competencies through various forms of education, including through massive open online courses (hereinafter referred to as MOOCs), offered by such global providers as Coursera, edX, Udacity, MOOCs have a variety of topics and provide a flexible schedule training and accessible to the general public. Higher education institutions have also developed MOOCs and provide online educational services. To ensure access to online learning for the wider population, existing platforms will be integrated and repurposed to issue electronic certificates.

Digital technologies can create new opportunities for cheating and breaches of academic integrity, for example through plagiarism or illegal use of online resources during exams. Universities in Kazakhstan are actively using tools to combat these problems and ensure fair conditions for all students.

Also, in the process of digital transformation of higher education, it is necessary to take into account the possible increase in digital inequality between different groups of students. This may be due to uneven access to technology, insufficient digital literacy skills, or other factors. Universities are taking action to reduce these inequalities and ensure equal opportunities for all students.

Ethical standards are followed when using digital technologies to collect and analyze student data, and research is conducted with the consent and benefit of the participants. There is also transparency and openness regarding the use of data and research results.

Addressing ethical issues in the context of the digital transformation of higher education in Kazakhstan requires careful analysis, broad discussion and the development of appropriate policies and strategies that will promote the development of the educational system and protect the interests of students and teachers.

4 Conclusion

The work uses methods of dialectics of knowledge of the process of digitalization and digital transformation of higher education. The use of a systematic approach during the study made it possible to consider the experience of Kazakhstan in the use of digital technologies in the educational process to identify the most suitable ways for further development. To highlight the pros and cons of introducing digital solutions in the field of education, a systematic bibliographic analysis of scientific literature was carried out. The method of comparative analysis helped to determine the common and distinctive features of digitalization of education in foreign countries. Other methods of scientific knowledge used in the work were the methods of comparative analysis, induction and deduction.

An integrated approach to the digitalization of higher education, used in Kazakhstan, makes it possible to create an educational environment that promotes the development of modern knowledge.

Thus, digital technologies are making significant changes to the educational environment of higher education in Kazakhstan, stimulating the transformation and development of educational practices, infrastructure and teaching methodologies.

They allow you to create a flexible educational environment, providing access to knowledge at any time and from anywhere in the world. Students can study online, choose their learning format, and create flexible schedules to suit their needs. And digital libraries and databases provide broad access to educational materials, articles, scientific publications and up-to-date information, which significantly enriches research work and student learning. At the same time, the development of mobile applications for education makes learning more accessible, as students can receive educational content through their mobile devices, which increases the flexibility and convenience of the learning process.

References

1. Luksha, P., Peskov, D.: The future of education: a global agenda. https://ouzs.ru/upload/iblock/e46/e4677181a1bb70c38fdffa4b68628986.pdf. Accessed 5 Mar 2024
2. World Digital Competitiveness Ranking 2023: International Institute for Management Development. https://worldcompetitiveness.imd.org/countryprofile/KZ/digital. Accessed 5 Mar 2024
3. Bugubaeva, R., Bespaeva, R., Berezyuk, V., Erzhanov, M.: Transformation of higher education in the conditions of informatization and digitalization. Bull. Univ. "Turan" **3**, 272–277 (2021). https://doi.org/10.46914/1562-2959-2021-1-3-272-277. Accessed 5 Mar 2024
4. Chernyavsky, A.: Digitalization of higher education. In: Materials of the Republican Scientific and Theoretical Conference "Seifullin Readings – 14: Youth, Science, Innovation: Digitalization - A New Stage of Development", vol. 1, pp. 46–49 (2018)

5. Ibrayeva, A., Yegemberdiyeva, S.: Assessment of digital transformation in the education system of Kazakhstan. Econ. Ser. Bull. L.N. Gumilyov ENU **4**, 152–160 (2022)
6. Kushzhanov, N., Balginova, K., Maydangalieva, Z., Satygalieva, B., Mahammadli, D.: The digital Kazakhstan. The development of human resources in education. Sci. J. "Bull. NAS RK" **6**, 82–94 (2018). https://doi.org/10.32014/2018.2518-1467.31. Accessed 5 Mar 2024
7. Ordov, K., Madiyarova, A., Ermilov, V., Tovma, N., Murzagulova, M.: New trends in education as the aspect of digital technologies. Int. J. Mech. Eng. Technol. **10**(2), 1319–1330 (2019)
8. Vial, G.: Understanding digital transformation: a review and a research agenda. J. Strateg. Inf. Syst. **28**(2), 118–144 (2019). ISSN 0963-8687. https://doi.org/10.1016/j.jsis.2019.01.003. https://www.sciencedirect.com/science/article/pii/S0963868717302196. Accessed 5 Mar 2024
9. Florence, M., Kui, X.: Digital transformation in higher education: 7 areas for enhancing digital learning. EDUCAUSE Review (2022). https://er.educause.edu/articles/2022/9/digital-transformation-in-higher-education-7-areas-for-enhancing-digital-learning#fn2. Accessed 5 Mar 2024
10. Brown, M., Reinitz, B., Wetzel, K.: Digital transformation signals: is your institution on the journey? EDUCAUSE (2020). https://er.educause.edu/blogs/2019/10/digital-transformations ignals-is-your-institution-on-the-journey. Accessed 5 Mar 2024
11. Gasparovich, E., Dongauser, E.: Digitalization of education as a way to improve the quality of professional training of students. Conceptual apparatus of pedagogy and education: collective monograph. Blagoveshchensk: BSPU, vol. 1, pp. 196–207 (2023). https://elar.urfu.ru/bitstream/10995/119533/1/978-5-8331-0454-5_2023_196-207.pdf. Accessed 5 Mar 2024
12. Shelepaeva, A.: Digital transformation of the higher education system: directions and risks. Open Educ. **27**(4), 42–51 (2023). https://doi.org/10.21686/1818-4243-2023-4-42-51. Accessed 5 Mar 2024
13. Minina, V.: Digitalization of higher education and its social results. Bull. St. Petersburg Univ. Sociol. **13**(1), 84–101 (2020). https://doi.org/10.21638/spbu12.2020.106. Accessed 5 Mar 2024
14. Law of the Republic of Kazakhstan dated July 27, 2007. No. 319-III "On Education" (with amendments and additions as of September 10, 2023). IS "Paragraph". https://online.zakon.kz/Document/?doc_id=30118747. Accessed 5 Mar 2024
15. Decree of the Government of the Republic of Kazakhstan dated December 12, 2017 No. 827 "On approval of the State Program "Digital Kazakhstan". IS "Para-graph". https://online.zakon.kz/Document/?doc_id=37168057. Accessed 5 Mar 2024
16. Report on the implementation of the State Program "Digital Kazakhstan" for 2018–2022 in 2018–2020. Ministry of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan. https://www.gov.kz/memleket/entities/mdai/documents/details/161189?directionId=14764&lang=ru. Accessed 5 Mar 2024
17. Strategy "Kazakhstan-2050": Official information resource of the Prime Minister of the Republic of Kazakhstan. https://primeminister.kz/assets/media/strategiya-kazakhstan-2050.pdf. Accessed 5 Mar 2024
18. Message from the Head of State Kassym-Jomart Tokayev to the people of Kazakhstan. September 1, 2020 Official website of the President of the Republic of Kazakhstan. https://www.akorda.kz/ru/addresses/addresses_of_president/poslanie-glavy-gosudarstva-kasym-zhomarta-tokaeva-narodu-kazahstana-1-sentyabrya-2020-g. Accessed 5 Mar 2024
19. Message from the Head of State Kassym-Jomart Tokayev to the people of Kazakhstan "Unity of the people and systemic reforms are a solid basis for the country's prosperity". Official website of the President of the Republic of Kazakhstan. https://www.akorda.kz/ru/poslanie-glavy-gosudarstva-kasym-zhomarta-tokaeva-narodu-kazahstana-183048. Accessed 5 Mar 2024

20. Message from the Head of State Kassym-Jomart Tokayev to the people of Kazakhstan "Economic course of a Just Kazakhstan". Official website of the President of the Republic of Kazakhstan. https://www.akorda.kz/ru/poslanie-glavy-gosudarstva-kasym-zhomarta-tokaeva-narodu-kazahstana-ekonomicheskiy-kurs-spravedlivogo-kazahstana-18588. Accessed 5 Mar 2024
21. Decree of the Government of the Republic of Kazakhstan dated August 19, 2022 No. 580 "On some issues of the Ministry of Science and Higher Education of the Republic of Kazakhstan". https://adilet.zan.kz/rus/docs/P2200000580. Accessed 5 Mar 2024
22. Decree of the Government of the Republic of Kazakhstan dated March 28, 2023 No. 248 "On approval of the Concept for the development of higher education and science in the Republic of Kazakhstan for 2023 – 2029". https://adilet.zan.kz/rus/docs/P2300000248. Accessed 5 Mar 2024
23. Decree of the Government of the Republic of Kazakhstan dated March 28, 2023 No. 269 "On approval of the Concept of digital transformation, development of the information and communication technologies industry and cybersecurity for 2023–2029". https://adilet.zan.kz/rus/docs/P2300000269. Accessed 5 Mar 2024
24. European Commission/EACEA/Eurydice, 2018. The European Higher Education Area in 2018: Bologna Process Implementation Report. Luxembourg: Publications Office of the European Union. https://op.europa.eu/en/publication-detail/-/publication/2fe152b6-5efe-11e8-ab9c-01aa75ed71a1/language-en. Accessed 5 Mar 2024
25. OECD/EU: Supporting Entrepreneurship and Innovation in Higher Education in Italy, OECD Skills Studies, OECD Publishing, Paris (2019). https://doi.org/10.1787/43e88f48-en. Accessed 5 Mar 2024
26. National Strategy for Digital Skills: Approved by Ministerial Decree of the Minister for Technological Innovation and Digitalization, 21 July 2020. https://repubblicadigitale.gov.it/portale/documents/20122/992735/National+Strategy+for+Digital+Skills.pdf/c3ff7732-e9ce-498e-71b3-f441ae55afcd?t=1666000144226. Accessed 5 Mar 2024
27. Digitalisation strategy for the higher education sector 2017–2021: Ministry of Education and Research. https://www.regjeringen.no/en/dokumenter/digitalisation-strategy-for-the-higher-education-sector-2017-2021/id2571085/?ch=5. Accessed 5 Mar 2024
28. Strategy for digital transformation in the higher education sector: Ministry of Education and Research, Norway (2023). https://www.regjeringen.no/en/dokumenter/strategy-for-digital-transformation-in-the-higher-education-sector/id2870981/. Accessed 5 Mar 2024
29. Concept for the Development of Higher Education and Science in the Republic of Kazakhstan for 2023–2029. https://adilet.zan.kz/rus/docs/P2300000248. Accessed 5 Mar 2024