

Digital transformation of education in the Arctic: case of North-Eastern Federal University

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Abstract. The article presents the case of developing a program for the digital transformation of higher education in the northern territories of the Russian Federation through the example of the North-Eastern Federal University. It describes the principles and mechanisms of digitalization of basic processes in conditions of limited resources and remoteness from the leading scientific, educational and cultural centres. The authors suggest the development of a digital educational ecosystem to provide high quality and accessible education in remote areas.

1 Introduction

The process of digitalization of basic processes in universities is becoming one of the priority areas for the development of higher education all over the world. In Russia, the implementation of national projects "Digital Economy", "Education", "Science and University" and Strategies for scientific and technological development involves the transition to digital technologies, testing of digital university models and introduction of data-based management mechanisms.

At the same time, the studies of digitalization processes in leading Russian universities show that the gap between the digital future and the existing digital competencies of the education system is a significant problem [1]. Modern researchers indicate the following major challenges of education digitalization: lack of experience in setting priorities, insufficient personnel with the necessary competencies, limited resources, and decision-making lagging behind the requirements of modern time [2].

The pandemic of the new coronavirus infection revealed the growing digital divide in society, threat to the quality of education due to inequality in access to digital resources [3], [4]. The analysis of management decisions of universities during the pandemic showed "excessive rigidity and inflexibility of the educational process of universities [5]. An expert assessment revealed the need of a significant transformation of higher education management [1], [5], "necessary renewal and sufficient improvement to ensure stability" [6]. One of such solutions in many universities is the development of programs for digital transformation of universities.

Nowadays the automation of basic processes using end-to-end technologies, the development of online courses, implementation of blended forms of education

and individual educational tracks, introduction of data-based management practices, and information security are the priority tasks of the North-Eastern Federal University (NEFU).

2 Results and Discussion

Currently, a program for digital transformation of the university is being developed, taking into account the potential and development zones. Digitalization of the main processes is a key principle for the development of NEFU for the medium term, along with such principles as social responsibility, priority of human interests, integration of education, science, applied research and production and concentration of resources for results.

2.1. NEFU program for digital transformation of the university

When developing the program, we took into account the influence of the heterogeneity of the environment and the territorial context of the development of education.

The processes of digitalization of basic processes are formulated taking into account the main constraints and problems of the university development:

- limited geography of reception due to territorial remoteness, extreme natural and climatic conditions, underdeveloped transport infrastructure of the macroregion, high cost of transfer;
 - remoteness from the leading scientific, educational and cultural centres of the country, imperfection of the social and transport infrastructure of the macroregion, a complex logistic scheme that limit the geography of attracting talented students and world-class researchers.
- The number of students from the member states of the Russian Federation entering the higher education programs is half the number of foreign students (253 and

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529 in 2019, respectively). These circumstances also explain the small proportion of students with bachelor's and specialist degrees from other universities who apply for master's degree programs of NEFU;

- Non-personalization, mass character of education of bachelor's degree programs;

- Forced transfer of education to a distance learning format due to the COVID-19 pandemic.

Accordingly, the digital transformation of the university is associated with the following challenges:

- The growing complexity of socio-technical, socio-economic, political and cultural systems, the acute demand for new skills and knowledge;

- Active development of information and communication technologies that provide the ability to process "big data", the automation of cognitive processes in artificial intelligence systems, new ways of individual and collective learning;

- Multiple increase in information flow, intensive development of digital technologies, arrival of the "digital" generation;

- The development of network communities, the growth of the importance of networks, storage of information on the network and its availability from anywhere in the world;

- Growth of scientific and educational collaboration, expansion of opportunities for cooperation with domestic and foreign educational and scientific centres;

- A request from employers for the development of metasubject competencies for the environment with increasing uncertainty;

- Growing demand for innovations aimed at solving the problems of intensive socio-economic development of the macroregion;

- The implementation of large-scale national projects "Science", "Education", "Digital Economy", "Healthcare", etc.

The digital transformation of the university is considered by us as the formation of a digital educational ecosystem that ensures the quality and accessibility of education, integration into the international scientific community, and the satisfaction of the information needs of all stakeholders of the university's life.

The program is aimed at to improve the activities of the university, taking into account modern technologies and strategies based on the experience of leading domestic and foreign educational centres. The digital transformation of NEFU affects all the main processes of the university:

- Digitalization of the educational process;

- Digitalization of research activities;

- Digitalization of university management processes;

- Institutional changes;

- Upgrading IT infrastructure.

2.2 Directions of NEFU development program

When developing the program, we took into account the three basic directions of digitalization that most universities are implementing: the development of distance education, the improvement of information infrastructure, digitalization and optimization of business processes [1], [2], [7], [8]. A.V. Arakelov and M.A. Kodzheshau distinguish such tasks of the digital transformation of the university as the automation of all types of university activities; creation of a unified information and educational space; organization of electronic document management; creation of tools for operational management; creation of a holistic person-centered electronic information and educational environment [9, p.14].

Each of the directions of NEFU development program provides the activities aimed at digitalizing basic processes, introducing data-based practices and ensuring information security:

1. Building flexible educational tracks through the use of blended learning formats and the introduction of digital, including end-to-end, technologies.

2. Expansion of the range of programs of additional professional education, including in the distance form, ensuring scalability and availability of supplementary vocational education for the population of the macroregion.

3. Creation of a system of digital academic mobility of students.

4. Digitalization of the scientific and innovation process, the introduction of digital technologies in the organization of research activities. The transition to digital technologies, robotic systems, new materials and design methods, the creation of systems for processing large amounts of data, artificial intelligence.

5. Expansion of interaction with leading centers and collaborations in the field of digital technologies.

6. Upgrading of employees skills in the field of digital technologies.

7. Implementation of the concept of a "smart campus" in accordance with the goals of sustainable development, the creation of a modern and technological campus based on advanced facility management technologies.

8. Digitalization of university management processes: the development of the digital ecosystem of the university, the integration of digital services into a single digital ecosystem of the university, created on the principle of a "single window", the transition to a digital university management platform using data-based management practices [10].

2.3 Implementation of NEFU Digital Transformation Program

The digitalization process begins with updating the content of existing and forming new professional educational programs aimed to ensure the scientific and technological development of the Far East, sustainable

development of the northern territories. They are implemented, inter alia, in the form of network interaction with educational, scientific organizations and enterprises of the real sector of economy. Today, NEFU provides 472 educational programs, including 83 in the field of digital economy and information and communication technologies, which is 17.6% of the total number of programs. In the 2019-2020 academic year a new international master's program "Convergence" started, which trains specialists in the field of modern digital technologies. The discipline "Introduction to end-to-end digital technologies" was added into the major educational programs of higher education of the bachelor's and specialist degrees. In order to expand the educational tracks of students, optional disciplines were introduced in the areas of end-to-end technologies of the digital economy (wireless communication, blockchain, artificial intelligence).

The 2020 pandemic has stimulated a completely total shift to distance learning technologies – both for teachers and students. A similar situation has developed in all universities of the country and the globe: "the rapid transition of one of the most massive systems of higher education in the world to a distance format - 450 universities in two weeks" [5], "the evolutionary period of transformation of education, which would have lasted for more than one decade" [6], "the pandemic has accelerated the speed of digitalization" [7], "the use of distance education using digital tools in higher education has increased particularly during the COVID-19 pandemic" [11].

It should be noted that before the transition to distance learning, the university had accumulated sufficient experience and technological groundwork for organizing distance learning in emergency situations. Thus, in 2018-2020 active work was carried out on the development of e-learning and distance learning systems of major educational programs. LMS Moodle (<http://yagu.s-vfu.ru>) is used as the main platform for the implementation of blended learning. During the pandemic, by mid-April 2020, an indicator of 100% was reached in terms of the fullness of distance learning environment with all the educational and methodological materials. At the moment, all 22179 subjects delivered in 154 major educational programs of NEFU are provided by the educational and methodological materials in electronic form and placed in the distance learning system.

The next direction is the construction of flexible educational tracks through the use of blended learning formats and the introduction of digital, including end-to-end technologies. NEFU takes part in a project to test educational models of blended learning using online courses as part of the priority project "Modern digital educational environment of the Russian Federation." This platform hosts 15 online courses in which students of NEFU and other universities are trained with confirmation of the learning outcomes.

Interaction with leading centres and collaborations in the field of digital technologies is expanding:

- NEFU is one of the co-founders of the University Consortium of Big Data Researchers together with

Tomsk and Moscow State Universities, Northern (Arctic) and Ural Federal Universities, Higher School of Economics to conduct joint scientific and applied research and solve socially significant problems using collection and data analysis from social networks, university learning management systems (LMS), open platforms;

- NEFU participates in the network project of the NTI University 20.35 to promote artificial intelligence technologies and the development of relevant competencies among university staff and students. 100 educational organizations of the country are parties to the agreement;

- NEFU signed a Memorandum of Intent with the Agency for Strategic Initiatives to promote new projects, the National Technology Initiative Platform, the National Technology Initiative University 20.35. Within the framework of this memorandum, in 2019-2020, events have already been held, such as NEFU Design and Educational Intensive according to the University model 20.35, within the framework of which the University 20.35 services were tested for organizing the work of student project groups, building individual educational tracks, fixing a digital footprint and an increase in competencies.

- on the basis of NEFU, an educational program for advanced training "Data-based Management – Chief Data Officer in the authorities" was carried out, organized jointly with the Centre for Project Practices CDO of Tomsk State University [12].

Within the framework of the federal project for free of charge training in computer literacy of pensioners under the program of advanced training courses "Computer literacy of the population", together with the Union of Pensioners of Russia, 409 citizens of retirement age were trained on the basis of the Institute of Continuous Professional Education. As part of the implementation of the national projects "Digital Economy of the Russian Federation", "Demography", the College of Infrastructure Technologies has implemented a software and vocational education program "Skills of the Wise"; 216 residents of Yakutia of pre-retirement age have been trained.

Targeted work on the development of the electronic informational and educational system allowed creating a basis for the further development of the digital ecosystem of the university, capable to solve the problems of improving and developing the scientific and educational activities of the university. At the moment, NEFU operates an electronic informational and educational system, developed in accordance with the requirements of the Federal State Educational Standard for the conditions of education and taking into account the experience of Russian universities [1], [6]. The electronic informational and educational system of NEFU provides users with the following information services:

- Access to full curriculum with the work plans of subjects (modules) and internships;

- Access to electronic library systems and educational resources indicated in the work plans of the subjects;
- Fixing the course of the educational process, the midterm assessment results and the academic progress in general;
- Lectures and seminars, assessment of academic outcome, the implementation of which is provided with the use of e-learning, distance learning technologies;
- The creation of an electronic portfolio, including the storage of course papers, diploma thesis, scientific works, reviews and assessment of these works (under the tutor's supervision);
- Synchronous and (or) asynchronous interaction between the students, teaching and supporting staff via the Internet.

3 Conclusion

Thus, the electronic informational and educational system of NEFU implements the tasks set in the practice of higher education: equal access to information resources; implementation of curricula and plans; control of the educational process, ensuring synchronous and asynchronous interaction of participants of the educational process.

In general, the following stages of the program implementation can be distinguished:

Program launch stage (September-December 2020).

At this stage, the following steps were taken:

- Internal examination of the program at strategic sessions and expert discussions, its adjustment, taking into account the proposals and recommendations made;
- External expertise by the main stakeholders;
- External expertise at sessions of the Moscow School of Management SKOLKOVO;
- Financial evaluation of the program;
- Approval of the digital transformation program at the Academic Council of the University.

The stage of digital transformation of the main mechanisms (2021-2024)

In this context, all the main areas of activity of NEFU are being digitalized: educational, scientific, innovative. Infrastructural transformations are carrying out. Organization of work of interdisciplinary project teams. Interim assessment of program implementation and adjustment.

The stage of assessment and analysis (2025) is the final assessment of the achievement of the goal and solution of the program objectives and the implementation of the main indicators.

Thus, we can conclude that on the one hand the development of digitalization is explained by a rapidly changing world, growing heterogeneity of the environment, uncertainty of social and political processes. On the other hand such factors as limited

resources, poor transport accessibility, remoteness from leading research and educational centres also promote the process of digital transformation of universities. This process consists, first of all, in the improvement of the quality and accessibility of education and increase in the efficiency of scientific research through the individualization of educational tracks.

References

1. A. Mikheev, Y. Serkina, A. Vasaev, *Current trends in the digital transformation of higher education institutions in Russia*, Ed. and Inf. Tech. (to be published)
2. E.V. Galazhinsky, *TSU: a model of digital transformation of the university*, EdCrunch Tomsk. Materials of the international conference on new educational technologies, Tomsk, 8-13 (2019)
3. S.K. Bekova, E.A. Terentev, N.G. Maloshonok, *Voprosy Obrazovaniya*, **1**, 1-15 (2021)
4. G. Coco, R. Lagravinese, G. Resce, *J. of Ec. Inequal.* **18**, 469 (2020)
5. D.A. Sergeev, V.N. Zimin, *Trends in the development of science and education*, **53-1**, 34-38 (2019)
6. E.A. Antyukhova, P.I. Kasatkin, *World Economy and international Relations*, **65**, **2**, 125-133 (2021)
7. A. Webb, R. W. McQuaid, C.W.R. Webster. *World Journal of Science Technology and Sustainable Development*, **18**, 1-19 (2021)
8. O. Tavstukha, O. Osivanova, T. Chelpachenko, A. Yudina, O. Ovchinnikov, L. Illarionova, Z. Gereev, N. Aleksandrova, *ropositos y Representaciones*, **9**, e1133 (2021)
9. A.V. Arakelov, M.A. Kodzheshau, *Distance educational technologies. Proceedings of the V International Scientific and Practical Conference*, Yalta, 9-15 (2020)
10. P.P. Ivanov, R.P. Ivanova, *Smart Innovation, Systems and Technologies*, **172**. 753-760 (2020)
11. U. Langedard, K. Kiani, S. Nielsen, PA. Svensson, *BMC Nursing*, **20** (**1**), 23 (2021)
12. V.M. Savvinov, P.P. Ivanov, *Year of digitalization at North-Eastern Federal University: concept, solutions, best practices* (Yakutsk, NEFU Publishing House, 2020)